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European Commission

Commercial Power Purchase Agreements

European Investment Advisory Hub

Europe's gateway to investment support

A Market Study including an assessment of potential financial instruments to support renewable energy Commercial Power Purchase Agreements

Final report prepared by Baringa

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Glossary of key terms

Term	Description
Additionality	Enabling an event through an action whereby the event would not have occurred without the action. PPAs may claim additionality over renewable energy project developments; development banks may seek additionality when introducing products to the market
Basis risk	Risk that power is remunerated on a different basis from which it is sold e.g. using different market reference prices
Credit risk and credit worthiness	Risk that a counterparty is unable to honor contracted position e.g. as a result of one party ceasing operations. Counterparties are credit worthy if they are deemed to have sufficiently low credit risk that a bank may lend money against the value of the contract
Developer/Promoter	The entity responsible for developing the asset, bringing it to a final investment decision
Financial instrument	An instrument that provides value by re-allocation of capital which may take the form of equity or quasi-equity investments, loans or guarantees, or other risk-sharing instruments
Generator	The entity owning the asset that produces the power
Large energy user	Consumers of power who consume large volumes and hence typically have some sophistication in power procurement e.g., large corporations, heavy industry and manufacturing
Mark-to-market (M2M)	The value of a contract versus current market rates e.g. the price of power agreed in a PPA versus the price available on the wholesale market
Offtaker/Buyer	The entity buying the power in a PPA or other transaction for power
Power purchase agreement (PPA)	Bilateral agreement between two parties to purchase power or financial derivative relating to power under fixed terms for a fixed period of time
Price risk (and price risk transfer)	Transfer from one party to another of the risk associated with adverse movements in power prices. PPAs with a fixed price or fixed ceilings or floors relating to the price effectively transfer price risk from the seller to the buyer
Route-to-market	The means by which a Developer generates revenue from their power e.g. through Government subsidies, CfDs, commercial PPAs or selling on the wholesale market
Shape risk	Risk that captured price is lower than the average market price
Trader/Seller	A commercial entity that buys and sells power on wholesale power markets, often leveraging trading capability to provide risk management products associated with different forms of risk as
Utility	A commercial entity that sells power to end users. Often they are vertically integrated and therefore can act as Developer, Generator, Offtaker and Trader
Volume risk	Risk of volume variation between years being lower than forecast

Objective of the study and sources used

Objectives

The EIB under the European Investment Advisory Hub was requested by the European Commission to undertake a market study on Commercial Power Purchase Agreements (PPA) to assess the scope and potential for financial instruments and non-financial solutions as a mechanism to further expand the potential for renewable generators and counterparties (corporates or utilities) working more intensively and thereby supporting the development of renewable generation capacity.

Baringa, an external service provider, was engaged by the EIB under the European Investment Advisory Hub to support this process, helping the EIB to analyse the status quo and future evolution of the commercial renewable energy PPA sector in the EU and, based on such analysis, propose a set of potentially viable financial instruments and non-financial solutions to help promote renewable energy commercial PPAs in the EU.

The analysis, completed in April 2021, covers the EU27 Member States and a sample of nine Member States are analysed in depth, ensuring that this sample is representative for the commercial PPA sector in the EU and insightful to the assignment.

The study was undertaken with extensive stakeholder engagement including regular discussions with the European Investment Bank and the European Commission.

Key sources used

Organisations we have engaged with

Developer	OX2, Aquila, Glenmont, Greencoat, Macquarie/GiG, Amarenco, Valorem
Utility	Iberdrola, Shell, Uniper, RWE
Large energy user	Amazon, Google, Vodafone Tesco, Kerry Group
Advisor	Green Giraffe, Tundra

Key data sources used

- RE100 annual reports and member list
- BNEF publically available PPA analysis
- Association of Issuing Bodies (GoOs)
- Baringa Pan EU reference case: power prices, Levelised Cost of Energy (LCOE) and renewables capacity projections
- EU Member State National Climate Energy Plans
- Various press articles and releases to quantify EU historial PPA activity
- Eurostat electricity generation and consumption
- Wind Europe, Solarpower Europe, RE-source

Reports consulted

- ReSource BayWa Energy Report (2019)
- WBCSD - How Multi-technology PPA Structures Could Help Companies Reduce Risk (2019)
- European Commission - Competitiveness Of Corporate Sourcing Of Renewable Energy (2019)
- WBCSD Innovation in PPA Structures (`2018)
- WBCSD Pathways To Scale Finance For Renewable Energy
- Wood Mackenzie Analysis Of Commercial And Industrial Wind Energy Demand In The United States (2019)

Definition of Power Purchase Agreements

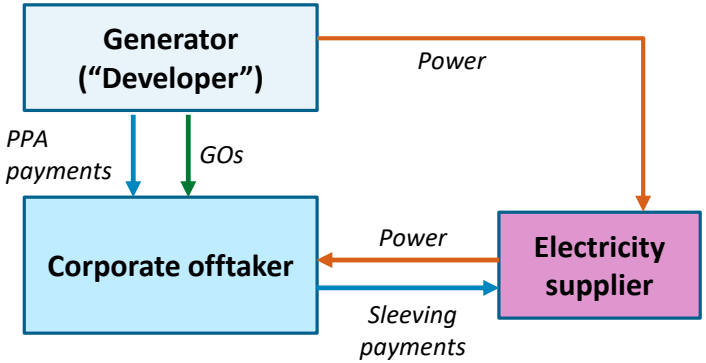
- A Power Purchase Agreement (PPA) is a bilateral contract between a power generator and a buyer, whereby the buyer agrees to purchase a defined amount of power from the generator from a specified source. There are two types:
  - **Commercial PPAs** – i.e. where the counterparty to the generator is a non-Governmental entity operating, such as a utility, power trader or corporation, who has a commercial interest in procuring the power output – **this IS the scope of this study**
  - **Government PPAs** – i.e. where the counterparty to the generator is the Government entity offering either a competitively set contract-for-difference (CfD) or an administratively set Feed-in Tariff (FIT) – **NOT in scope of this study**

PPAs direct with corporates can be physical or financial

Both structures have been deployed to date in Europe

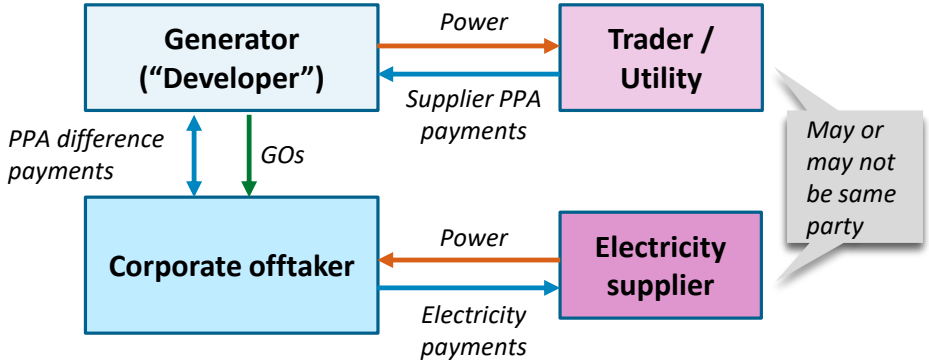
Typical corporate PPA contract structures

Physical Corporate PPA



- Direct physical PPA between the corporate off-taker and the generator where the offtaker pays the generator a fixed amount per unit volume (MWh) of power produced
- Separate contracting between corporate and its supplier to manage financial risks, in particular to manage volume imbalances between project output and corporate demand
- Corporate pays generator fixed price for output
- Corporate buys (or sells back) any shortfall (or excess) power to their electricity supplier via a separate 'sleeving' contract

Financial Corporate PPA (CfD, synthetic PPA)



- Contract for Difference (CfD) between the Corporate off-taker and the Generator, while generator's has physical PPA with a supplier/trader and the Corporate's Energy Supply Agreement with its supplier, each exposed to fluctuating market prices
- Generator sells to Trader at the market price. Corporate buys from Electricity supplier at the market price
  - If *market price > CPPA strike price, g*enerator makes 'difference' payment to Corporate so each pays a net amount equal to strike price
  - If *market price < CPPA strike price,* Corporate makes 'difference' payment to generator equal to CPPA strike price
- More popular in U.S. as it allows contracts across markets that are not physically connected (e.g., between Texas and New England)

Table of types of PPA

A wide range of counterparties and commercial structures are emerging to replace Government support. This study focuses on PPAs with tenors over five years which transfers price risk among participants

	Route-to-market	Description	Price risk transfer*	In scope?	Range of typical tenor	
Financial PPA	Financial Corporate PPA	Direct financial agreement between generator and corporate large energy user	Yes, from generator to offtaker	✓	Typically mid-term/long-term	Focus of this study
Financial PPA	Trader Commercial PPA (financial)	Financial agreement between generator and power market actor (utility, bank, or independent trader)	Yes, from generator to offtaker	✓	Typically mid-term/long-term, shorter than corporate PPAs	
Physical PPA	Physical Corporate PPA	Direct agreement for physical flows of power between generator and corporate power market participant	Yes, from generator to offtaker	✓	Typically mid-term/long-term	
Physical PPA	Trader Commercial PPA (physical)	Agreement between generator and power market trader for offtake of physical power (utility, bank, or independent trader)	Yes, from generator to offtaker	✓	Typically mid-term/long-term, shorter than corporate PPAs	
Physical PPA	Trader to Corporate PPA product	Agreement between market actor and corporate for offtake of physical flows of power	Yes, from trader to offtaker	✓	Can be short or long term but typically shorter tenor	
	Sleeving Agreement	Agreement between offtaker and retail power provider to manage shape, volume, and physical risks associated with physical corporate PPA	No	✗	Can be short or long term but typically shorter tenor	
	Route-to-market PPA / Trading Services Agreement	Agreement between generator and power market participant, indexed/floating reference price used	No	✗	Can be short or long term but typically shorter tenor	

Note: *Does not imply *complete* price risk transfer - see glossary of terms

Main report

A Market Study including an assessment of potential financial instruments to support renewable energy Commercial Power Purchase Agreements

Key conclusions and recommendations (1)

Market sizing and assessment of drivers and barriers

What is the market size potential for commercial PPAs in Europe?

- The EU aims to achieve 55% of power generation from renewable sources by 2030 under the current EU RE targets. Government support will continue to play an important role for the majority of RE projects. However, the further decrease in technology costs and an increasing demand among corporates for green electricity support the development of a sizeable market for commercial PPAs. Commercial PPAs are an important tool to de-risk projects and thereby central to investment decisions
- The commercial PPA market size depends on a number of fundamentals – project economics (RE costs, electricity market prices), government support levels, merchant risk appetite and offtaker demand. All of these parameters are highly uncertain. In order to capture these uncertainties, two different scenarios for supply and demand side were used. The **market size is estimated to be between 140 TWh and 290 TWh** in 2030 – equivalent to c.10% and 23% of 2030 solar and wind generation*
  - **Appetite among offtakers** is estimated to be **between 150 TWh and 290 TWh** – depending on the industry's ambition to green their operations. The lower bound assumes limited additional demand from offtakers beyond large, listed organisations publicly committed to procuring renewables, while the upper bound assumes more participation by large energy users who have the appropriate footprint to consider PPA.
  - The **requirement of generators for PPAs** depends on the availability of Government support and their merchant risk appetite. If both elements are strong, **generators require c.140 TWh of renewable generation** to be under commercial PPAs by 2030. This would likely be met by offtakers. If Government support is relaxed, and generators have less merchant appetite, up to 480 TWh would require PPAs by 2030. In such case, the market would be constrained by corporate appetite for PPAs.

What barriers are preventing commercial PPAs from occurring?

- Limited **price risk appetite** among offtakers who see risk of price decline and face stiff **competition** is a key barrier preventing sectors with tighter margins and stiffer competition such as heavy industry, infrastructure, and fast moving consumer goods from contracting the majority of their demand on long term commercial PPAs which exceed their natural business cycle
- Our market sizing shows **up to 86 TWh of PPAs will come from offshore wind assets** over the next decade, where **long construction times** and the **scale of projects** add additional barriers to corporates seeking PPAs which they can market as being 'additional' i.e. enabling the project to proceed
- **Credit worthiness** is a major barrier across most sectors, particularly in in heavy industry and manufacturing, and in less developed European economies, where many organisations have appropriate energy footprint for PPAs but are not rated by any major credit rating agency. Debt providers to renewables projects continue to require strong credit rating in order to consider the PPA bankable
- More broadly we see the need for **additionality** itself as a key barrier which also raises questions over the 45 TWh of assets which by 2030 will have exited their existing Government subsidies or existing commercial PPAs. Some of these which will require long-term contracts to de-risk ever-larger portfolios of assets as the market matures financially but currently there is, apart from additionality, no recognition for corporates signing commercial PPAs over buying Guarantees of Origin
- We also recognise the **availability of products to hedge** volume, shape, basis and physical risk, and the further standardisation of terms in PPAs as being features of a mature PPA market which markets have approached, while others are at an earlier stage. Hedging products become expensive once extended beyond the typical 2-3 years of wholesale power liquidity in most markets, though evidence from Spain and Sweden, among others, suggests hedging becomes easier as volumes of PPA deals increase
- The **complexity of negotiating PPAs** acts as a soft barrier which slows entry into the market by less sophisticated offtakers. Utilities have begun to play a role in offering simplifying structures and we expect the market to continue to find ways of slowly reducing complexity through platforms and standardisation of terms

* This is equivalent to% and 18% of total RE generation or c. 7% and 13% of 2030 I&C consumption in the EU.

Key conclusions and recommendations (2)

Summary of regional dynamics and assessment of potential financial instruments

How do PPA barriers and drivers differ across Member States?

- Our assessment of barriers and drivers covers nine Member States in depth and concludes that barriers and drivers vary considerably across Member States. Member States such as **France** and **Ireland** (17% and 1% of EU generation volume respectively) have deep pools of credible offtakers to draw on and at least one renewable technology capable of offering unsubsidised projects over the coming decade but currently **lack synergistic integration of Government support with PPA markets**, though we note this may change in both cases given stated policy ambition
- **Iberia and the Nordics should continue to see PPA activity** in solar and wind respectively, with **Germany** and **Netherlands following suit** given strong green mandates among corporate base and competitive technologies. **Italy** should also follow but **requires a greater role for utilities and traders** in providing required hedging services to manage zonal basis risk
- **Central and Eastern European Member States have some of the most attractive economics** for PPAs and renewables investment more broadly, but lack experience and mandate for renewable PPAs among offtakers. Investor confidence in policy and regulatory schemes is also lower. **Poland** is the most attractive of these markets currently, though policy currently heavily incentivises development on end user sites over PPAs with utility-scale developers. **Romania** has similarly attractive economics but requires re-activation of Government support to get the renewables industry back on its feet

What financial instruments could a bank use to unlock more PPAs?

- Financial institutions can in theory support PPAs through provision of tailored debt, equity, or credit guarantees, financial derivatives on power prices. Given the central role of utilities and experienced power traders in providing derivatives, we have assessed three financial instruments, two focusing on project debt and one on a credit guarantee, that address the more material barriers we see in the market:
  - We think **project debt linked to PPAs** could accelerate maturity of markets such as **France**, **Italy** and **Central and Eastern Europe** where PPAs are currently viewed either as being very risky (France) or are required to be too long in tenor. Such financial instrument could help standardise terms and practices in those countries and bring them more quickly in line with more mature markets and lowering the long term price risk burden on offtakers. This would require an expansion of EIB's existing project debt mandate to provide more debt against merchant risk in these markets in order to enable shorter tenor PPAs
  - **Construction loans and mezzanine financing** linked to PPAs could facilitate more PPAs, in particular on **offshore wind** where project level financing is required. The use of such financing would allow offshore wind farms to be constructed without signed PPAs and implicitly lower the additionality requirement by tying refinancing to successful execution of PPAs
  - A **credit guarantee** offered by a financial institution, and in collaboration with an aggregator of corporate demand (e.g. utility, large corporate, or PPA platform), could in principle unlock more PPAs in Europe's more mature markets (e.g. **Spain**, **Netherlands**, **Germany**, **Sweden**) where larger, credit worthy entities have led the way. This could be part of a wider drive to prompt utilities into business models which facilitate longer term procurement of power by offtakers
- These instruments can be used to **implicitly reduce complexity and redefine additionality** by increasing standardisation of instrument Terms and Conditions (T&Cs). Any of these financial instruments, if deployed by a **National Promotional Bank or Institution (NPBI) or an International Financial Institution (IFI) (such as the EIB)** could drive a standard PPA template that itself becomes recognised as being 'additional' in terms of contribution to development and could serve as the template for similar financial instruments from other commercial banks
- Finally, we have laid out the most important next questions for validating the deployment of some of these financial instruments in the market

Drivers and barriers to commercial PPAs

The need for commercial PPAs is driven by renewable capacity targets, the level of Government support for new capacity, limited merchant risk appetite among generators, and demand for green energy among offtakers

Drivers		Description of drivers
A	Renewables capacity targets	▲ Targets of 55% renewable generation by 2030 drive investment from developers and in building a strong pipeline of projects seeking to secure a route-to-market
B	Level of Government support	▲ Government support can be reduced in markets where renewable technologies can compete with market prices
C	Merchant risk appetite	▲ Without Government support, generators seek commercial PPAs to guarantee revenue streams from exposure to longer term price fluctuations
D	Offtaker demand for PPAs	▲ Large energy users seek commercial PPAs to achieve recognition for being sustainable and potentially to unlock value where PPAs can beat market power prices

Barriers		Description of barriers
1	Price risk & Competition	▲ Offtakers' capacity to contract can be limited by the risk it poses to their cost base and consequently their competitive position
2	Clip size & forward start	▲ Volume of power can be too large for a single offtaker to contract or the development timeframes too extended to merit signing up to a PPA prior to construction
3	Credit worthiness	▲ Credit-worthiness of offtakers as viewed by project debt providers can be insufficient to deem the PPA as 'bankable' revenue
4	Contract complexity / length	▲ Complexity and cost of contracting can be a barrier to executing PPAs for less sophisticated energy consumers
5	Hedging availability	▲ Forward liquidity affects the availability of risk management products, i.e. for shape, volume and basis risk, which help de-risk long-term positions taken through PPAs
6	Additionally & Corporate recognition	▲ Offtakers' requirements for additionality in order to receive sustainability recognition can limit the timing and range of projects that offtakers are willing to contract with

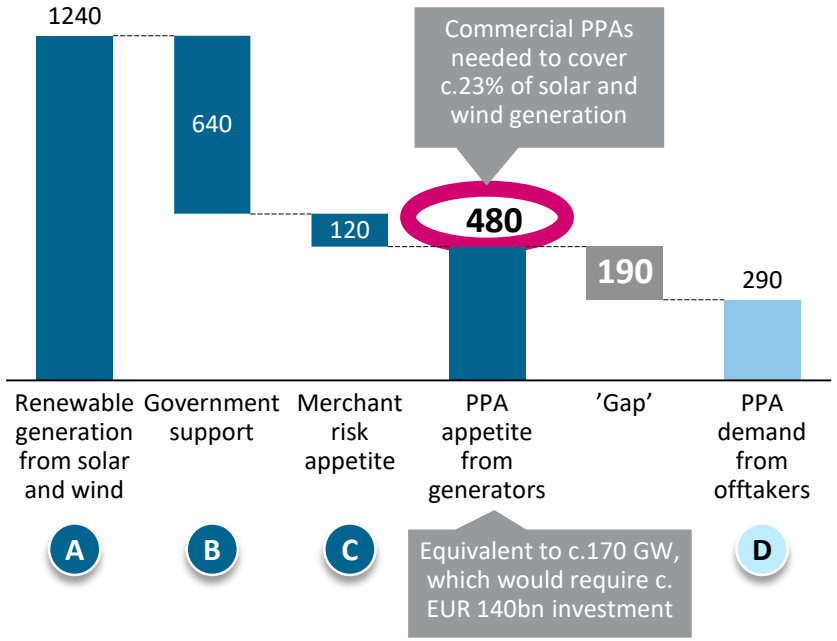
Market size potential for commercial PPAs: Scenario A

In an optimistic scenario, up to 480 TWh of contracts could be sought by generators by 2030, which could leave a gap of up to c.190 TWh not willing to be met by offtakers

We have estimated market size potential under **two scenarios** which span the realistic range of uncertainty in drivers and barriers

In **Scenario A**, generator and offtaker appetite for commercial PPAs is at the upper bound of what we expect

TWh generation[1] in EU27 in 2030 in a scenario with higher appetite from generators and offtakers



What does Scenario A mean?

A **Renewable capacity targets** – Both scenarios assume Member States' National Climate and Energy Plan targets are met, which action EU targets of 55% renewable power generation by 2030, are met. Solar and Wind are considered most relevant to commercial PPAs and both new assets and assets rolling off subsidy are considered

B **Less Government support** – Less Government support is required as technologies are more competitive. We assume that not all announced support is delivered in markets where technologies (solar, wind) may show competitive economics over the coming decade

C **Less merchant risk appetite** – There is less appetite for taking merchant risk among generators, we assume generators are willing to leave up to 10% of volumes uncontracted

D **More offtaker demand** – There is stronger appetite from offtakers, reflecting more participation by large energy users who have the appropriate footprint to consider PPAs. Though at the upper bound, this estimate does not assume any major intervention to remove barriers but assumes a stronger green mandate among offtakers; it reflects 16% of non-domestic power demand being under PPA by 2030

In this scenario Generators' requirements for commercial PPAs is expected to **outstrip demand among offtakers** – requiring either Government support to be stepped up to reduce the requirement, or key barriers to commercial PPAs need to be removed to increase offtaker demand

1) Numbers have been rounded to 10 TWh; 2) Based in National Climate Energy plan targets and does not account for renewables required to reach 40 GW of Hydrogen electrolyser capacity; which itself may also provide additional base of offtaker demand

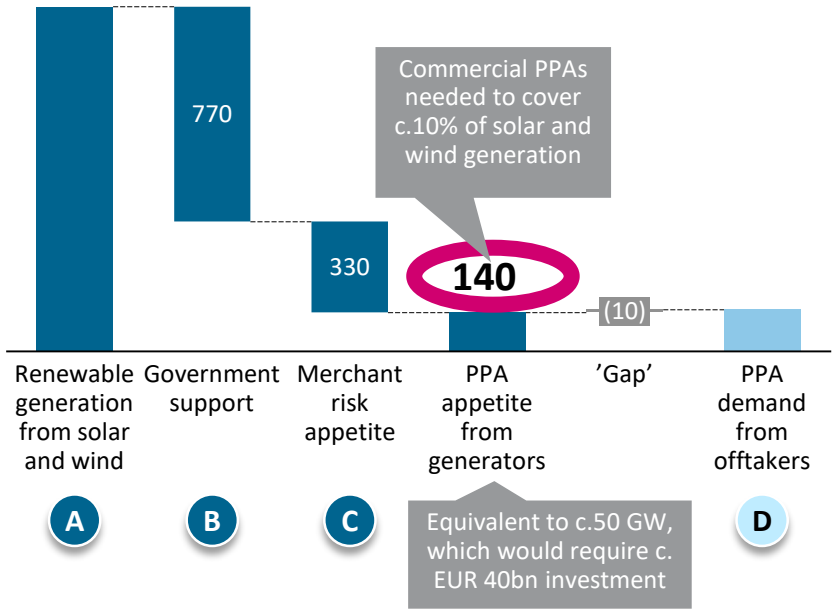
Market size potential for commercial PPAs: Scenario B

In a more conservative scenario, only 140 TWh of contracts are sought by generators by 2030 resulting 10 TWh of offtaker demand not being met

We have estimated market size potential under **two scenarios** which span the realistic range of uncertainty in drivers and barriers

Here in **Scenario B**, generator and offtaker appetite for commercial PPAs is at the lower bound of what we expect

TWh generation[1] in EU27 in 2030 in a scenario with lower appetite from generators and offtakers



What does Scenario B mean?

- **A** **Renewable capacity targets** – Both scenarios assume Member States' National Climate and Energy Plan targets are met, which action EU targets of 55% renewable power generation by 2030, are met. Solar and Wind are considered most relevant to commercial PPAs and both new assets and assets rolling off subsidy are considered
- **B** **More Government support** – More Government support is required as technologies are less competitive. We assume that all announced support will follow through in markets where technologies (solar, wind) may be competitive over the coming decade
- **C** **More merchant risk appetite** – There is more appetite for taking merchant risk among generators, we assume generators are willing to leave up to 35% of volumes uncontracted
- **D** **Less offtaker demand** – There is limited additional demand beyond that from large offtakers, listed organisations publicly committed to procuring renewables, resulting in less than 10% of non-domestic power demand being under PPAs by 2030

In this scenario Generators' requirements for commercial PPAs is expected to **fall short of demand among offtakers** by up to c.10 TWh – meaning Government support could be reduced and limited intervention in the PPA market to remove barriers is warranted

1) Numbers have been rounded to 10 TWh; 2) Based in National Climate Energy plan targets and does not account for renewables required to reach 40 GW of Hydrogen electrolyser capacity; which itself may also provide additional base of offtaker demand

Identified barriers and their materiality

We have identified six barriers as being more material in preventing commercial PPAs

1	**Price risk & Competition**	**Clear barrier across most markets** - prevents less secure corporates and utilities from procuring a higher portion of their demand via long term PPA volumes across all markets. Market has some limited capacity to address - utilities are playing a role in taking on long term price risk where projects are attractive vs market prices but ultimately have limited capacity to take on such positions
2	**Clip size & forward start***	**Barrier for some offshore wind projects** given the volumes and development time frames. However, also an issue for corporates with **disaggregated demand** across a number of European countries that do not want to over hedge in any single market
3	**Credit worthiness**	**Clear barrier across most markets** - prevents a large number of corporates with suitable energy demand but lacking an investment grade balance sheet. Removal of risk has been demonstrably effective in Norway through a power purchase guarantee scheme provided by the Norwegian Export Credit Guarantee Agency (see slide 43). No evidence of market not addressing barrier - lenders have strict credit risk criteria. Will remain a barrier as long as investment models stay the same
4	**Contract complexity / length**	**Soft barrier i.e. introduces inertia into market activity** - prevents corporates with strong green mandates but limited understanding of energy markets, particularly in markets where utility sleeving is limited and expensive. **Market can and will act** - numerous platforms and some utilities already attempting to simplify
5	**Hedging availability**	**Barrier in markets with lower long-term liquidity and/or weaker competition among power traders** e.g. Italy, Central and Eastern Europe - additionally, basis risk acts as a barrier to cross border PPAs but in conjunction with complexity and additionality
6	**Additionality and corporate recognition**	**Subtle barrier but widespread impact** - there is currently no material differentiation between a Guarantee-of-Origin (GoO) backed deal and a 7-10 year PPA with an asset in construction or operations; this will prevent de-risking of operational assets rolling off subsidy over coming decade, which could be a material enabler of further funding for new build assets within portfolio generators

Applicable across most markets

Applicable in a smaller but significant number of cases

Less clear evidence of material applicability

* Clip size refers to the significant size of certain assets; forward start refers to long development/construction lead times.

Price risk and competition

Commercial PPAs tie offtakers into long term fixed price for power, which for some sectors can mean introducing risk into their business

1

Price risk & Competition

Limited price risk appetite prevents less secure corporates and utilities from procuring a higher portion of their demand via long term PPA volumes **across most markets**. While utilities have some capacity to carry the risk, they can only take on risk where projects are attractive vs market prices and as long as they do not run out of risk budget

Large Energy User Sector (not exhaustive) + Example organisation	% change in profit resulting from EUR 10 movement in power prices	Electricity as % of total operating costs @ EUR 60 / MWh
Technology	0.3%	0.6%
Manufacturing	0.7%	0.3%
Fast Moving Consumer Goods	2.1%	1.8%
Infrastructure	1.7%	0.7%
Heavy industry	48%	8.2%

- Offtakers' exposure to price risk depends on i) electricity consumption as a proportion of overall costs and ii) the ability to pass any additional costs onto customers, which itself depends on competitive strength

  "…Technology giants have driven the PPA market in the Netherlands, helped by their strong balance sheets…" – Developer

- More cost competitive sectors such as **Fast Moving Consumer Goods (FMCG)** and **Infrastructure** (e.g., telecoms) operate on tighter margins and are less able to take on price risk than value added manufacturing or technology

  "…The long term nature of PPA contracts, hence long term price risk associated does concern us; if there were more 3-5 year contracts available we would have more PPAs…" – Telecoms major

- **Heavy Industry** (metals, cement, minerals, refining and chemicals) has a high energy consumption as a core part of its operations and are unlikely to incur any price risk that does not carry reward

- More risk averse sectors can see high PPA activity where there is a follow-the-leader approach e.g. UK saw a wave of PPAs with FMCG offtakers between 2017 and 2019

- In active markets such as Spain, utilities are carrying price risk rather than end users in order to lock in value they see in the PPAs. However, this requires very strong balance sheet utilities and very attractive economics and is only possible to a limited extent

- Business cycles also contribute to risk - **Heavy Industry** and **Technology** benefit from longer (10+ year) business cycles while most other sectors plan on a 3-5 year basis, with some placing a premium on having flexibility to exit locations at speed if required

Note: Utilities have not been included in the table of large energy users as they are not the end user of the power they procure and electricity is therefore not a true cost component of their business

Minimum Size and future start date

Projects seeking PPAs have a minimum size they need contracted and require sufficient lead time for project construction

2

Clip size & forward start

The desired PPA size and long-dated forward start is a barrier for some **offshore wind projects** given the volumes and development time frames. However, it can also be an issue for corporates with **disaggregated demand** across a number of European countries that do not want to over hedge in any single market

Offshore wind
0.5-2 GW
2-4 year build

Onshore wind
10-200 MW
1.5-2 year build

Solar PV
10-200 MW
1-1.5 year build

- Offshore wind assets take considerably longer to build than either onshore wind or solar PV assets. As a result, corporates with business planning cycles of 3-5 years are less prepared to sign PPAs for assets that will take up to 3 years to come online. Only global majors in technology and manufacturing, who have longer planning horizons, are likely to be willing to wait

  "…We've got a 5 year planning cycle…last time we looked we were getting offered 2024/25 start dates for offshore wind in Germany whereas we can get solar much more quickly…"
  Telecoms major

- Additionally, the typical size of onshore wind and solar PV projects tends to fall within the range sought by most large energy users. Offshore wind assets are an order of magnitude larger in scale and require either exceptionally large offtakers or a larger number of PPAs which have weaker claims to additionality

  "…We've had discussions with offshore wind farms over 1.5 GW that need 60% of their volume contracted. That could be 40-50 PPAs, each of which take a long time to negotiate!…"
  Market advisor, Netherlands

- Corporates who have a highly disaggregated power footprint across Europe (e.g. consumer brands) have been suggested as possible offtakers for such projects but are typically sensitive to hedging their power through a single market

Credit worthiness of offtakers

Lack of credit worthiness blocks a significant pool of otherwise credible demand; only a subset of counterparties with scale and green ambition will be credit worthy

3

Credit worthiness

Credit worthiness is a major barrier across most sectors, particularly in heavy industry and manufacturing, and in less developed European economies, where many organisations have appropriate energy footprint for PPAs but are not rated by any major credit rating agency. Debt providers to renewables projects continue to require strong credit rating in order to consider the PPA bankable

- Banks providing project debt require PPAs to be signed with investment-grade counterparties in order for the revenue stream associated with the PPA to be considered secure

  "…Banks are not willing to accept the slightly less credit worthy counterparties…"
  Developer

- Credit guarantees provided by financial institutions are possible but generally not affordable

- Outside of the EU, where the risk has been removed, it has been effective in unlocking PPAs

  "…The Norway credit guarantee scheme was essential in being able to sign our PPA…"
  Developer

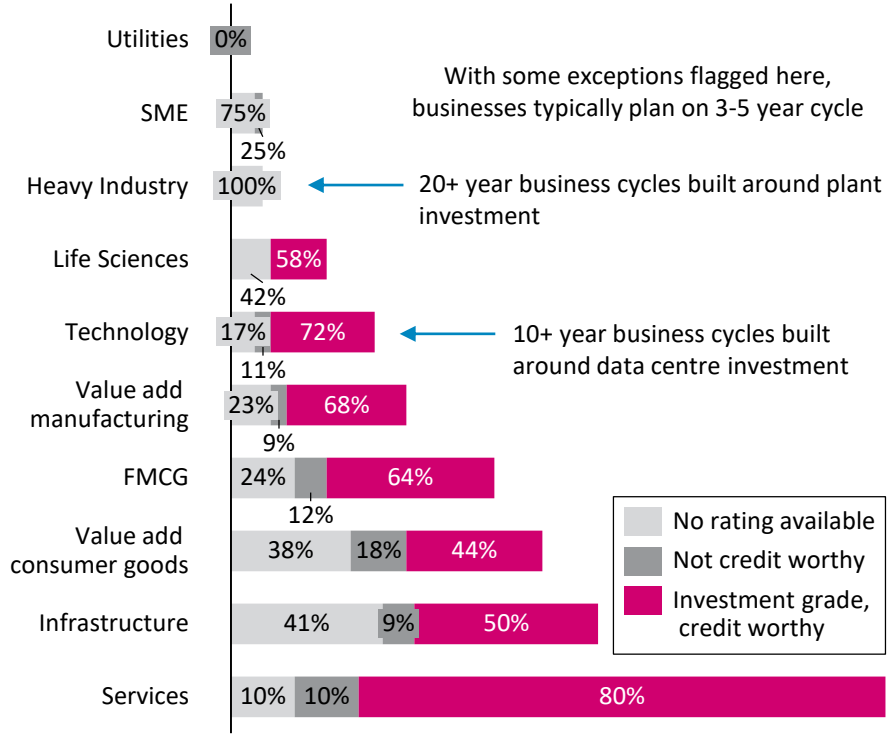
- Removing this risk would not unlock all remaining power demand among large energy users

  "…Aversion to price risk often goes hand in hand with credit risk. Removing credit risk doesn't suddenly open up all mid-tier users with suitable size demand…."
  Utility

- There is also evidence of utilities taking on this credit risk on behalf of end users by taking on long-term PPAs without first securing demand among end users

  "…Utilities are increasingly loading up on long term PPAs but not backing this off onto corporate end users…"
  Utility

% or RE100 members who are credit worthy



Source: Moodys, S&P, Fitch; RE100

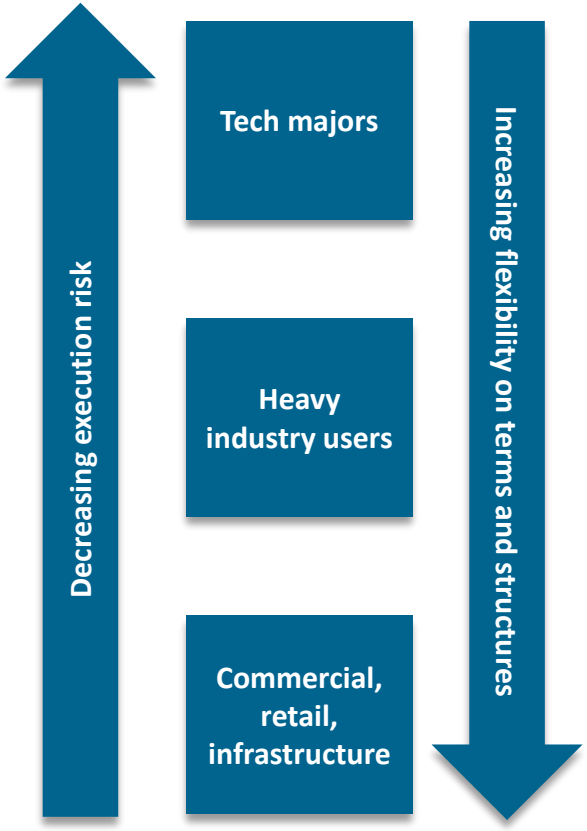
Ability to execute commercial PPAs

Sophistication and demands of tech majors markedly higher than consumer and retail

4

Contract complexity / length

The **complexity of negotiating PPAs** acts as a soft barrier which slows entry into the market by less sophisticated offtakers. Utilities have begun to play a role in offering simplifying structures and we expect the market to continue to find ways of slowly reducing complexity through platforms and standardisation of terms



Approach to procurement

- Tech majors have invested heavily in energy procurement capabilities and as a result are highly sophisticated and strategic in developing novel procurement solutions that meet ambitious green targets at a minimal cost - they will dictate terms to counterparties
- Less novel approaches to procurement than tech majors but capable of pursuing and developing long term solutions to suit their needs
- Less in-house expertise than more intensive power users and as a result often requires much higher time investment during procurement to educate on risks
- Preference for simple structures but are more open to structures with a lower hurdle of additionality

Evidence base

- Google held its own Europe-wide tender process for 1.3 GW wind in 2019
- Both Google and Microsoft attempting to procure renewable power with zero marginal emissions i.e. all power is 100% renewable on an *hourly* basis
- Several heavy industry users in the Nordic states have successfully secured long term PPAs with onshore wind developers which have provided significant value vs market prices

"…Take pharmaceutical companies: they need to be seen to do something green but they're not experts, they'll take simple pay-as-produced additionality…"
Utility

"…We've got over 10k connection points we need to manage, we don't have the resources to get up to speed, we'd rather a utility package a PPA up for us…"
Telecoms major

Source: Company annual reports and disclosures

Hedging availability

Long term liquidity in power markets helps either offtakers or generators manage certain risks associated with taking a long term position on power

5

Hedging availability

The availability of products to manage **volume and shape and intra-state basis risk** is a barrier in markets with lower long-term liquidity and/or weaker competition among power traders e.g. Italy, Central and Eastern Europe - additionally, basis risk acts as a barrier to cross border PPAs but in conjunction with complexity and additionality

Several markets have a legacy of long term PPAs or long term liquidity due to their structure

- In France the Exeltium initiative between EDF Energy and large energy users in a 25 year contract to purchase nuclear energy
- Nordic countries have similar legacies from hydro and nuclear assets, with standard products available to firm volume and shape
- US continues to have a large presence of monopoly utilities used to purchasing long term contracts from generators

Iberia has seen a rise in long term liquidity purely from renewables deployment

- PPA boom over last three years has introduced material liquidity up to 7-8 years as many utilities active in the market now have long term positions on their books

However most liberalised markets continue to have liquidity limited to commodity forwards

- 2-3 years liquidity, similar to gas/coal forwards in markets where gas/coal still sets marginal price

Some markets have uniquely challenging hedging environments owing to market structure

- Italy lacks efficient management if intra-zonal basis risk required to bring together competitive projects in the state's southern pricing zones with offtakers' exposure to national retail prices
- Ireland and other similarly small and relatively new markets (e.g. Greece) can lack liquidity even beyond one year, making it even more difficult to hedge and price PPAs

Corporate need for additionality remains across sectors

Some segments of commercial PPA demand may be willing to adopt less stringent requirements than the most common definition of additionality among offtakers

6

Additionality and corporate recognition

In order for corporate PPAs to provide additional value to corporates compared to GoOs, they need to prove a higher level of additionality. This has driven demand for commercial PPAs with long tenors that can linked to financial close on renewable projects, and can thus be marketed to stakeholders as being 'additional'. As a result there is more limited demand for commercial PPAs with shorter tenors among some corporates

- Additionality is being driven by the more ambitious brand leaders who are eager to be seen as progressive

  "…We're not going to do any more PPAs on assets already receiving subsidies…"
  Tech Major A

  "…Additionality is our north star…it becomes an issue for us if the PPA is only five years…"
  Tech Major B

- This has filtered down into other global brands' approach to procuring green

  "…We've purchased green certificates to begin with but we see that very much as a temporary solution while we find projects with additionality…"
  Global Lifesciences Major

  "…The big German automotive players we know have strong additionality requirements and want solutions that are physically close to their operations…"
  Utility

- However, there is some indication that a less strict approach is willing to be adopted by less sophisticated players

  "…In Poland there's much less emphasis on going green and corporates are generally only comfortable with hedging any part of their power for three or at most five years out…"
  Market Advisor

  "…We've got strict targets for how much power we procure through PPAs but at the same time our PPA portfolio includes a five-year PPA from a utility (and not a generator)…"
  Market Advisor

Additionality 'gap'

Unbundled GoOs and retail tariffs → **Commercial PPAs or long term fixed price tariffs on operational assets** → **Commercial PPAs underpinning construction debt finance**

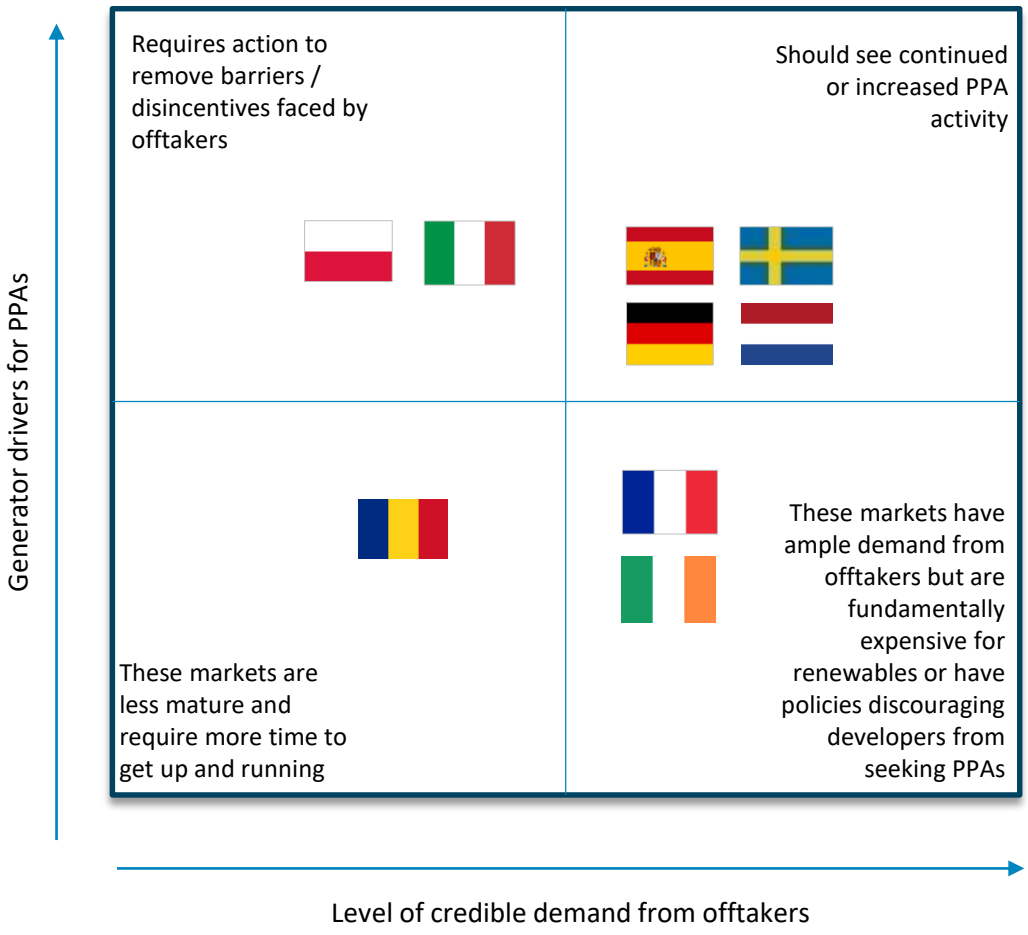
Increasing additionality and required price risk transfer to offtaker

Source: Stakeholder interviews

Summary of drivers at Member State level

We have analysed nine Member States in depth to assess qualitatively where they are likely to be supply or demand constrained

Generator vs offtaker drivers for commercial PPAs by country



Summary of drivers for each country analysed in depth

	Good pipeline of solar seeking PPAs and strong presence of global manufacturing brands
	Lack of incentives for generators to seek PPAs due to large auction commitments
	Strong economics but weak pipeline due to permitting constraints, and lack of cost-effective hedging services from utilities
	Strong pipeline and good economics in solar and wind; new policy expected to drive increasing demand among corporate end users
	Very strong economics but current policies heavily steer offtakers towards on-site build
	Strong pipeline and parity economics in wind and proven demand among offtakers
	Potentially competitive economics for some offshore wind with strong pipeline and demand from offtakers
	Strong economics but less mature renewables pipeline and less mature offtaker demand for green power
	Weaker economics despite ambitious PPA targets and strong presence of global technology majors and life sciences

Long list of financial instruments / interventions considered

We have looked in more detail at instruments which are core banking products and which address material barriers

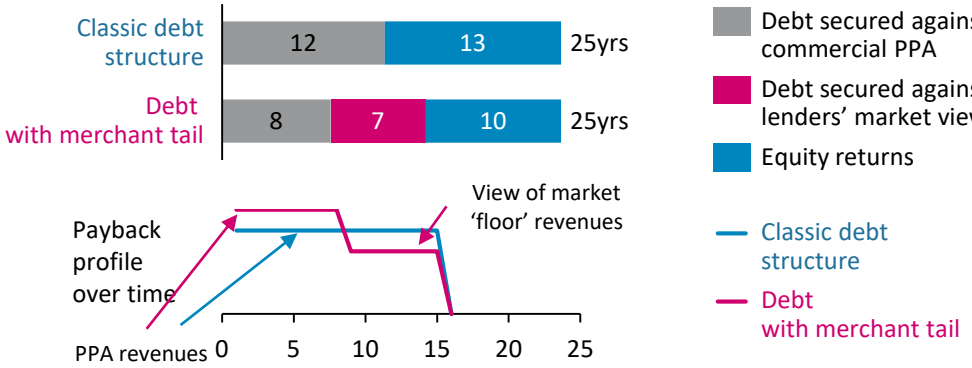
	Type of instrument	Description / Example		Is this worth focusing on for a public bank?	
1	**Project Debt & Equity**	Equity, debt structured finance to a project with a PPA, or where there is a clear link to a PPA product or strategy	✓	Core commercial bank capability addressing **limited price risk appetite** or issues with **clip size and forward start**	***Structures proposed***
2	**Credit Guarantees / Insurance**	In favour of a corporate in relation to default risk under a PPA, or an intermediary in relation to default risk under a PPA (where link to capital deployment or recycling can be proven)	✓	Core commercial bank capability addressing **credit worthiness** of offtakers	
		In favour of a project in relation to default risk under a PPA	✗	Not addressing a material barrier	
3	**Corporate Finance**	To a platform or intermediary providing PPA or PPA related products	✗	Not an infrastructure financing product, no need identified for early-stage financing among platforms	
4	**Derivatives / Risk Management**	Swaps or floor prices on power price, carbon price	✗	Banks are typically funders not power traders - not set up to manage long term or short term market risks	
		Sleaving risk management products (volume, shape, basis, physical)			
5	**(Consultancy / Structuring)**	PPA advisory services to corporates, projects or commercial banks	✓	Can be considered in combination with a targeted financial product to address **complexity**	
6	**(Advocacy / Market Change)**	PPA or Tariff Accreditation on credibility of green sourcing	✓	Can be considered in combination with a targeted financial product to address **additionality**	
		Advocacy for regulatory reform to remove market regulatory barriers	✗	No major regulatory barriers specific to PPAs identified	

Instrument 1a - project loans with merchant tail exposure

Debt (or guarantee on debt) to projects with shorter PPA tenors with a merchant tail could reduce the tenor required of PPAs

What kind of product could work?

- A bank could provide **debt or guarantees on debt to projects with shorter PPA tenors with a merchant tail**
- Where a 'classic' debt structure provides debt solely on commercial PPA revenues, this would provide additional debt based on the lender's view of maximum downside risk on power prices i.e. the 'market floor'
- These would open up shorter tenor PPAs by making these more viable to projects & their sponsors - Similar products already offered by some commercial banks in Spain, pushing PPAs down to 7-10 year tenors or into cap-and-floor pricing structures
- If deployed by a NPBI/IFI, the intention would be to encourage similar behavior in other purely commercial banks or sell down the portfolio of guarantees to commercial banks once relatively mature – this allows corporates with shorter business cycles to enter into PPAs
- The product would need to be **explicitly linked to a commercial PPA** with a defined minimum tenor i.e. not act solely as a means of transferring merchant risk from developer to bank, which brings no change in market behavior



What barrier is this addressing?

Price risk & Competition	Credit worthiness of offtakers	Corporate Recognition / additionality

What segment of the market would benefit most?

Countries	**Central and Eastern Europe** where economics are attractive for renewables due to relatively high cost of carbon and legacy of coal plant; further PPA volumes likely to be constrained due to conservative lending practices and limited risk appetite among offtakers
Technologies	**Solar and onshore wind** where economics are strongest
Offtaker Segment	Heavy industry, infrastructure, and fast moving consumer goods where competitive pressures on cost base are relatively high

Softer solutions that compliment or add-on

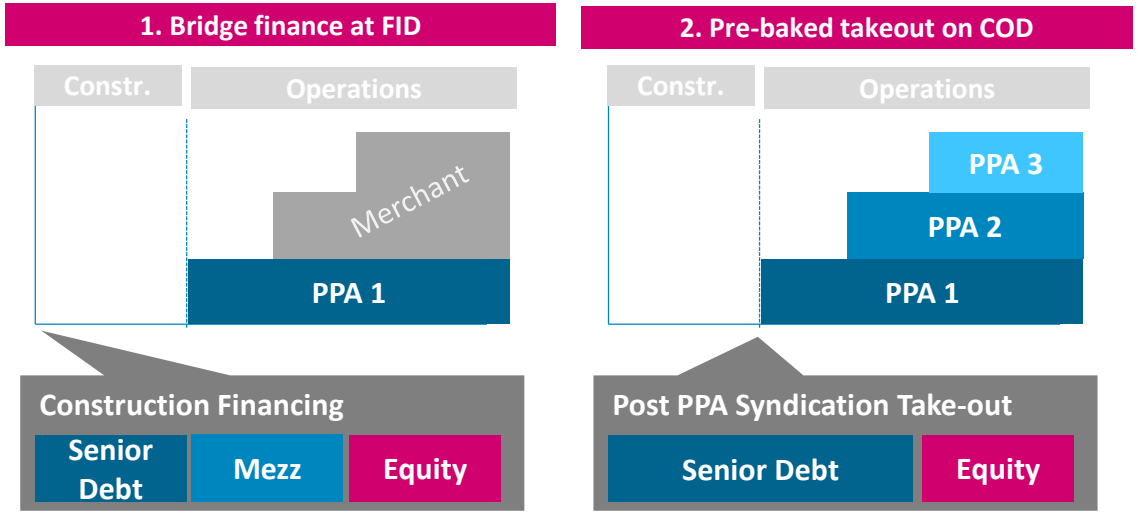
- Implicitly accredit additionality in project due diligence
- Work with Governments to implement incentives on sectors to sign longer term PPAs
- Foster greater transparency on targets and contracted position, giving competitors more confidence in taking more aggressive positions on longer term PPAs

Instrument 1b - mezzanine financing for construction

A high yield debt product targeting offshore wind assets in parity markets where contracting sufficient volumes of PPAs ahead of financial close is difficult given size of assets and length of construction

What kind of product could work?

- A NPBI or IFI offers high yielding / mezzanine tranche against an uncontracted or partially contracted asset on final investment decision (FID)
- Agreed PPA strategy and pipeline with the sponsor on PPA syndication (provider targeting sponsors that have a business model / supply footprint / trading model that will give it priority access to customers)
- Bridge tranche with structural protections (e.g. cash sweep, balloon, margin step-up) and pricing post FID that incentivizes refinancing at the point the asset is contracted
- Option to include a pre-baked refinancing of the bridge based upon and agreed PPA structure, debt sizing and pricing mechanics[1]



What barrier is this addressing?

2 **Forward Start / Clip Size**

4 **Standardisation of PPA terms**

Target countries / customer segments?

Countries	**Germany, Netherlands, Poland**
Technologies	**OFSW**
Offtaker Segment	**Large players**

Softer solutions that compliment or add-on

- Implicitly accredit additionality in project due diligence

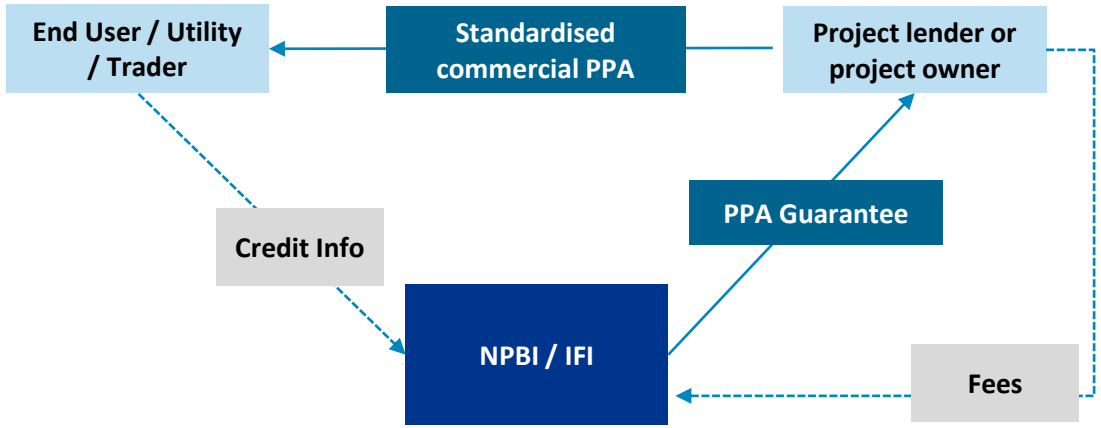
1 Similar structure can already observed for larger onshore wind/ solar portfolios in provided by commercial banks in Spain.

Instrument 2a - providing a credit guarantee

A guarantee that enables motivated corporates outside of the investment grade global cohort to contract long term in parity markets where credit quality on their own would not unlock capital

What kind of product could work?

- NBPI / IFI provides a guarantee to a project lender or project owner in relation to the liability of an offtaker in the event of default
- The project or the intermediary would specify the quantum of the guarantee - in terms of the % of the M2M liabilities in the event of termination
- Project pays a fee linked to the guaranteed quantum and credit strength of the end user
- Range of acceptable credit profile would need to be defined but a lower-risk target group would be users without a credit rating but with a long business cycle e.g. heavy industry plants
- Eligibility for the guarantee could be linked to projects that are additional of were the sponsor can provide that it will trigger investment in new capacity



What barrier is this addressing?

Credit worthiness of offtakers

Standardisation of PPA terms

Target countries / customer segments?

Countries	**CEE, Spain, Italy**
Technologies	**All - but primarily onshore technologies**
Offtaker Segment	**Mid market / end users & utilities**

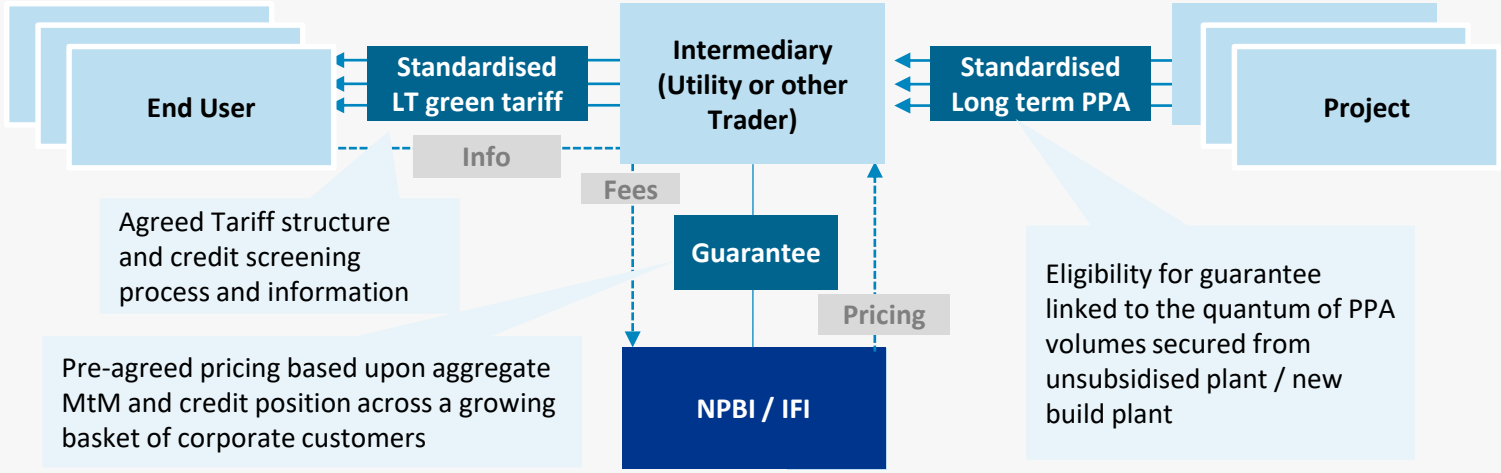
Softer solutions that compliment or add-on

- Foster greater transparency on targets and contracted position, giving competitors more confidence in taking more aggressive positions on longer term PPAs
- Work with aggregators attempting to group together smaller parties with poorer credit (see next slide)

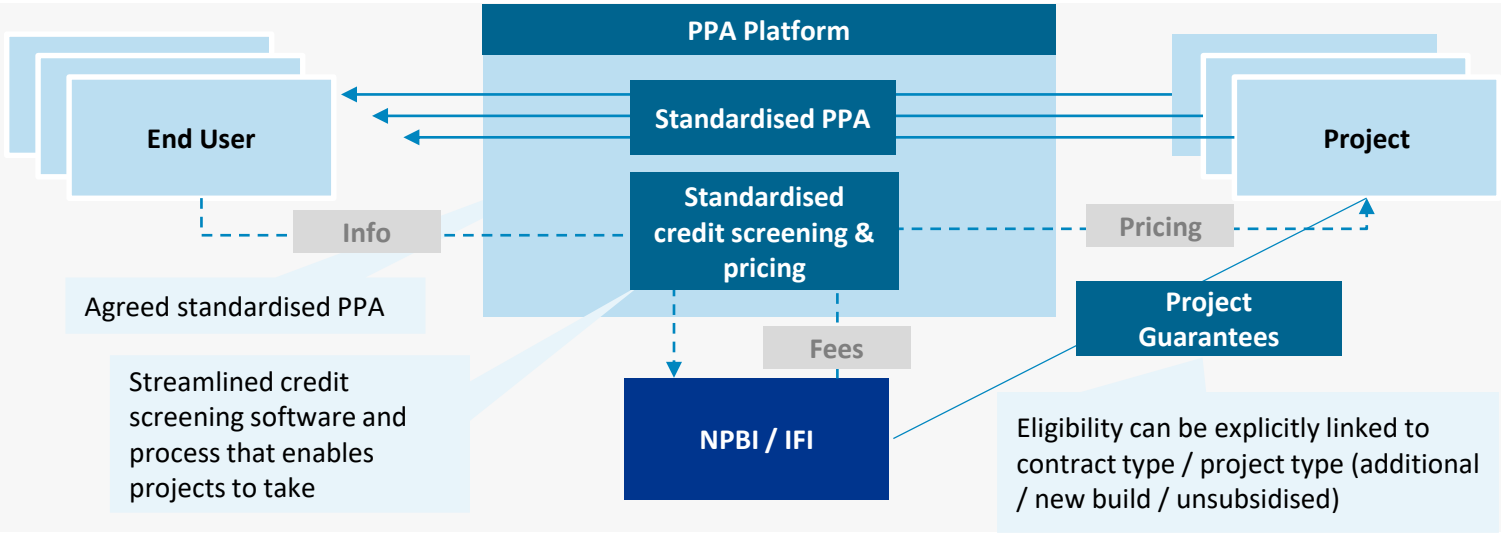
Instrument 2a - provide credit guarantee to intermediary

…however scale will be key to successful diversification of the credit risk which will probably require the provider to partner over time with intermediaries in the market

Aggregate through an Utility / Trading Intermediary



Aggregate through PPA Platform



Instrument 2b - creating intermediary utility

A more involved strategy is to create a utility purpose built for managing credit risk and introducing more long-term price risk into end user tariffs

Why a new utility?

- Utilities exist to buy power from generators and sell it to end users and as a result are best placed to i) aggregate end user demand, ii) efficiently manage market risk on behalf of end users, and iii) efficiently execute large contracts with generators
- An entity with these capabilities combined with the mandate to introduce more long term price risk among mid-tier consumers and the additional capability to manage credit risk would open up the mid-tier market currently constrained by the complexity, long tenors, stringent credit requirements and large clip size of bilateral PPAs
- There is little evidence of utilities who wish to increase risk bearing capacity among end users and address credit risk issues despite the market shifting from the 'old-world' in which generator and end user contracts were similar length to the 'new-world' where long term PPAs are needed for generators but are assumed unacceptable to offtakers

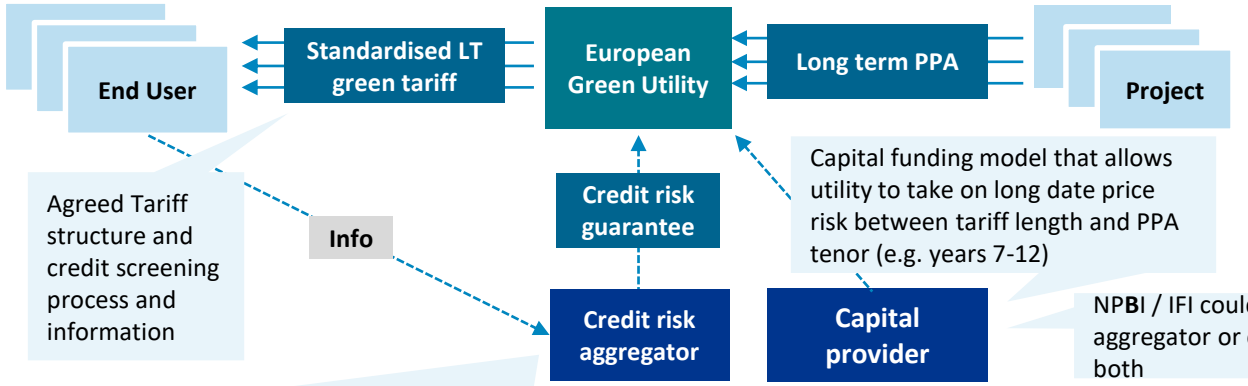
What barrier is this addressing?

Price risk and competition	**Credit worthiness**
Standardisation of PPA terms	**Corporate Recognition / additionality**

Target countries / customer segments?

Countries	**All**
Technologies	**All**
Offtaker Segment	**Mid market / end users**

Possible structure



Can be either NPBI/IFI leveraging risk assessment software (e.g. as used for P2P lending) or partnering with entities who are experienced in managing long term credit exposure of SMEs e.g. leasing companies and their banks. NPBI/IFI required to hold credit risk while demand is aggregated up sufficiently for risk pooling

Assessment of financial instruments

Credit risk instruments more likely to change market behaviour

Type of instrument		Primary rationale	Concluding assessment
1a	**Project loans (or guarantee on loan) with merchant tail exposure**	*Reduce price risk to acceptable levels for certain groups of corporates by moving it onto banks*	▲ Financing with longer merchant tails is being offered by commercial banks in more active markets, particularly in Spain. Additionally some of this lending activity is under terms EIB already considered risky. ▲ However, less mature markets where prices are still coal-driven and commercial banks are still yet to get comfortable with merchant risk are worth exploring further
1b	**Mezzanine financing for construction**	*Widen window for PPAs by delinking from close on construction financing*	▲ Financing bridging loans to offshore wind is already available through commercial banks and might arguably sit outside of a NPBI/IFI mandate ▲ Feedback from market participants on the potential efficacy of such an instrument is mixed, with some demand in Spain, but other participants noting that much offshore wind projects are financed by large utilities on balance sheet
2a	**Providing a credit guarantee**	*Widen access to PPAs to smaller offtakers by guaranteeing their long term credit worthiness*	▲ Worth exploring further as it is not currently available within the market i.e. is highly additional for EIB ▲ Two challenges i) requires significant scale (in EIB's case, beyond existing project financing activity) in order to pool enough parties together to reduce the effective risk; ii) assessing the credit worthiness of offtakers is not a capability typically held within the renewables market ▲ To explore further requires identification of suitable partners for assessing credit risk and aggregating demand
2b	**Creating a intermediary utility**	*Widen access to long-term price risk by creating a utility focused on long-term tariffs underpinning renewable capacity*	▲ Same challenges and benefits to 2a but takes ownership over aggregating demand and executing PPAs ▲ Clearly more ambitious but allows most other barriers to be addressed alongside credit worthiness as the entity has the mandate to address additionality and end user price risk appetite through its operating model and product innovation ▲ Worth exploring further if no existing utility can be found which matches strategic goals of the desired green utility ▲ Can be sold off once the model has been successfully adopted by other utilities

Capital required for instruments

We have used two illustrative examples to show the scale of capital required for these instruments

If a loan **with merchant tail exposure** was provided to PPAs for c.5% of non-domestic power demand tomorrow…

How much debt that is unsecured against PPA revenues would be required?

- We use a very simple example where 100 TWh portfolio of projects originated now and geared at 70% of Capex with a bankable 7-year PPA backing 60% of repayments and a further 40% backing projected prices for years 8-15
- We use solar in Poland as an example where the 'floor' of power prices should not fall below EUR 35-40 / MWh, due to dominant coal fleet, and therefore favours lending against merchant tail over the coming decade

c. EUR 20bn of debt unsecured against a 'bankable' contract

If a **credit guarantee** was provided to offtakers PPAs for c.5% of non-domestic power demand tomorrow…

How much capital would be require to cover exposure to offtaker default?

- We use a simple example where 100 TWh portfolio of projects have a credit guarantee provided that covers c.60% of the M2M exposure of those contracts in case of default over a 10 year period
- We use UK solar as an example where strike prices are currently in the EUR 40-50 / MWh range and downside projections of power prices fall below EUR 30 / MWh by 2030

c. EUR 3bn required to cover default of counterparties if power prices reflect most bearish outlook

Future considerations

	Hypothesis	Some important questions to answer / validate in developing the strategy
2a Credit risk guarantee	*There are markets where prices will be very robust over the next decade and demand for PPAs will increase substantially if tenors are reduced but where banks are currently not willing to lend against merchant risk*	▲ What scale is required to make the product viable and how does that match with scales of interest to the EIB? ▲ What is the cost of credit checks? How could emerging technology help minimise costs e.g. leveraging peer-to-peer lending platforms / b2b / b2c unsecured lending? ▲ Which if any partners are of interest – who is selling long term tariffs and are therefore trying this? How do they differ? Utilities, platforms? ▲ Who will be deemed credit worthy and who will not be credit worthy? ▲ What will be considered a commercial PPA that is eligible? In terms of tenor, size, jurisdiction, and pricing structure? How can this be simplified to enable scale deployment
2b Green utility	*There are many large energy users which are not credit rated but which are otherwise suitable for and intent on doing commercial PPAs, and which could be offered a credit guarantee to protect against default on a PPA at an affordable price, though this is not currently being offered*	▲ What is every other utility and PPA platform doing? Can we validate the market failure? ▲ Can we validate the intervention will change market behavior – using analogies from other markets (e.g. UK telecoms) ▲ Which if any partners are of interest – who is selling long term tariffs and are therefore trying this? How do they differ? Utilities, platforms ▲ What (if any) partnership model is required? What does the EIB do vs what does the partner do? ▲ What capital is required and what returns are expected? What is the type of capital (equity, debt, guarantees) ▲ Who would own the entity and what is the exit strategy once the right market behaviours have been cultivated? What role would the EIB play? ▲ Would the entity be non-profit and how much capital would be required to fund it?
1a Loan with merchant tail exposure	*Utilities are best placed to match generator supply and large energy user demand and should be able to increase offtakers long term price risk appetite through product innovation and holding some risk themselves, but there is a lack of utilities in the market doing this*	▲ Can we validate the hypothesis for specific Member States? ▲ Is there a sweet spot where the fundamentals are strong but competition from commercial banks is low (e.g. CEE where carbon content will drive a robust "floor" but higher country risk may limit bank liquidity relative to more mature markets such as Nordics or Spain)? ▲ How much merchant tail would be willingly financed? ▲ Would it be senior debt or mezzanine financing? ▲ What is the strategy for cultivating similar behaviours in commercial banks?

Annex

1. Assessment of European PPA Market

A Market Study including an assessment of potential financial instruments to support renewable energy Commercial Power Purchase Agreements

Our assessment of European PPA market

- There is a strong green mandate and diverse mix of industrial and commercial power consumers across most Member States which is likely to manifest in better policies to promote renewables and PPAs at a national level
- However much of the European market will see limited commercial PPA activity due to what we term 'fundamentals', which determine the availability of renewables projects that are competitive with wholesale power prices. This includes:
  - The **availability of projects** that are competitive with wholesale power prices. This is considerably challenging for offshore wind, while solar PV is expected to compete with power prices in some markets by 2030
  - **Harmony with any other subsidy mechanisms** for generators to offer competing incentives for offtakers, which makes auctions more attractive than PPAs despite Levelised Cost of Energy (LCOE) being close to competitive with market prices, for example with onshore wind in Ireland and solar PV in France
  - Spain, Poland and Italy have relatively **attractive economics** for solar PV, while France and Germany are expected to improve cost competitiveness on solar in the next 10 years
  - A substantive increase of RE targets – as foreseen under the EC proposal for the EU Green Deal – would be expected to deteriorate the competitiveness of most RE technologies over the coming years
- Additionally, each market carries large **long term price risk** resulting from both commodity price risk and **cannibalisation from more renewables**, while sourcing PPAs from abroad will continue to carry a very material basis (i.e. spread) risk as well as physical hurdles: lack of cross-border electricity interconnectors and complexities involved in booking long-term capacity on interconnectors
  - This is more manageable in certain EU Member States which have a **legacy of long term power contracts** owing to a large nuclear (France) or hydro (Sweden) fleets

Scale of green ambition across Member States

Northern European countries have a higher climate ambition than Eastern European countries

	Overall Score	Net zero target[1]	Support for greater ambition at EU level	Public attitudes to climate change[2]		Commentary
Germany		2050 target in law	Notably absent in calling for increased EU ambition	Strong belief climate change is important	▲	Net zero target in law and strong public concern, but not at the forefront of pushing the green agenda
France		2050 target - in law	Called for more ambitious EU targets in 2019	Strong belief climate change is important	▲	Strong Government climate agenda and public attitudes on climate change
Italy		Net zero target under discussion	Notably absent in calling for increased EU ambition	Limited concern about climate change	▲	Limited concern about the climate at public and Government level, potential for more ambitious targets
Spain		2050 target - draft law	Called for more ambitious EU targets in 2019	Strong belief climate change is important	▲	Strong Government climate agenda and public attitudes on climate change
Poland		No net zero target	Opposed to greater EU ambition	Limited concern about climate change	▲	Limited concern about the climate at public and Government level
Sweden		2045 target - in law	Called for more ambitious EU targets in 2019	Strong belief climate change is important	▲	Strong green activism in Nordics, driving most ambitious national targets in EU and strong public opinion on climate
Netherlands		Net zero target under discussion	Called for more ambitious EU targets in 2019	Strong belief climate change is important	▲	Strong Government climate agenda and public attitudes on climate change
Romania		No net zero target	Opposed to greater EU ambition	Limited concern about climate change	▲	Limited concern about the climate at public and Government level
Ireland		2050 target - coalition agreement	Opposed to greater EU ambition	Moderate concern about climate change	▲	Historically opposed to greater EU ambition, pushing for loopholes to dilute laws; moderate public concern

Scoring: High green ambition | Moderate green ambition | Limited green ambition

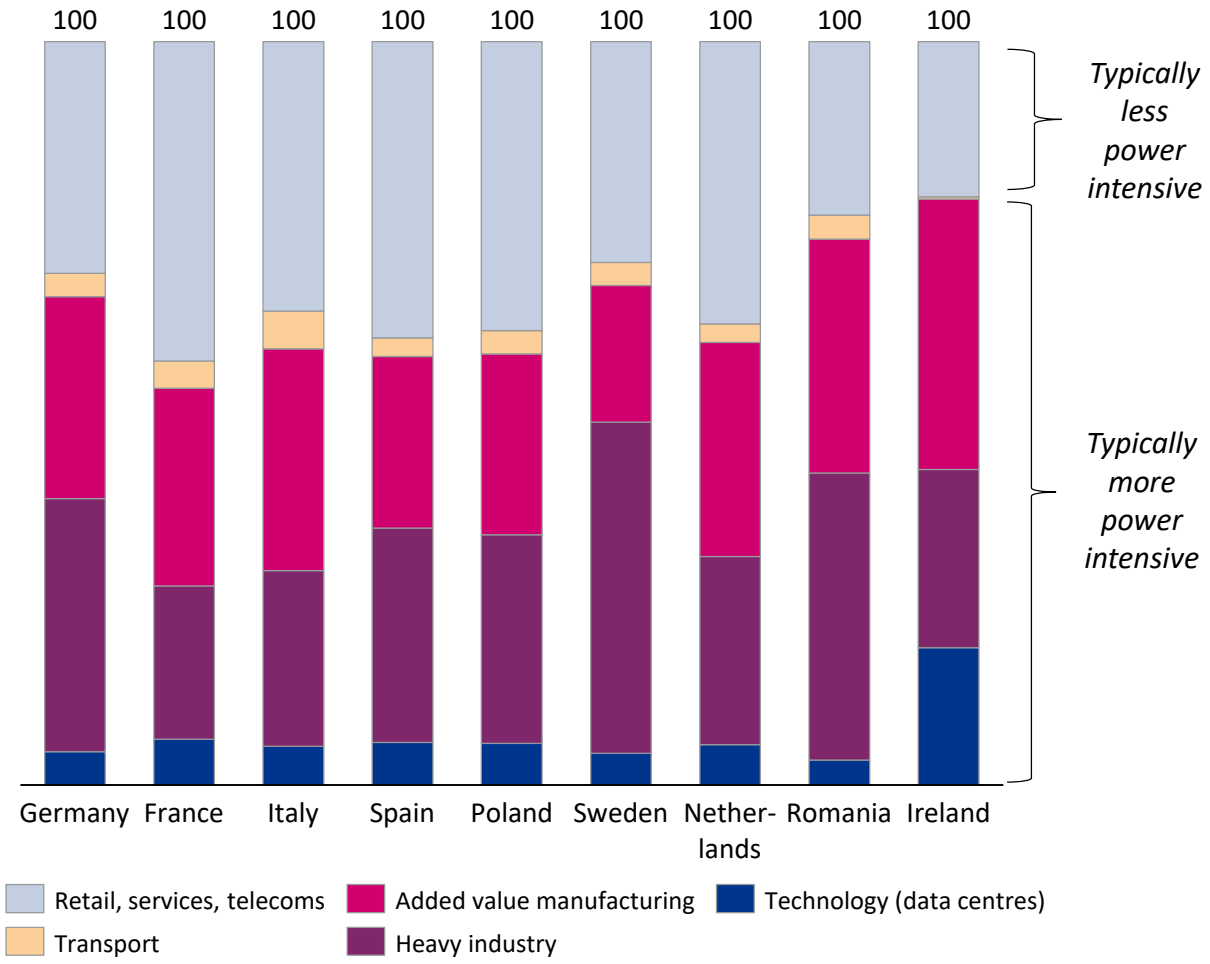
1: Interpretations of Net Zero are not uniform across Member States
2: Public attitude to climate change is defined by two metrics: proportion of public surveyed asking if climate change is one of the most serious problems concerning the world, and the proportion of the public who have personally taken action to fight climate change

Source: European Commission, Climate Action Network

Characteristics of commercial power demand in EU countries

Member States generally have a diverse mix of industrial and commercial (I&C) demand, a high proportion of which is energy intensive

% of electricity I&C demand by country and sector in 2018



- There is generally a large pool of energy intensive demand across each country
- Ireland benefits from particularly high data centre demand
- Sweden, Romania and Germany have a notably higher heavy industry base, with Italy and Spain lacking an equivalently strong industrial base

Source: Eurostat

Level of Government support

Levelised Cost of Energy (LCOE) in several Member States suggest projects unable to offer much value vs wholesale prices

Competitiveness	
In the money	Projects expected to offer material savings to offtakers vs wholesale prices over the course of a long term PPA
Competitive	Some projects expected to offer material savings to offtakers, albeit with material price risk, but others will require support
More expensive	Most projects will require subsidies to compete with wholesale prices

- Our estimate of generators' PPA requirements considers whether each Member State x technology vector among nine EU is going to be competitive with respect to wholesale prices over the next decade. Competitiveness stems from several factors:
  - For the cost of renewables, the availability of solar / wind resource, the cost of acquiring and developing fully permitted and consented sites and available economies of scale on sites, as well as the relative cost of capital for funding development are the key determinants of the eventual LCOE
  - The generation capacity mix and commodity prices for coal, gas and carbon will continue to set the wholesale power price
- We have categorised each vector into three states of competiveness through consultation with external stakeholders and our Pan-EU long-term power price modelling team, as well as drawing on experience from our own advisory work in the market. We have also accounted for observed bidding behaviour in auctions, noting where we see actors taking on merchant risk through zero-price bidding as an indicator of competitive economics
- While markets such as Spain and Sweden have had highly competitive technologies for several years now, many other markets are on the verge of competitiveness, particularly in solar PV, where LCOE costs continue to fall
- An increasing RE penetration might lead to a decline of capture prices in the future and hence, result in a deterioration of competitiveness
- We note several Eastern European markets (e.g. Poland and Romania) as having particularly strong economic fundamentals due to the high quantities of carbon in their current capacity mix, which is likely to keep power prices relatively high over the coming decade provided carbon prices stay at current levels

Status of Government support in Member States

Support has largely moved from administratively set tariffs to competitive processes, but there are few cases of fully unsupported technologies

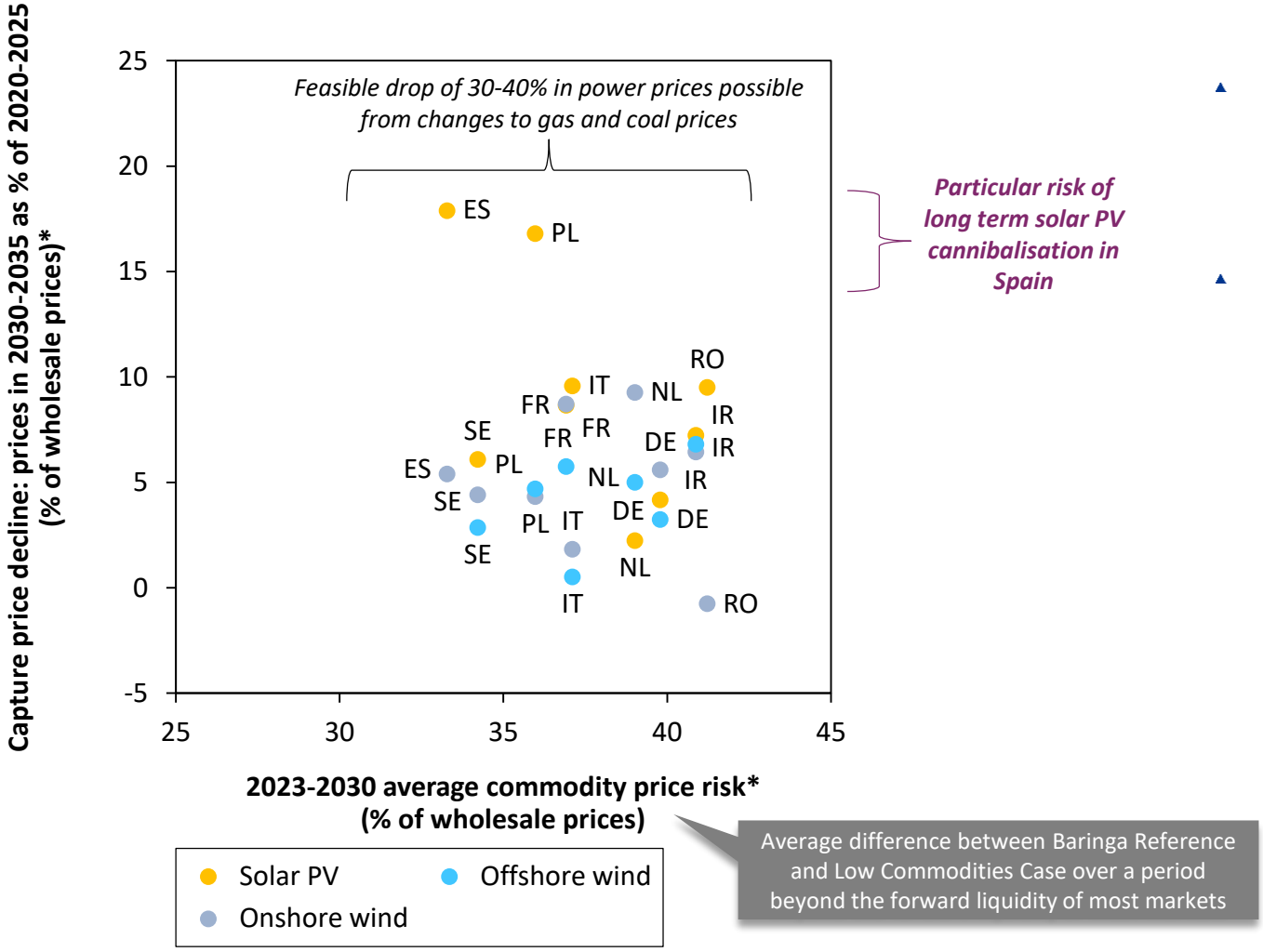
Member State (MS)	Offshore wind	Onshore wind	Utility scale solar	Small scale solar
Germany	*Contract for Difference (CfD) auction incl. tech specific and tech neutral categories*		*No support*	*As per wind*
France	*CfD auction for renewable projects built after 2016, replacing Feed in Tariff (FiT) mechanism; Rooftop PV >100kW still eligible for FiT*			
Italy	*No support*	*Reverse auction system of >1MW, mixed technology auctions*		*FiT schemes*
Spain	*Auctions (up to 500MW for wind eligible); projects bid a discount on the reasonable rate of return of the investment*			
Poland	*No support, CfD scheme under development*	*CfD auction for two way CfD of 15 years*		
Sweden	*Fixed volume of renewable obligation certificates, market determined price*			
Netherlands	*CfD auctions (SDE+) grants a premium on market price; amount of support differs for each technology and plant size*			
Belgium	*Tendering mechanism at national level*	*Green certificate scheme which varies at regional level*		
Finland	*Auction based tendering system, technology neutral*			
Austria	*FiT, costs are borne by the consumers*			*Investment grants available for 5-200kW capacity*
Czechia	*No support; support schemes withdrawn from January 2014, with small hydro as an exception*			
Greece	*Feed in premium based on pay-as-bid tenders; wind over 50MW and solar PV over 20MW eligible for mainland. FiT contracts entered into on non-interconnected islands*			*No support*
Romania	*No support; Green certificate scheme was cancelled in 2016, new CfD scheme in pipeline*			
Ireland	*No support*	*2-way CfD auctions with technology specific categories*		

c.90% of EU27 demand

Competitive | Administratively set

Long term price risk across Member States

Commodity risk is material everywhere, but there is real additional price risk associated with rapid deployment of renewables in Spain and Poland



Particular risk of long term solar PV cannibalisation in Spain

Average difference between Baringa Reference and Low Commodities Case over a period beyond the forward liquidity of most markets

- Power prices in Europe will remain largely tied to gas and coal prices over the next decade, proving up to 40% of downside risk on commodity price movements during unhedgeable periods
- In addition - there is also **real concern among market participants over cannibalisation in markets where renewable penetration is occurring** rapidly e.g. Spain

"…solar output in Spain is highly synchronised so we expect to see a lot of cannibalisation over the next 10 years …"
Developer

Note: *Capture prices based on Baringa Pan-EU Reference Case; Commodity risk taken as difference between power price in Baringa reference case and Baringa Low Commodity Price case scenario

Source: Baringa Reference Case; stakeholder interviews

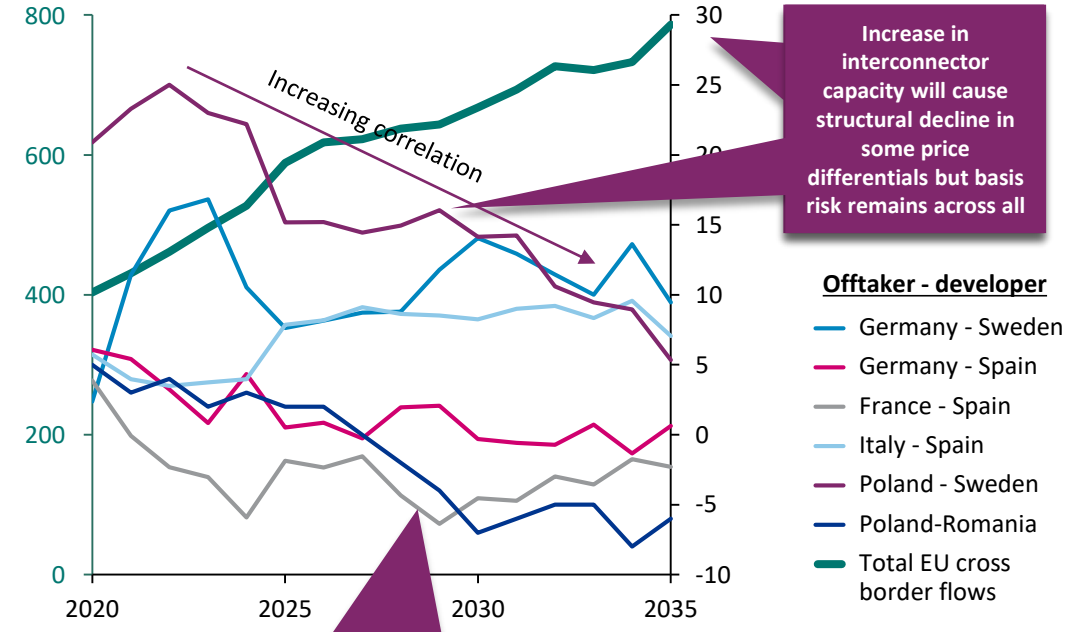
Basis risk for cross border PPAs

Basis risk across markets will remain material despite increasing market integration, while few offtakers are interested in cross border PPAs due to associated complexity of managing basis and legal risks

Basis risk will be material for cross border PPAs between Member States as the market becomes more integrated

TWh Total EU cross border flow (2020-2035)

EUR / MWh difference in wholesale prices (2020-2035)



Perception of corporate ability and willingness to deal with cross border PPAs is mixed

- Several stakeholders maintain that cross-border PPAs add too much complexity for all but the most sophisticated procurers

  "…From our experience with corporates, basis risk is too much hassle for all but the very sophisticated…"

  Developer

- It has been posed as a solution for large energy users in Member States constrained by supply, although not having an energy footprint in the source country can be a barrier

  "…If I'm a big pharma company in Switzerland, what other choice do I have?…"

  Developer

- For physical cross border PPAs, a significant amount of additional complexity arises from dealing with multiple market jurisdictions and guaranteeing interconnector capacity

- Users who carry a small footprint in individual Member States but a more suitable sized footprint at a pan-EU level, have been identified as potential candidates

  "…There's a lot of well known consumer brands that have a foothold in each country but no major manufacturing base. Those are the ones interested in aggregating up demand across borders…"

  Developer

Source: Baringa Reference Case; Stakeholder interviews

Market structure impact on liquidity and available projects

More liquidity in markets with legacy of nuclear and hydro while auction schemes substantially lower generator's requirements for commercial PPAs in some markets

Case Study: Exeltium Initiative in France

- Exeltium initiative is a partnership between EDF and a group of large energy users in a 25 year contract to purchase low cost nuclear energy
- Initiative **limit the number of credit worthy counterparties** that are available to offtake PPAs
- However, **legacy of long term procurement for power** created through the initiatives contracting structure for cheap nuclear power

Case Study: Liquidity and risk management in Nordics

- Significant hydro capacity in the Nordics has resulted in **high levels of market liquidity** and a **suite of risk management products**

- Baseload products are standard in Nordics due to strong hydro resource; high demand from industrials in Nordics is suited to baseload products

- Contrasted by gas-driven markets such as the UK where liquidity is not as high, fewer risk management products

Case Study: Auctions limiting PPA

Onshore Wind in Germany
High auction prices achieved in Government subsidy scheme, combined with onshore wind auctions being undersubscribed limits PPA potential for onshore wind in Germany

"…There are very few renewable projects outside the EEG subsidy scheme, Germany is a sellers market with few projects for offtakers…"

Finance Partner

Onshore Wind in Ireland
Developers holding out for future auctions; onshore wind is the only competitive technology, yet limited volume procured through tech-neutral auctions

SDE+ scheme in Netherlands
Grid connection cost covered through SDE+ alongside uncompetitive auctions limits incentives for PPAs

France CfD mechanism
High subsidy scheme prices (EUR 55-60 / MWh) does not incite developers to consider PPAs as a route-to-market

"…We have a development company in France, but have been unable to attract their attention on PPAs given high subsidy prices…"

Pan-European Utility

Summary of drivers by Member State (1 of 2)

Member State	Market Fundamentals			
	2030 Targets	Government support	Merchant risk appetite	Offtaker demand
Germany	Ambitious, with healthy pipeline in solar and offshore wind	Undersubscribed onshore wind auctions - PPAs uncompetitive	Generator requirement for PPAs unproven	Strong overall large energy user base, strong green mandate
France	Ambitious, with healthy pipeline	High renewable auction prices limiting PPA RtM	Generator requirement for PPAs unproven	Exeltium Initiative means PPAs competing with low nuclear prices but also provides framework for long term contracts
Italy	Ambitious, pipeline needs work	Generous subsidy scheme (20 year tenor), except some solar	Generator requirement for PPAs unproven	Low LEU base, behind on green mandate, zonal pricing creates basis risk against national price
Spain	Ambitious, with healthy pipeline	Lacking support over past few years but new auctions schemes due this year	Strong appetite for PPAs to reduce merchant risk exposure	High utility participation, LEUs soon incentivised to follow, concern over cannibalization risk on solar PV, up to 7 year liquidity
Poland	Modest	CfD auctions but limited in budget and volume	Strong appetite for PPAs to reduce merchant risk exposure	Strong industrial base but weaker green mandate and competing incentives for on-site generation
Netherlands	Ambitious, with healthy pipeline	SDE+ scheme limiting solar PPAs	Strong appetite for PPAs to reduce merchant risk exposure	Very strong data centre demand, also strong liquidity up to 2-3 years; many instruments available
Sweden	Ambitious, with healthy pipeline	ELCERT - certificate based, still exposed to market prices	Strong appetite for PPAs to reduce merchant risk exposure	High corporate participation, concern over cannibalization risk, standard baseload PPAs available
Romania	Modest	Certificate scheme closed in 2016; CfD mechanism in design	Generator requirement for PPAs unproven	Generators obliged to sell to central market
Ireland	Ambitious, with healthy pipeline	Undersubscribed CfD auctions - PPAs uncompetitive	Generator requirement for PPAs unproven	Very strong data centre demand but perception of additional long term price stability due to wind penetration in capacity mix

Absence of key driver severely constrains large areas of market

Absence of key driver severely constrains one or more groups of participants

Healthy

*More context on each cell provided in accompanying xl sheet

Summary of PPA drivers by Member State (2 of 2)

We have summarized driver for PPAs within each Member State

Member State	Summary	
Germany	**High potential, some pipeline challenges**	Growing pool of utilities and suitable corporates seeking PPAs and good pipeline of solar and offshore wind projects, though some pipeline challenges exist in onshore wind. Some offtakers seeking cross-border PPAs in countries with available projects
France	**Challenging overall fundamentals**	Challenging economics due to relatively high cost of capital for PPAs and low offtaker demand due to cheap nuclear power and price regulation
Italy	**Poor pipeline and zonal basis risk**	Good economics for solar but dysfunctional pipeline, poor sleeving support from utilities, and sizeable basis risk between zonal and national pricing
Spain	**Highly active but becoming more limited by long term price risk**	Good economics and strong solar pipeline, with end user demand set to grow driven by policy. Largely driven by utilities to date, though with mixed views on long term price risk due to solar cannibalization
Poland	**Great fundamentals but demand for PPAs constrained**	Projects competitive with market price and expected to become more competitive as solar LCOEs fall. Strong competition from auctions scheme and limited availability of corporates due to weaker green mandates and generous subsidy schemes for on-site generation
Netherlands	**Challenging economics due to prioritization of offshore wind**	Strategic focus on offshore wind, which has challenging economics and developers have opted not to receive Government support. Healthy solar pipeline but competition from SDE+ scheme
Sweden	**Highly active but may need more offtakers**	Strong fundamentals, growing data centre demand, no major barriers apart from credit risk and long term price risk for smaller offtakers
Romania	**Good fundamentals but less mature**	Playing catch up but good fundamentals and reinstatement of Government support through auctions will grow the market
Ireland	**Challenging overall fundamentals**	Challenging economics and strong competition from auctions due to low auction clearing ratios

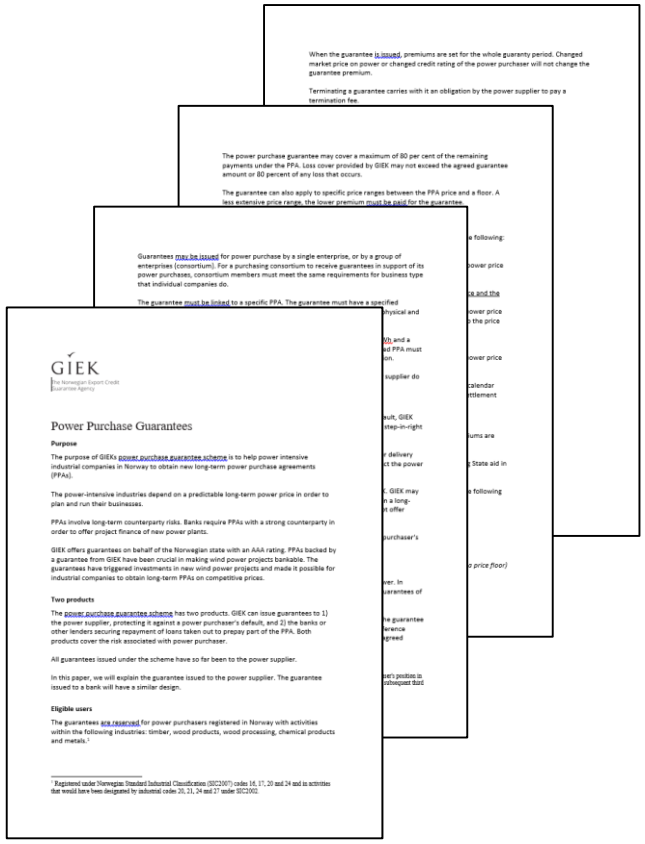
Case study: Norwegian Power Purchase Guarantee Scheme

Power purchase guarantee offered by the Norwegian Export Credit Guarantee Agency (GIEK) supports investment in renewable energies and enhances industrial companies ability to obtain long-term PPAs

- The purpose of GIEK's power purchase guarantee scheme is to help power intensive industrial companies in Norway to obtain new long-term PPAs.
- GIEK can issue guarantees to 1) the generator, protecting it against an offtaker's default, and 2) the banks or other lenders securing repayment of loans taken out to prepay part of the PPA. Both products cover the risk associated with offtakers.
- The guarantees are reserved for offtakers registered in Norway with activities within the following industries: timber, wood products, wood processing, chemical products and metals.
- The guarantee must be linked to a specific PPA. The guarantee must have a specified maximum amount and designated time period. GIEK can issue guarantees for both physical and financial PPAs, with terms between 7 and 25 years.
- The offtaker must have an annual power consumption of at least 10 GWh and a contracted volume of at least 35 GWh over the period of the PPA.
- The scheme is technology neutral with regard to the generator. The generator do not necessarily need to be located in Norway.
- GIEK require collateral in the PPA for the guarantee. In case of an offtaker's default, GIEK has the right to step into the offtaker's position in the PPA. The step-in-right requires a PPA under Norwegian law.
- From the point in time when the generator rightfully discontinues its power delivery under the PPA due to the offtaker's default, GIEK will step in and instructs the generator on how to sell the power.

More information available under

https://www.giek.no/getfile.php/138326-1590588718/Power%20Purchase%20Guarantees.docx


GIEK

Power Purchase Guarantees

Purpose

The purpose of GIEKs power purchase guarantee scheme is to help power intensive industrial companies in Norway to obtain new long-term power purchase agreements (PPAs).

The power-intensive industries depend on a predictable long-term power price in order to plan and run their businesses.

PPAs involve long-term counterparty risks. Banks require PPAs with a strong counterparty in order to offer project finance of new power plants.

GIEK offers guarantees on behalf of the Norwegian state with an AAA rating. PPAs backed by a guarantee from GIEK have been crucial in making wind power projects bankable. The guarantees have triggered investments in new wind power projects and made it possible for industrial companies to obtain long-term PPAs on competitive prices.

Two products

The power purchase guarantee scheme has two products. GIEK can issue guarantees to 1) the power supplier, protecting it against a power purchaser's default, and 2) the banks or other lenders securing repayment of loans taken out to prepay part of the PPA. Both products cover the risk associated with power purchaser.

All guarantees issued under the scheme have so far been to the power supplier.

In this paper, we will explain the guarantee issued to the power supplier. The guarantee issued to a bank will have a similar design.

Eligible users

The guarantees are reserved for power purchasers registered in Norway with activities within the following industries: timber, wood products, wood processing, chemical products and metals.[1]

[1] Registered under Norwegian Standard Industrial Classification (SIC2007) codes 16, 17, 20 and 24 and its activities that would have been designated by industrial codes 20, 21, 24 and 27 under SIC2002.

2. Assessment of Drivers and Barriers

A Market Study including an assessment of potential financial instruments to support renewable energy Commercial Power Purchase Agreements

Our assessment of drivers and barriers to commercial PPAs

- We have assessed barriers to commercial PPAs primarily through the lens of different offtaker sectors which each have different procuring behaviours, green mandates and power consumption characteristics
- Mandates for green procurement among industrial and commercial power consumers is increasing, **even heavy industries experience increasing pressure from investors and from downstream in the supply chain**, where consumer-facing organisations are pressuring their supply chains to go green
- However, there is a clear gap between procuring behaviour of ambitious, highly visible, cash-rich tech and manufacturing majors and other more conservative, cash-constrained firms who find it more challenging to make the business case for commercial PPAs. The 'majors' have more ability to:
  - **Hedge power over 10-15 year time frames** without taking on **dangerous levels of price and volume risk**
  - **Pay a premium** for long-term power in order to meet their decarbonisation goals
  - Invest in **long procurement cycles** than the typical 3-5 year strategic horizon
  - As a result of the above, contracting a more substantial amount of their overall electricity demand through PPAs
- Above all else, the **ability to own long term price risk** and provide **sufficient credit worthiness** are the main barriers preventing less sophisticated, smaller scale corporates with suitable power footprints from executing commercial PPAs
- Sectors with **local competition** are influenced by peer behaviour and may be willing to take on more risk if they are comfortable it does not negatively affect competitive strength
- **Additionality** is currently a key criteria for corporates. The ability to link PPAs to new projects is considered necessary to demonstrate a commitment beyond 'greenwashing'. This is inhibiting the use of shorter commercial PPAs as a means of releasing capital and is **a particular challenge for offshore wind due to its inherent size**
- **Larger utilities** with strong balance sheets have **started to take on some of the price and credit risk** in markets where they see good economics and growing corporate demand
  - **This provides more standardisation** in terms and removes complexity for corporate customers able to contract through utilities
  - However, this **may not be sustainable** or extend across to small utilities or markets where economics are more challenging

What is a ‘driver’ and what is a ‘barrier’

We have defined what we see as a fundamental strength or weakness of the renewables market and what is a barrier specific to executing commercial PPAs

	Criteria	What are we assessing?
Drivers	A Renewables capacity targets	▲ Is there a strong pipeline of ‘shovel ready’ projects, are there permitting/planning issues that may be slowing development of new projects?
	B Level of Government support	▲ To what extent does Government support renewables deployment investment where renewable technologies are not competitive enough to be deployed unsupported
	C Merchant risk appetite	▲ How much exposure to power prices can the industry take on, and therefore how many PPAs are required to reduce that exposure?
	D Offtaker demand	▲ Is there credible and motivated demand to sign PPAs and procure renewable energy from utilities and corporate large energy users
Barriers	1 Price risk & Competition	▲ How is offtakers’ capacity to contract long-term affected by their competitive environment?
	2 Clip size & forward start	▲ Is the volume of power too large for a single corporate or offtaker to contract in one go? Or the development timeframes too extended to sign up to a PPA prior to FID
	3 Credit worthiness	▲ Is credit worthiness of each party a preventing otherwise credible and willing parties to execute PPAs
	4 Contract complexity / length	▲ Is the complexity and cost of contracting / procurement a barrier to executing PPAs?
	5 Hedging availability	▲ How far forward is there liquidity in the forward power and how does that affect the availability of risk management products i.e. for shape, volume and basis risk
	6 Additionally & Corporate recognition	▲ What are offtakers’ requirements for additionality; Is it sufficiently linked to releasing capital for new renewables?

Splitting demand into distinct sectors (1 of 2)

We have defined sectors based on varied characteristics which affect approach to energy procurement

Sector	Examples active in PPAs	Energy characteristics	Competitive dynamics
Utilities	uniper, aspo, Shell, IBERDROLA	Typically source power on behalf of end user customers, making money off of risk management of power markets	Increasingly represented by international players with strong balance sheets who compete on energy risk management
Data centres	Google, Amazon, Facebook, Microsoft	Very power intensive, resulting in intense focus on optimising power costs. Footprint concentrated on a small number of sites per country	Dominated by global tech majors with exceptionally strong balance sheets and high profit margins Co-locators and local developers also a significant segment with more competition and less margins
Heavy industry	ArcelorMittal, ALCOA, Hydro	Very power intensive, particularly in aluminium, resulting in intense focus on optimising power costs. Footprint often concentrated on a small number of sites globally	Typically listed entities with strong balance sheets who compete globally
Value-added manufacturing	BOSCH, Prysmian	Typically power intensive, with active management of power use and procurement through hedging. Footprint often concentrated on a small number of sites globally	Mix of major global brands with high margins and more local B2B manufacturers who compete locally and operate with tighter margins
Life sciences	NOVARTIS, DSM, Pfizer, BAYER	Can be power intensive but often less so than heavy industry or manufacturing. Some active management of power procurement but considered less of a value driver vs heavier manufacturing. Footprint often concentrated on a small number of sites globally	Typically global brands with strong balance sheets and high margins

Splitting demand into distinct sectors (2 of 2)

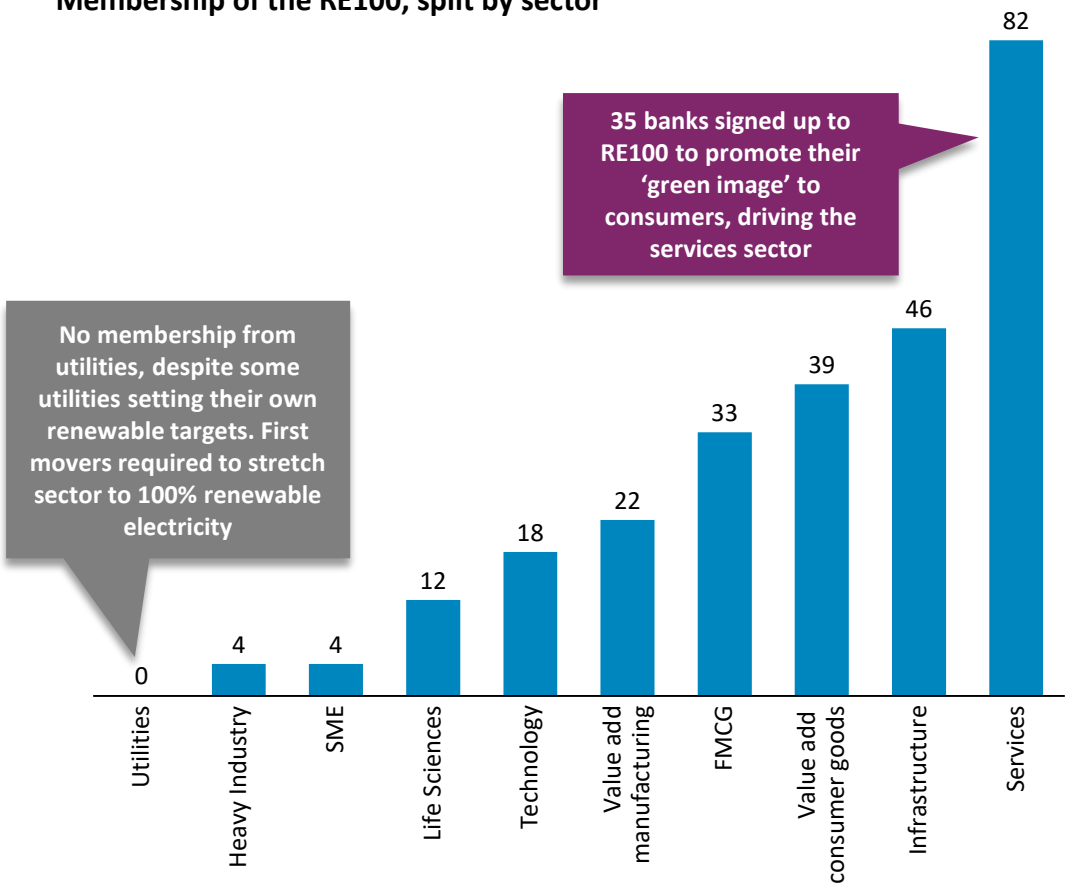
We have defined sectors based on varied characteristics which affect approach to energy procurement

Sector	Examples active in PPAs	Energy characteristics	Competitive dynamics
Fast moving consumer goods (FMCG) and major retailers		Typically large power footprint, with active management of power use and procurement through hedging. Dispersed over a large number of sites at a national level	Strong local competition concentrated among small number of large entities, very low margins, 3-5 year business cycle, highly consumer facing
Value-added consumer goods		Less power intensive, with less active management of power use. Low footprint in a single country but global brands typically present in multiple countries	Mix of global and local competition, mid-high margins, 3-5 year business cycle, consumer facing
Infrastructure		Typically power intensive, with active management of power use and procurement through hedging. Dispersed over a large number of sites at a national level	Strong local competition among small number of large, listed entities. Very low margins, 3-5 year business cycle, consumer facing
Services		Not power intensive, with less active management of power use and procurement through hedging. Dispersed over a large number of sites at a national level	Strong local competition among small number of large, listed entities. Low margins, 3-5 year business cycle, consumer facing
SMEs		Low power use, less active management of power, typically taking retail tariffs	Varied

Mandates to procure renewable energy across sectors

Consumer facing sectors dominate the RE100, though manufacturing, technology and heavy industry will come with larger energy footprints

Membership of the RE100, split by sector



- Stakeholder pressure to go green is more prevalent in consumer facing sectors, and is driving action in what targets are set and how energy is procured

  "…We see a corporate PPA to some extent as a cost of doing business. It's about reputation management…"

  Tech Major

- Manufacturing sectors have been slower reflecting the higher cost/risk to their business model of going green, though this is changing as a result of increased pressure from financial stakeholders

  "…We are seeing more activity around greening of supply chains as investors increasingly care about our companies ESG agenda, resulting in more sectors and companies looking to go green… "

  Major UK retailer

- Pressure to go green is often driven by competitors in a sector, but requires first movers to set the tone

  "…In reality, other companies in our sector have slightly different targets but we are chasing our competitors to in our ability to source renewable energy, and go green…"

  Telecoms Major

Source: RE100

Price risk and competition

Commercial PPAs tie offtakers into long term fixed price for power, which for some sectors can mean introducing risk into their business

1

Price risk & Competition

Limited price risk appetite prevents less secure corporates and utilities from procuring a higher portion of their demand via long term PPA volumes **across most markets**. While utilities have some capacity to carry the risk, they can only take on risk where projects are attractive vs market prices and as long as they do not run out of risk budget

Large Energy User Sector (not exhaustive) + Example organisation	% change in profit resulting from EUR 10 movement in power prices	Electricity as % of total operating costs @ EUR 60 / MWh
Technology	0.3%	0.6%
Manufacturing	0.7%	0.3%
Fast Moving Consumer Goods	2.1%	1.8%
Infrastructure	1.7%	0.7%
Heavy industry	48%	8.2%

- Offtakers' exposure to price risk depends on i) electricity consumption as a proportion of overall costs and ii) the ability to pass any additional costs onto customers, which itself depends on competitive strength

  "…Technology giants have driven the PPA market in the Netherlands, helped by their strong balance sheets…" – Developer

- More cost competitive sectors such as **Fast Moving Consumer Goods (FMCG)** and **Infrastructure** (e.g., telecoms) operate on tighter margins and are less able to take on price risk than value added manufacturing or technology

  "…The long term nature of PPA contracts, hence long term price risk associated does concern us; if there were more 3-5 year contracts available we would have more PPAs…" – Telecoms major

- **Heavy Industry** (metals, cement, minerals, refining and chemicals) has a high energy consumption as a core part of its operations and are unlikely to incur any price risk that does not carry reward

- More risk averse sectors can see high PPA activity where there is a follow-the-leader approach e.g. UK saw a wave of PPAs with FMCG offtakers between 2017 and 2019

- In 'hot' markets such as Spain, utilities are carrying price risk rather than end users in order to lock in value they see in the PPAs. However, this requires very strong balance sheet utilities and very attractive economics and is only possible to a limited extent

- Business cycles also contribute to risk - **Heavy Industry** and **Technology** benefit from longer (10+ year) business cycles while most other sectors plan on a 3-5 year basis, with some placing a premium on having flexibility to exit locations at speed if required

Note: Utilities have not been included in the table of large energy users as they are not the end user of the power they procure and electricity is therefore not a true cost component of their business

Competition within sectors

Propensity to take on risk is affected by what competitors are doing; case studies below indicate that decisions depend on what peers are doing and competitive strength

1

Price risk & Competition

Limited price risk appetite prevents less secure corporates and utilities from procuring a higher portion of their demand via long term PPA volumes **across most markets**. While utilities have some capacity to carry the risk they can only take on risk where projects are attractive vs market prices and will run out of risk budget

Case Study: Norsk Hydro's 29 year PPA

Overview of heavy industry activity

- PPAs with the heavy industry sector have been led by Nordic countries
- 11.9 TWh of PPAs signed in the Nordics with heavy industry offtakers, including worlds 'longest wind power deal' (29 year PPA)
- Norsk Hydro alone have signed three PPAs with onshore wind in the Nordics, all of long tenor

How is Norsk Hydro able to sign a 29 year PPA deal?

- Legacy of long term liquidity in Nordpool allows baseload PPAs to be offered to offtakers
- Norsk Hydro are in a strong competitive position globally and the PPA is for c.10% of their requirement, resulting in PPA with acceptable level of long term price risk
- Renewables cost and wholesale power prices are fundamentally stable, limiting long term price risk

"…Heavy industry are concerned about long term price certainty and see long term contracts as a benefit…"

Finance Partner

Case Study: FMCG PPAs in the UK

Overview of FMCG activity

- 0.9 TWh of PPAs signed by FMCG in the UK; typically long tenor of 15+ years
- Led by solar PV technology PPAs; some onshore wind PPAs have also been signed

Enablers of FMCG PPA avalanche in 2016-2019

- In the UK, there are a small number of large FMCG entities creating strong competition
- Strongly influenced by customers (UK public are highly concerned about climate)
- McDonalds were the first mover in the UK, signing four PPAs across the UK
- High competition and need to show a 'green image' triggered a wave of FMCG PPA activity; Tesco, Sainsbury's, M&S all signed PPAs within 2-3 years

"…Our investors really care about our ESG and sustainability agenda, this drove our long term energy agenda and signing long term PPAs…"

Major UK retailer

Case Study: Google & Microsoft 'arms race'

Overview of tech activity

- First movers in PPA markets across the world, with 6.3 TWh of PPAs signed in Europe
- Both firms now setting more ambitious renewable energy targets

Drivers of Google and Microsoft ambition

- Undergoing more scrutiny than other sectors from customers, regulators, investors and staff
- Stable and long-term demand from data centres suits large volumes of PPAs
- Electricity price has a tangible, but limited, effect on profitability due to stable demand and strong balance sheet
- Moving to targets more ambitious than additionality-seeking PPAs as a result
- *"…We are currently consider carbon displacement and being green 24/7 in our sustainability agenda and additionality definition…"*

Tech Major

Business cycles within sectors

Business cycles also limit appetite for longer tenors

1

Price risk & Competition

Limited price risk appetite prevents less secure corporates and utilities from procuring a higher portion of their demand via long term PPA volumes **across most markets**. While utilities have some capacity to carry the risk they can only take on risk where projects are attractive vs market prices and will run out of risk budget

	Length of business cycle			
Heavy industry users	***20+ years***	▲ Sites used to produce and refine petrochemicals, metals and minerals require very high capex and thus are built to last 20+ years	*"…Someone like Norsk Hydro can afford to take out 29 year PPAs because they know those assets will be there that long…"* *Developer*	**Longer business cycles enable long PPA tenors**
Data centres	***10+ years***	▲ Operate with relatively predictable demand and utilisation over a 10+ year period	*"…PPAs make sense for us because they fit well with the business lifecycle, the contract isn't going to outlive the data centre…"* *Data Centre*	
Added value manufacturing, consumer goods, and telecoms	***3-5 years***	▲ Manufacturing typically stays on site for periods longer than required PPAs tenors but flexibility is often required to relocate to different countries	*"…Some of these manufacturers don't know if they're going to still have a plant in that country in five years…"* *Developer*	**Shorter business cycles increase operational risk associated with changes in energy profile or manufacturing location**
		▲ High level of flexibility required to deal with changes to operating models and supply chain infrastructure	*"…We refresh our strategy every five years and knowing the PPA outlives that does limit the amount we can contract…"* *Telecoms major*	

Source: Stakeholder interviews

Clip size and forward start

Projects seeking PPAs have a minimum size they need contracted and require sufficient lead time for project construction

2

Clip size & forward start

The desired PPA size and long-dated forward start is a barrier for some **offshore wind projects** given the volumes and development time frames. However, it can also be an issue for corporates with **disaggregated demand** across a number of European countries that do not want to over hedge in any single market

Offshore wind
0.5-2 GW
2-4 year build

Onshore wind
10-200 MW
1.5-2 year build

Solar PV
10-200 MW
1-1.5 year build

- Offshore wind assets take considerably longer to build than either onshore wind or solar PV assets. As a result, corporates with business planning cycles of 3-5 years are less prepared to sign PPAs for assets that will take up to 3 years to come online. Only global majors in technology and manufacturing, who have longer planning horizons, are likely to be willing to wait

  "…We've got a 5 year planning cycle…last time we looked we were getting offered 2024/25 start dates for offshore wind in Germany whereas we can get solar much more quickly…"
  Telecoms major

- Additionally, the typical size of onshore wind and solar PV projects tends to fall within the range sought by most large energy users. Offshore wind assets are an order of magnitude larger in scale and require either exceptionally large offtakers or a larger number of PPAs which have weaker claims to additionality

  "…We've had discussions with offshore wind farms over 1.5 GW that need 60% of their volume contracted. That could be 40-50 PPAs, each of which take a long time to negotiate!…"
  Market advisor, Netherlands

- Corporates who have a highly disaggregated power footprint across Europe (e.g. consumer brands) have been suggested as possible offtakers for such projects but are typically sensitive to hedging their power through a single market

Credit worthiness of offtakers

Lack of credit worthiness blocks a significant pool of otherwise credible demand; only a subset of counterparties with scale and green ambition will be credit worthy

3

Credit worthiness

Credit worthiness is a major barrier across most sectors, particularly in heavy industry and manufacturing, and in less developed European economies, where many organisations have appropriate energy footprint for PPAs but are not rated by any major credit rating agency. Debt providers to renewables projects continue to require strong credit rating in order to consider the PPA bankable

- Banks providing project debt require PPAs to be signed with investment-grade counterparties in order for the revenue stream associated with the PPA to be considered secure

  "…Banks are not willing to accept the slightly less credit worthy counterparties…"
  Developer

- Credit guarantees provided by financial institutions are possible but generally not affordable

- Outside of the EU, where the risk has been removed, it has been effective in unlocking PPAs

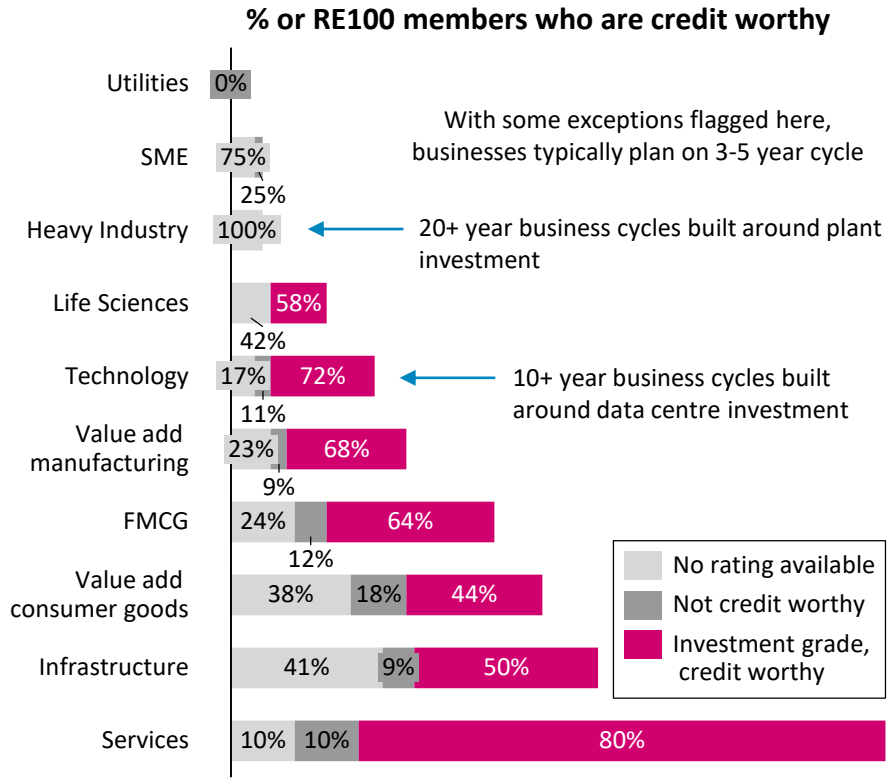
  "…The Norway credit guarantee scheme was essential in being able to sign our PPA…"
  Developer

- Removing this risk would not unlock all remaining power demand among large energy users

  "…Aversion to price risk often goes hand in hand with credit risk. Removing credit risk doesn't suddenly open up all mid-tier users with suitable size demand…."
  Utility

- There is also evidence of utilities taking on this credit risk on behalf of end users by taking on long-term PPAs without first securing demand among end users

  "…Utilities are increasingly loading up on long term PPAs but not backing this off onto corporate end users…"
  Utility



Source: Moodys, S&P, Fitch; RE100

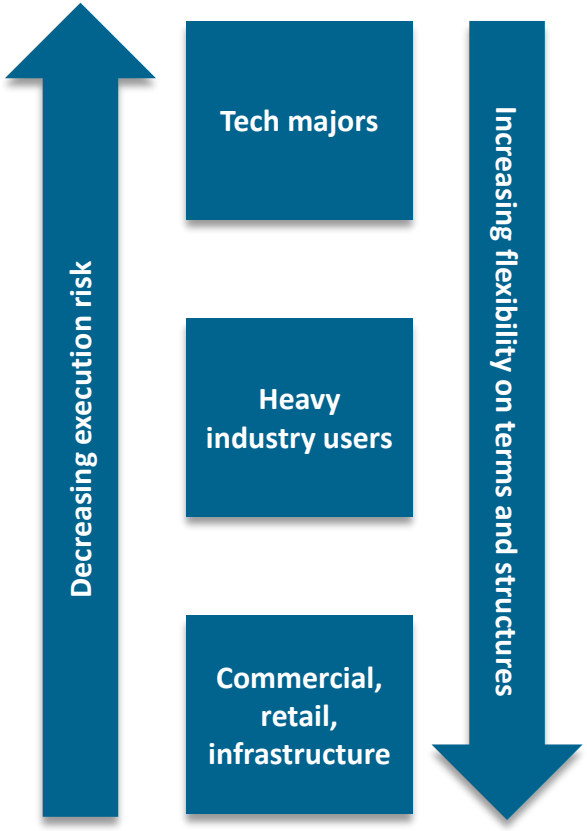
Ability to execute commercial PPAs

Sophistication and demands of tech majors markedly higher than consumer and retail

4

Contract complexity / length

The **complexity of negotiating PPAs** acts as a soft barrier which slows entry into the market by less sophisticated offtakers. Utilities have begun to play a role in offering simplifying structures and we expect the market to continue to find ways of slowly reducing complexity through platforms and standardisation of terms



Approach to procurement

- Tech majors have invested heavily in energy procurement capabilities and as a result are highly sophisticated and strategic in developing novel procurement solutions that meet ambitious green targets at a minimal cost - they will dictate terms to counterparties
- Less novel approaches to procurement than tech majors but capable of pursuing and developing long term solutions to suit their needs
- Less in-house expertise than more intensive power users and as a result often requires much higher time investment during procurement to educate on risks
- Preference for simple structures but are more open to structures with a lower hurdle of additionality

Evidence base

- Google held its own Europe-wide tender process for 1.3 GW wind in 2019
- Both Google and Microsoft attempting to procure renewable power with zero marginal emissions i.e. all power is 100% renewable on an *hourly* basis
- Several heavy industry users in the Nordic states have successfully secured long term PPAs with onshore wind developers which have provided significant value vs market prices

"…Take pharmaceutical companies: they need to be seen to do something green but they're not experts, they'll take simple pay-as-produced additionality…"
Utility

"…We've got over 10k connection points we need to manage, we don't have the resources to get up to speed, we'd rather a utility package a PPA up for us…"
Telecoms major

Source: Company annual reports and disclosures

Hedging availability

Long term liquidity in power markets helps either offtakers or generators manage certain risks associated with taking a long term position on power

5

Hedging availability

The availability of products to manage **volume and shape and intra-state basis risk** is a barrier in markets with lower long-term liquidity and/or weaker competition among power traders e.g. Italy, Central and Eastern Europe - additionally, basis risk acts as a barrier to cross border PPAs but in conjunction with complexity and additionality

Several markets have a legacy of long term PPAs or long term liquidity due to their structure

- In France the Exeltium initiative between EDF Energy and large energy users in a 25 year contract to purchase nuclear energy
- Nordic countries have similar legacies from hydro and nuclear assets, with standard products available to firm volume and shape
- US continues to have a large presence of monopoly utilities used to purchasing long term contracts from generators

Iberia has seen a rise in long term liquidity purely from renewables deployment

- PPA boom over last three years has introduced material liquidity up to 7-8 years as many utilities active in the market now have long term positions on their books

However most liberalised markets continue to have liquidity limited to commodity forwards

- 2-3 years liquidity, similar to gas/coal forwards in markets where gas/coal still sets marginal price

Some markets have uniquely challenging hedging environments owing to market structure

- Italy lacks efficient management if intra-zonal basis risk required to bring together competitive projects in the state's southern pricing zones with offtakers' exposure to national retail prices
- Ireland and other similarly small and relatively new markets (e.g. Greece) can lack liquidity even beyond one year, making it even more difficult to hedge and price PPAs

Corporate need for additionality remains across sectors

Some segments of commercial PPA demand may be willing to adopt less stringent requirements than the most common definition of additionality among offtakers

6

Additionality and corporate recognition

In order for corporate PPAs to provide additional value to corporates compared to GoOs, they need to prove a higher level of additionality. This has driven demand for commercial PPAs with long tenors that can linked to financial close on renewable projects, and can thus be marketed to stakeholders as being 'additional'. As a result there is more limited demand for commercial PPAs with shorter tenors among some corporates

- Additionality is being driven by the more ambitious brand leaders who are eager to be seen as progressive

  "…We're not going to do any more PPAs on assets already receiving subsidies…"
  Tech Major A

  "…Additionality is our north star…it becomes an issue for us if the PPA is only five years…"
  Tech Major B

- This has filtered down into other global brands' approach to procuring green

  "…We've purchased green certificates to begin with but we see that very much as a temporary solution while we find projects with additionality…"
  Global Lifesciences Major

  "…The big German automotive players we know have strong additionality requirements and want solutions that are physically close to their operations…"
  Utility

- However, there is some indication that a less strict approach is willing to be adopted by less sophisticated players

  "…In Poland there's much less emphasis on going green and corporates are generally only comfortable with hedging any part of their power for three or at most five years out…"
  Market Advisor

  "…We've got strict targets for how much power we procure through PPAs but at the same time our PPA portfolio includes a five-year PPA from a utility (and not a generator)…"
  Market Advisor

Additionality 'gap'

Unbundled GoOs and retail tariffs → **Commercial PPAs or long term fixed price tariffs on operational assets** → **Commercial PPAs underpinning construction debt finance**

Increasing additionality and required price risk transfer to offtaker

Source: Stakeholder interviews

Trader and utility demand in Member States

Utilities are very active as offtakers but are split on owning risks on behalf of corporates; some see themselves as natural owners of long term risks, others less so

- Utilities have become very active in long-term commercial PPAs in Spain and are also active in the Nordics, Netherlands and Germany
- They are currently taking on long term price risk and credit risk in these markets without passing on to end users

  "…All the utility PPAs we see happening are not backed onto consumers…"

  Utility A

  "…We buy 10+ years of risk and own it, we'll package it into 2-3 year chunks for our customers…"

  Utility B
- There are mixed views on traders' ability or willingness to continue to take on these risks

  "…It's a strategic decision many utilities are taking but it can't go on forever, there will be some big winners and losers eventually…"

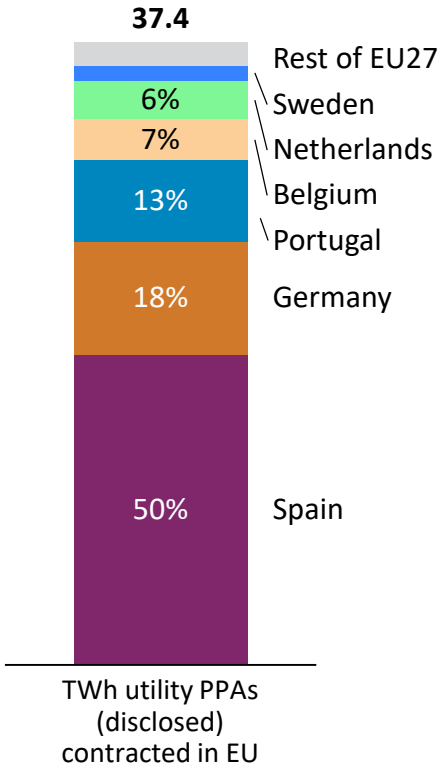
  Utility A

  "…We think it's our role to own that risk and to leverage our strong balance sheet to do it…"

  Utility B

  "…When we take power we try to find offtakers for it to eliminate as much of the mark to market risk as possible…"

  Utility C



Source: Stakeholder interviews

PPA barriers across sectors

Sectors vary in their capacity and appetite to execute commercial PPAs; data centres and utilities are uniquely advantaged

Sector	Mandate and ability to procure	Suitability for developers	Other key barriers
Utilities	Growing green mandate and strong expertise in procurement	Credit worthy and willing to contract utility-scale deals	Limited risk appetite beyond 10 years, zero appetite to pay over and above market price
Data centres	Very strong green mandate and expertise in executing wide variety of structures	Typically credit worthy and willing to contract utility-scale deals	No other major barriers
Heavy industry	Expertise in executing wide variety of structures	Willing and sufficiently sized to contract utility-scale deals but many parties lack sufficient credit worthiness	Generally require firm volume and shape, zero appetite to pay over and above market price
Value-added manufacturing	Growing green mandate and expertise in executing wide variety of structures		Preference for shorter tenors to fit business cycle, only global majors willing to take price risk
Life sciences	Growing mandate but often lack of expertise, preference for simpler structures	Typically credit worthy and willing to contract utility-scale deals	
Fast moving consumer goods and major retailers		Mix of credit worthy and non credit worthy; often not enough demand to procure in a single country	Limited appetite for long term price risk due to local competition and importance of power in cost base
Infrastructure		Typically credit worthy and willing to contract utility-scale deals	
Services	Many segments lack a large energy footprint. Retail banks with large building footprint are an exception	Mix of credit worthy and non credit worthy; often lacks demand to procure in one country	No other major barriers
SMEs	Less green mandate, not power experts	Not credit worthy and not enough demand to contract at scale	Limited appetite for long term price risk due to strong local competition

Major barrier - severely constrains most of sector

Moderate barrier - severely constrains one or more groups of participants

Minimal barrier

Identified barriers and their materiality

We have identified six barriers as being more material in preventing commercial PPAs

1	**Price risk & Competition**	**Clear barrier across most markets** - prevents less secure corporates and utilities from procuring a higher portion of their demand via long term PPA volumes across all markets. Market has some limited capacity to address - utilities are playing a role in taking on long term price risk where projects are attractive vs market prices but ultimately have limited capacity to take on such positions
2	**Clip size & forward start***	**Barrier for some offshore wind projects** given the volumes and development time frames. However, also an issue for corporates with **disaggregated demand** across a number of European countries that do not want to over hedge in any single market
3	**Credit worthiness**	**Clear barrier across most markets** - prevents a large number of corporates with suitable energy demand but lacking an investment grade balance sheet. Removal of risk has been demonstrably effective in Norway through the power purchase guarantee scheme provided by the Norwegian Export Credit Guarantee Agency (see slide 43). No evidence of market not addressing barrier - lenders have strict credit risk criteria. Will remain a barrier as long as investment models stay the same
4	**Contract complexity / length**	**Soft barrier i.e. introduces inertia into market activity** - prevents corporates with strong green mandates but limited understanding of energy markets, particularly in markets where utility sleeving is limited and expensive. **Market can and will act** - numerous platforms and some utilities already attempting to simplify
5	**Hedging availability**	**Barrier in markets with lower long-term liquidity and/or weaker competition among power traders** e.g. Italy, Central and Eastern Europe - additionally, basis risk acts as a barrier to cross border PPAs but in conjunction with complexity and additionality
6	**Additionality and corporate recognition**	**Subtle barrier but widespread impact** - there is currently no material differentiation between a Guarantee-of-Origin (GoO) backed deal and a 7-10 year PPA with an asset in construction or operations; this will prevent de-risking of operational assets rolling off subsidy over coming decade, which could be a material enabler of further funding for new build assets within portfolio generators

Applicable across most markets

Applicable in a smaller but significant number of cases

Less clear evidence of material applicability

* Clip size refers to the significant size of certain assets; forward start refers to long development/construction lead times.

3. Assessment of Market Size Potential

A Market Study including an assessment of potential financial instruments to support renewable energy Commercial Power Purchase Agreements

Note: Figures which appear here may differ from those presented in the main report due to rounding of the Main Report figures. Rounding has been done in the Main Report to minimise spurious accuracy while figures here have been preserved unrounded to allow for reconciliation with the market size spreadsheet provided as part of the scope of this work

Summary of market size potential

Our estimate of the market size potential for EU commercial PPAs is 140-290 TWh under contract by 2030 and is based on an assessment of generator requirement and offtaker demand in nine EU Member States

- We have estimated the market potential by **considering both generator requirements and underlying offtaker demand**. We are covering nine EU Member States which cover a wide geographical berth, a variety of market dynamics, and collectively span c.80% of EU supply and demand
- The **EU aims to achieve 55% of power generation from renewable sources by 2030 under the current EU RE targets**.* Government support will continue to play an important role for the majority of RE projects. However, the further decrease in technology costs and an increasing demand among corporates for green electricity support the development of a sizeable market for commercial PPAs. Commercial PPAs are an important tool to de-risk projects and thereby central to investment decisions
- The **market size is estimated to be between 140 TWh and 290 TWh** in 2030 – equivalent to c. 10% and 23% of 2030 solar and wind generation. The commercial PPA market size depends on a number of fundamentals – project economics (RE costs, electricity market prices), government support levels, merchant risk appetite and offtaker demand. All of these parameters are highly uncertain and the span reflects this uncertainty. This is equivalent to **c.10-40% of total generation from solar and wind renewables in 2030** (or 7-16% of I&C demand) and would de-risk **EUR 40-80bn** of renewables investment
  - Appetite among offtakers is estimated to be between 150 TWh and 290 TWh – depending on the industry's ambition to green their operations. The lower bound assumes limited additional demand from offtakers beyond large, listed organisations publicly committed to procuring renewables, while the upper bound assumes more participation by large energy users who have the appropriate footprint to consider PPA.
  - The requirement of generators for PPAs depends on the availability of Government support and their merchant risk appetite. If both elements are strong, generators require c.140 TWh of renewable generation to be under commercial PPAs by 2030. This would likely be met by offtakers. If Government support is relaxed, and generators have less merchant appetite, up to 480 TWh would require PPAs by 2030. In such case, the market would be constrained by corporate appetite for PPAs.
- In order to reach such market size, the removal of certain barriers and their underlying market barriers is necessary. Activity to date suggests the overall European market will need to pick up pace and requirements could be imbalanced across countries if the availability of credible I&C demand is not accounted for (a risk in Spain) or is under-utilized (a risk in Germany and France)

* Proposed target under the European Green Deal is 55% in total energy generation resulting in a higher share of renewables in power generation

Approach to assessing market size

We have considered generator requirements, offtaker demand, and the impact of barriers in our analysis

What are EU Member State renewables targets?

- What targets have been set in Member States?

How much of that requires commercial PPAs?

- How much support have Member States committed to through Government auctions?
- How much more are they likely to commit, based on market fundamentals and historical committed volumes?

How far will the EU get in current trajectory?

- What course is the commercial PPA market currently on?
- How is this likely to evolve over the next 5-10 years, assuming no major interventions or changes in PPA-specific drivers and barriers?

How much more potential demand is there among offtakers?

- What is the fundamental demand for green electricity among different sectors in different Member States?

Where is supply and demand constrained?

- Which Member States have a greater generator requirement vs offtaker underlying demand?

Nine Member States analyzed in depth

Baringa

We have analysed a set of Member States which cover a wide geographical berth, a variety of market dynamics, and collectively span c.80% of EU supply and demand

Member State (MS)	Power market size (TWh annual power demand)	# disclosed commercial PPA* deals since 2014
Germany	508	18
France	474	10
Italy	322	10
Spain	247	53
Poland	166	8
Sweden	133	19
Netherlands	116	10
Romania	54	5
Ireland	32	3

Rationale for selection of countries

- Geographical berth - spanning North, South, East and West Europe
- Variety of market dynamics, spanning differences in both market fundamentals and drivers/barriers specific to commercial PPAs
- Wide EU coverage, collectively accounting for over 80% of EU electricity demand and supply

Source: IEA (power market consumption); press articles and databases (disclosed deals)
Note: *Ony PPAs appearing to offer additionality have been included

Understanding drivers for commercial PPAs

Baringa

We have defined the fundamental drivers of PPA and developed two scenario 'cases' to assess how much renewable generation capacity will require a commercial PPA

Drivers

A	Renewables capacity targets	▲ Will there be a strong pipeline of 'shovel ready' projects seeking a route-to-market as a result of policy geared towards deployment at pace?
B	Level of Government support	▲ To what extent does Government provide support for renewables such that commercial PPAs are not required?
C	Merchant risk appetite	▲ How much exposure to power prices can the industry take on, and therefore how many PPAs are required to reduce that exposure?
D	Offtaker demand	▲ Is there credible and motivated demand to sign PPAs and procure renewable energy from utilities and corporate large energy users to serve generators' requirement?

Potential PPA requirement of generators

Commercial PPAs required by generators =

Scenario A - High PPA case

Lower Government support and continued low merchant risk appetite

Scenario B - Low PPA case

Higher Government support and higher merchant risk appetite

A – Total expected renewables capacity build

- ▲ National Energy and Climate Plan (NECP) targets will either be met or, where strong economics exist, exceeded
- ▲ Niche renewable technologies (e.g. biogas) and small scale solar are excluded as they are less relevant and less likely to seek PPAs respectively

Key assumptions

B – What is supported by Government

- ▲ In the **Scenario A - High PPA case**, Governments provide additional support where projects are uncompetitive but announced support is retracted where technologies are competitive
- ▲ In the **Scenario B - Low PPA case**, all announced auctions will occur irrespective of whether projects are competitive
- ▲ Both scenarios do not differentiate on power prices

Key assumptions

C – What is willing to operate on merchant risk

- ▲ Non-supported capacity consists of operational tail of projects rolling off existing support schemes plus new assets
- ▲ Across all "support-free assets", 10% of all cash flows across the market are merchant in the **High PPA case** and 35% in the **Low PPA Case**, reflecting range of evolution of merchant risk appetite according to where different markets are at today

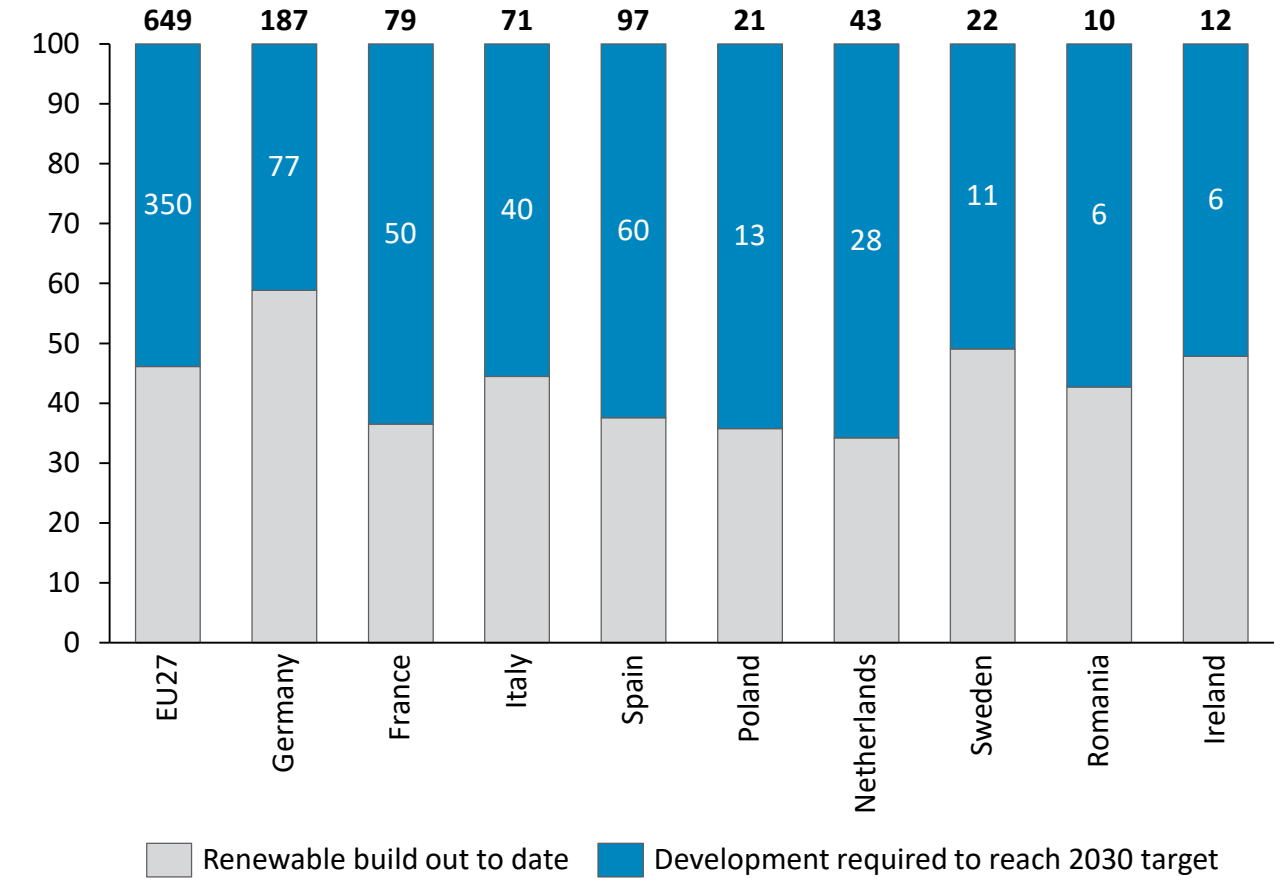
Key assumptions

A EU renewables targets

Baringa

Current EU policy targets c.650 GW of renewable energy capacity by 2030, which is reflected in Member States' NECPs; some Member States are further towards targets than others

Current and 2030 targeted renewable energy capacity



- Overall, the EU will need to develop 350 GW of new wind and solar capacity by 2030 to meet their renewable NECP targets
- Majority of EU27 Member States will need to at least double their renewable installed capacity over the next 10 years
- Germany has the largest shortfall against their target capacity (77 GW), but has the highest proportion of existing capacity against their NECP target (59%)
- Netherlands, France and Poland have the greatest proportion of remaining renewable capacity left to build by 2030, compared to their current renewable build out
- We have assumed current NECP targets but targets may increase once plans reflect European Green Deal and the European Commission's targeted 40 GW of renewable hydrogen production

Source: EU Member States' NECPs

Note: Baringa reference case projections used for 2030 targets. Renewable energy capacity targets exclude hydro, and other niche renewable technologies

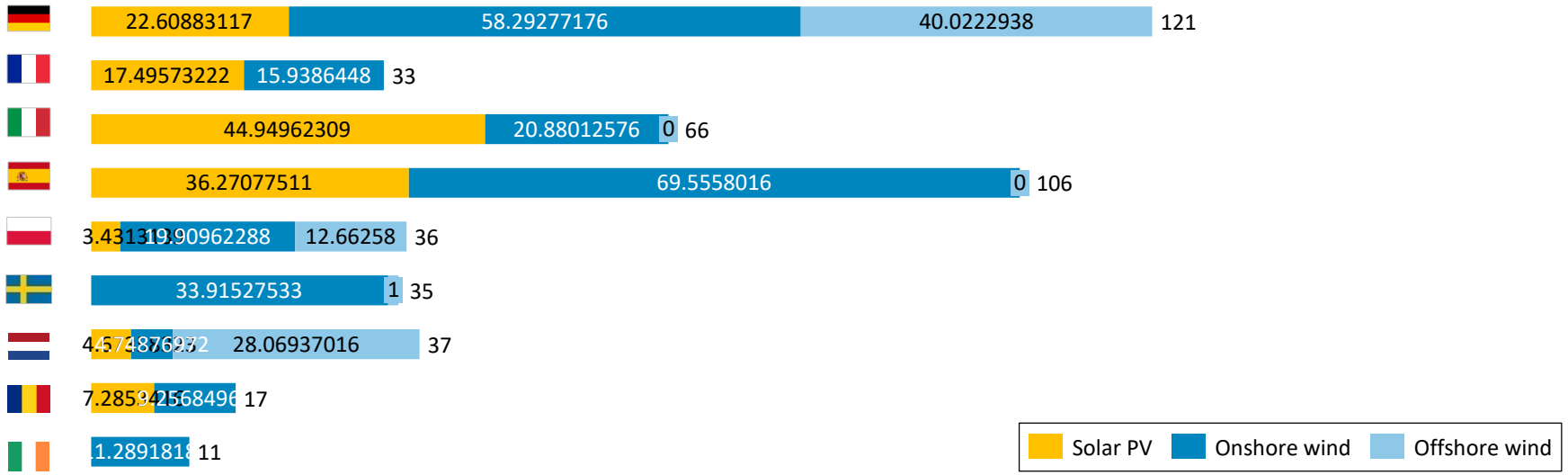
B Level of new Government support

Build out variers considerably by technology across Member States due to competitiveness of technologies

Competitiveness	
In the money	Projects expected to offer material savings to offtakers vs wholesale prices over the course of a long term PPA
Competitive	Some projects expected to offer material savings to offtakers, albeit with material price risk, but others will require support
More expensive	Most projects will require subsidies to compete with wholesale prices

- Where a technology in a specific markets is deemed **competitive**, we assume 50% of projects are competitive enough to seek a commercial route-to-market without any government support if required to
- Where a technology in a specific markets is deemed **in the money**, we assume 100% of projects are competitive enough to seek a commercial route-to-market without any government support if required to
- We assume support is in the form of auctions which replace the need to PPAs rather than certificate schemes which compliment, and is aligned with a general trend towards auctions by Member States in the last several years
  - In the **High PPA case**, Governments provide additional support where technologies are uncompetitive but announced support is retracted where technologies are competitive
  - In the **Low PPA Case**, all announced auctions will occur and any additional Government support required where technologies are uncompetitive will come through

TWh utility-scale solar and wind not supported by Government in 2030 (High PPA case)



B Level of contunuing Government support

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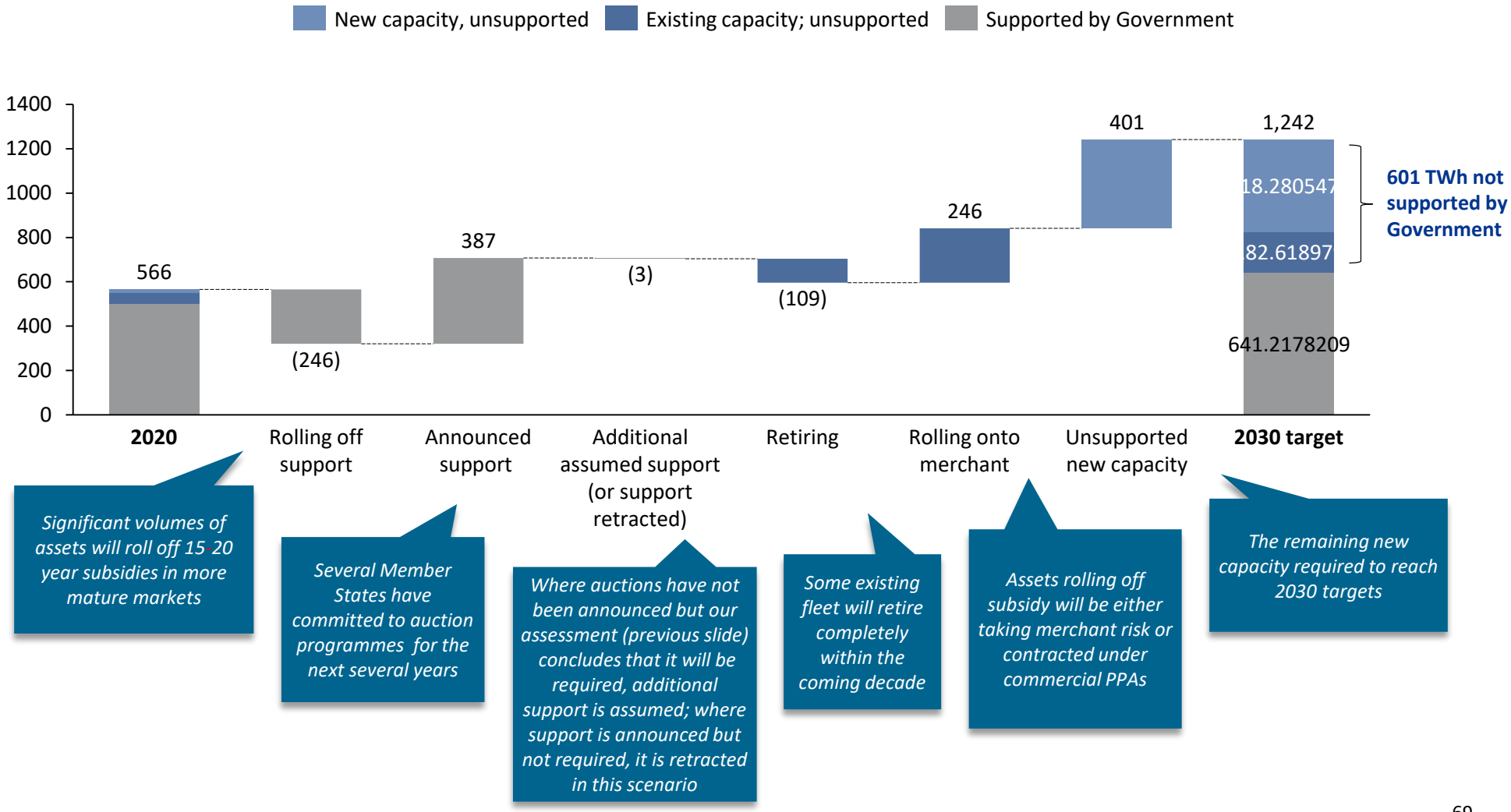
In the High PPA Case, 601 TWh of renewables, new and rolling off subsidy, will not be supported by Government in 2030

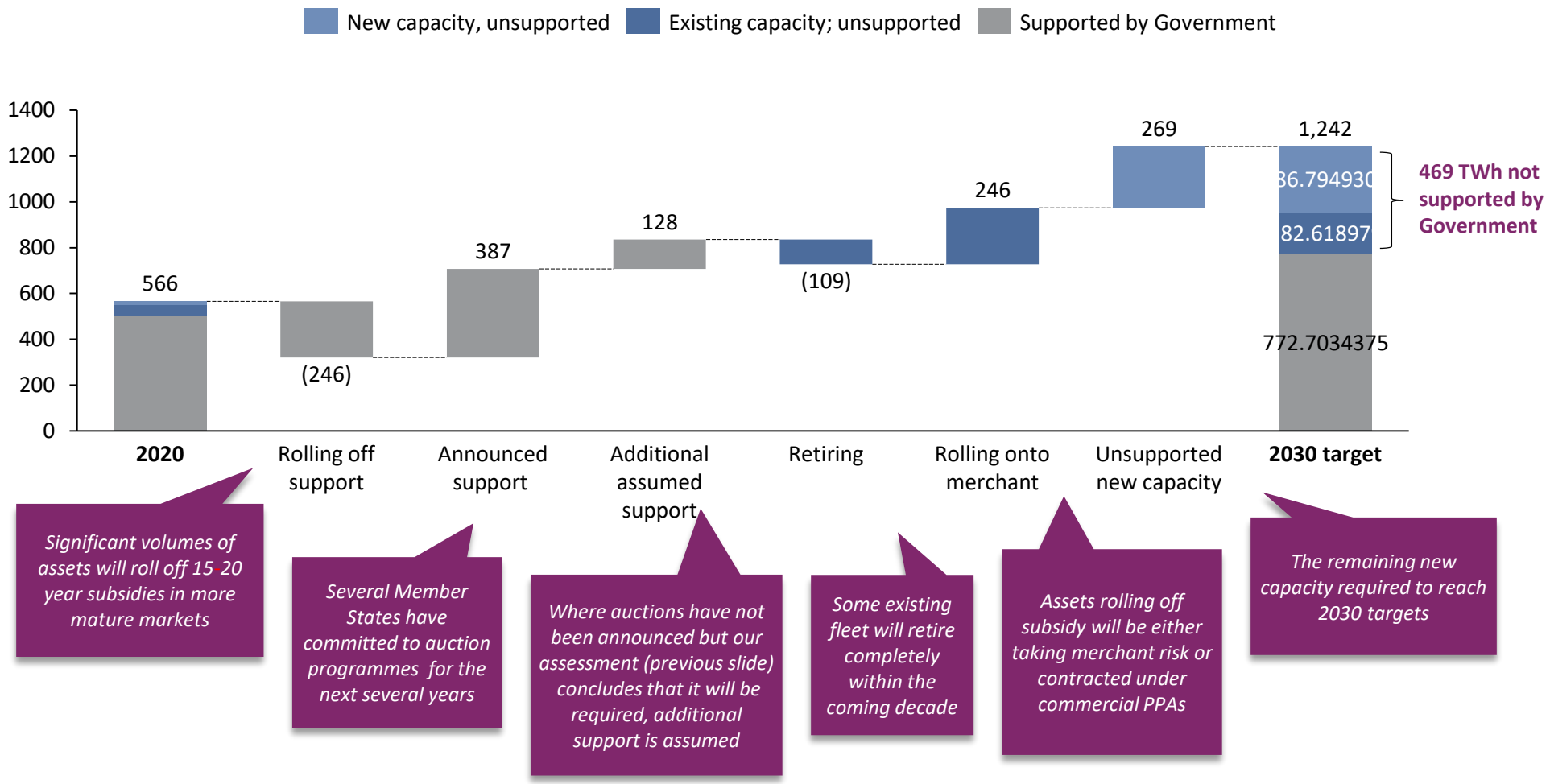
Scenario A - High PPA case - Evolution of solar and wind generation capacity, 2020 to 2030, TWh p.a.



B Level of contunuing Government support

In the Low PPA Case, 469 TWh of renewables, new and rolling off subsidy, will not be supported by Government in 2030

Scenario B - Low PPA case - Evolution of generation capacity, 2020 to 2030, TWh p.a.



C Range of possible merchant risk exposure

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We assume 10-35% merchant risk exposure is possible based on project experience in markets with certificates and through stakeholder interviews

	How have revenues looked over last 5 years		
	Socialised / subsidised revenues	**Contracted market revenues**	**Resulting Merchant exposure**
PPA on Swedish wind backed by certificates	***15-25% for 20 years*** EUR 10-15 / MWh *revenue available through the Swedish-Norwegian electricity certificate market over 2015-2018 period, based on volume weighted prices*	***~55%*** Commercial PPA at EUR 30 / MWh, fixed price on 90% of P90, based on Baringa experience in advising projects	***20-30%***
PPA on UK wind backed by certificates	***c.50% for 20 years*** EUR 50-65 / MWh *available through the UK Renewable Obligation Certificate (ROC) market over 2015-2020, based on the buy-out price*	***0-20%*** Some route-to-market PPAs on certificate projects have offered guaranteed 'floor' prices at EUR 25-30	***30-50%***
Auctioned wind in France	***100% for 15 years*** All contracted through auction schemes	***0%*** for merchant tail	***10-20%***
Feedback from capital providers	*"…The banks' limit is around 50% uncontracted revenue but realistically, you get very limited interest from equity once you go lower than around 65% uncontracted…"* *Global Renewables Investor* *"…If we get, say, half of our volume secured through Government auctions, we'll still ideally want 80% contracted…"* *Offshore Wind Developer*		***20-35%***

10-35% merchant exposure is a realistic boundaries on range of merchant exposure over the coming decade

Source: Swedish-Norwegian Electricity Certificate Market Annual Report 2018; UK OFGEM

Generator PPA requirement in Europe over next decade

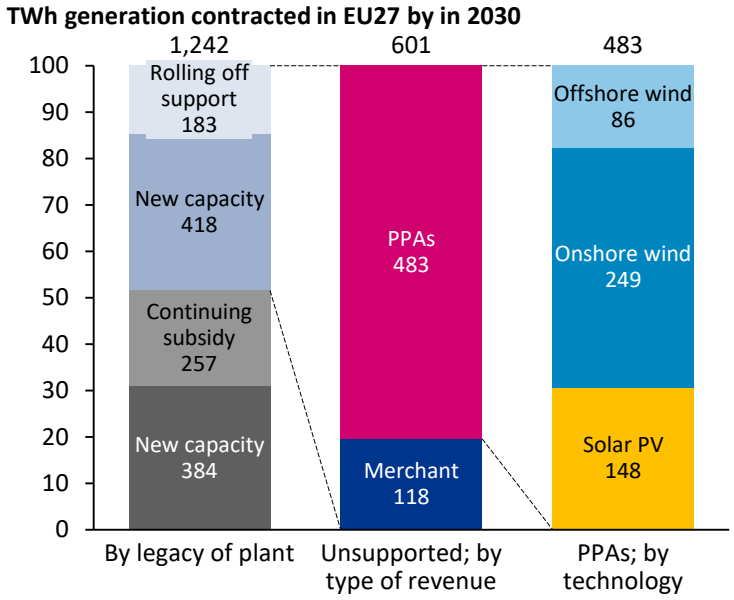
After accounting for merchant risk appetite we estimate generators' requirement for commercial PPAs to be 142-483 TWh under contract by 2030

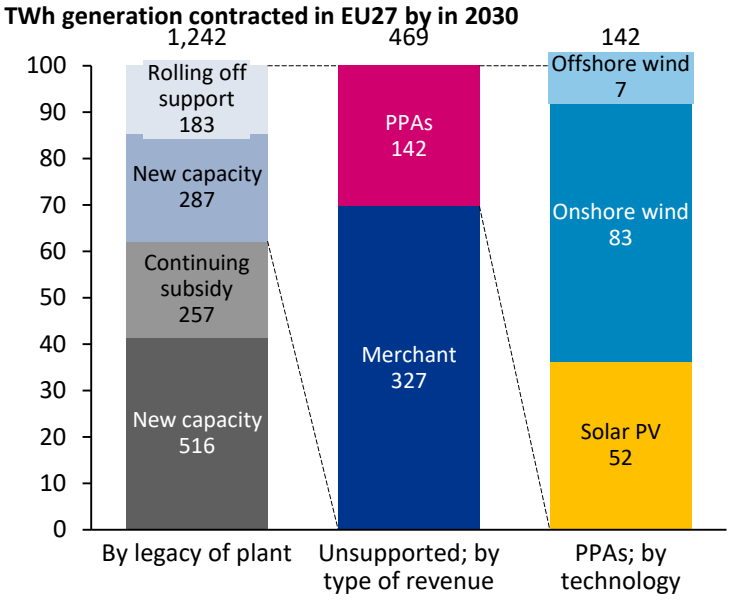
Low PPA case

Higher Gov. support; higher merchant risk appetite limits need for PPAs: Generators require a cumulative total of c.480 TWh to be under PPA by 2030, with new capacity build accounting for 75% of total generation

High PPA case

Lower Gov. support; lower merchant risk appetite drives need for PPAs Generators require a cumulative total of c.140 TWh to be under PPA by 2030, with new capacity build accounting for c.60% of total generation





- The broad range between scenarios reflects the uncertainty in future Government support and evolution of merchant risk appetite. Approx. 15% of generation in 2030 will come from assets rolling off subsidy schemes. Assuming merchant risk is managed at a portfolio level, these assets will also require commercial PPAs to de-risk portfolios
- Each of the major technologies have produced commercial PPAs in Europe to date, though each face different challenges: solar is intrinsically intermittent, onshore wind can face public opposition, while offshore wind typically cannot provide offtakers 'additionality' through a single PPA
- Up until now, 75% of generation under PPA has been under either onshore wind or solar with the remainder largely under offshore wind. The continuing role of offshore wind in unsupported generation going forward reflects evidence of merchant risk appetite seen in recent auctions in Germany, Netherlands and (though out of scope of report) UK

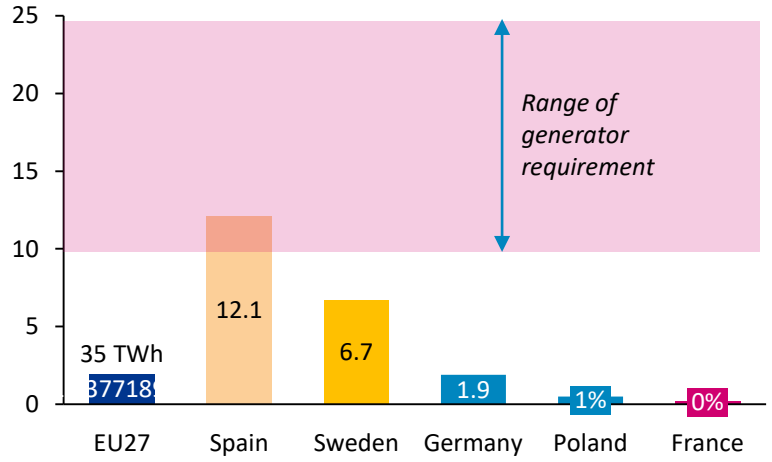
Note: *Extrapolated from analysis of 9 countries: Germany, France, Poland, Spain, Italy, Romania, Netherlands , Sweden and Ireland

Progress in Europe to date and trajectory

The market has picked up rapidly since 2017, but pace is uneven across Member States

The market has picked up pace considerably in the last two years

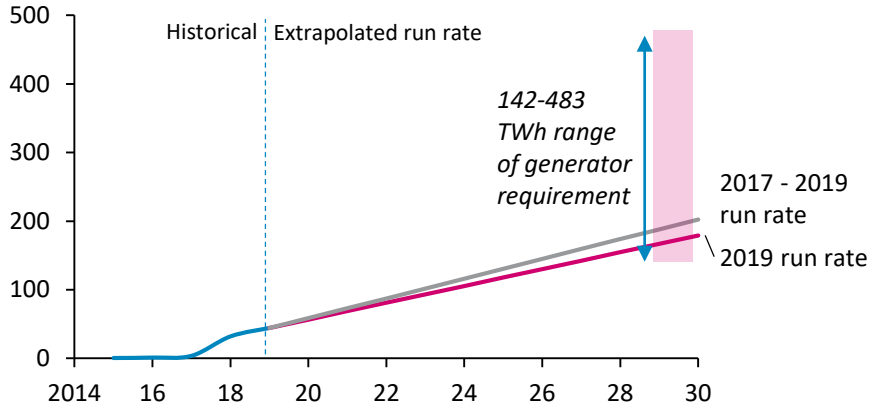
% total I&C TWh demand contracted under PPA today



- Sweden and it's neighbouring countries have seen steady PPA activity since the market kicked off in the middle of the previous decade. These have largely been corporate PPAs with both data centres and heavy industry offtakers
- Spain has seen over 10% of I&C demand contracted through commercial PPAs over the last few years, primarily through utility offtakers. However, these utilities typically have not had to pass additional long term price risk onto their corporate customers, instead either holding or negotiating PPAs with less price risk e.g. through cap-and-floor structures or shorter fixed price periods
- Countries with strong offtaker demand such as Germany and France are much less mature by comparison, largely as a result of less competitive renewables

We estimate 35 TWh of generation contracted under commercial PPAs, though the maturity of countries differs substantially

TWh cumulative commercial PPA contracted in EU27 at 2018-2019 run rate
(2020-2030F)



- PPA activity in Europe picked up substantially in 2017, with 2018 seeing the highest volume of activity to date, largely thanks to a handful of framework PPA deals against large volumes of solar in Spain
- To put the market size potential in perspective, we have extrapolated the run-rate of both 2019 and the period 2017-2019 to highlight that activity is likely to need to pick up pace in order to meet generators' requirements. Consequently, the need to address barriers seen in the market today is significant

Note: *Where only contracted capacity is reported, annual volumes estimated using standard load factor for each geography/technology
Source: Eurostat; Publicly disclosed PPA deals

How requirements compare to power demand

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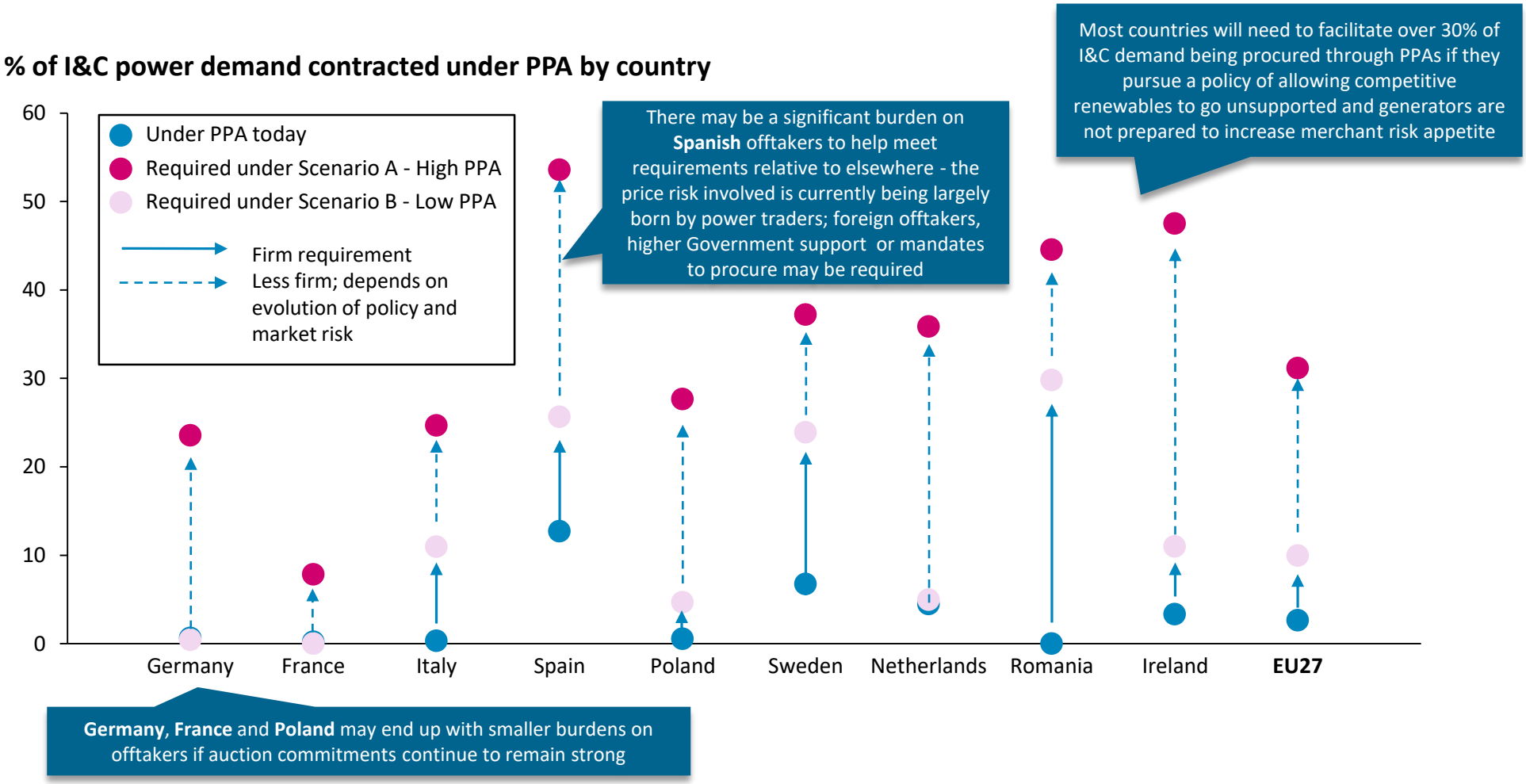
Spain will require a higher proportion of its industrial and commercial (I&C) demand base to procure PPAs to meet generator requirements



Source: Eurostat electricity consumption; publicly disclosed PPA deals; Baringa Pan-EU reference case

We have considered four metrics to triangulate demand

Baringa

Underlying demand has been triangulated by considering Guarantees of Origin (GoOs) demand, credit worthiness of I&C demand, energy user size and RE100 demand shortfall

1. **GoOs demand in supply constrained countries**
   - Where GoOs pricing is material, assume GoOs retirements are an expression of end user demand
2. **% of credit worthy I&C demand**
   - Using prior independent third party work on Germany as a case study, estimate user demand through estimation of credit worthy counter-parties and ability to procure without affecting credit rating
3. **Size and risk appetite of energy user**
   - Using Baringa experience on UK market as case study, estimate number of parties large enough to contract and the portion of demand they are typically willing to be contracted under long term hedge
4. **RE100 shortfall in demand**
   - Analyse demand committed under RE100 signatories and extrapolate to future membership size, estimating portion requiring procurement in Europe

GoOs activity as a proxy for pent up corporate demand

Baringa

Germany is the largest consumer (buyer) of GoOs in the EU, whilst Spain creates (sells) the most GoOs

1 Assessing GoOs demand in supply constrained countries

Key drivers of the value of GoOs: The balance of supply and demand for certified green power → The willingness of end users to pay a premium for certified green power → The resulting 'scarcity value' in an (under)supplied market

	Net trade of GoOs (TWh)	GoOs price (EUR/MWh)	PPAs as % GoOs retired	GoOs retired as % of I&C demand	Contracted PPAs as % I&C demand	Conclusions
Germany	83	0.80 - 1.6[2]	7%	27%	1.9%	▲ Net GoOs importer (very few imports) and high GoOs cancellations, with few PPAs suggests pent up demand
France	(1)	0.55	2%	11%	0.2%	▲ Limited imports and exports of GoOs but relatively high retirement of GoOs, suggests limited demand
Italy	(30)	0.98	1%	21%	0.3%	▲ Net GoOs exporter, few PPAs, suggests limited demand
Spain	(21)	Nominal	11%	45%	5.0%	▲ High GoOs cancellation and high number of PPAs, suggests high green demand in Spain
Poland	Unknown	0.19	Unknown	Unknown	0.5%	▲ Not a member of EECS[1] which suggests limited interest in GoOs trading and demand from corporates
Sweden	2	0.25	13%	54%	6.7%	▲ High cancellation vs GoOs imports & exports, but large PPA volumes suggests demand in Sweden for PPAs over subsidies
Netherlands	29	1.0 - 6.5*	7%	63%	4.5%	▲ Net importer of GoOs, strongest GOO pricing, high I&C demand through PPAs, suggests strong market with growth potential
Romania	N/A	N/A	N/A	N/A	0.0%	▲ Romania is not a member of the EECS which suggests limited interest in GoOs trading and demand from corporates
Ireland	Unknown	Unknown	29%	11%	3.3%	▲ Small number of GoOs cancelled, high contracted PPAs as % of I&C demand suggests growing demand

1) European Energy Certificate System (EECS); 2) Significant GoOs price variations observed since COVID-19
Source: Eurostat, Association of Issuing bodies, PowerNext

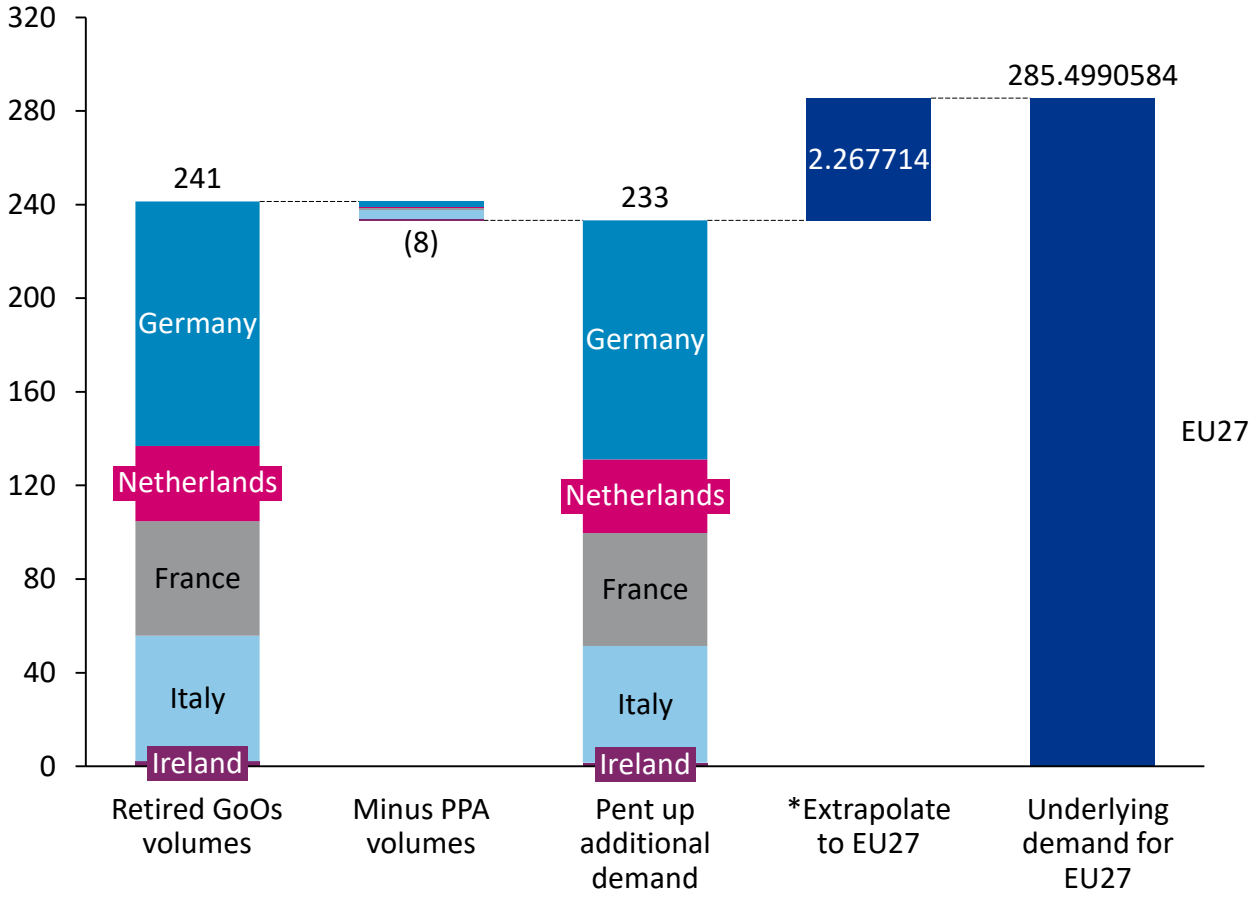
285 TWh of GoOs demand without adequate supply

Baringa

EU Member States with high rates of GoOs retirement suggests high demand for renewable energy

1 Assessing GoOs demand in supply constrained countries

TWh GoOs volumes in supply constrained markets



- High GoOs retirement volumes (and moderate-high GoOs imports) in Germany, Netherlands and Italy suggests there is strong demand for renewable energy which is not being met by projects in country
- Further reflected by the development constraints, permitting issues and grid access concerns which limit the pipeline of renewable projects
- This is an optimistic assessment of underlying demand, assuming that when a GoOs is retired it reflects a consumer actively choosing renewable energy, hence demand

Source: Association of Issuing bodies

**Extrapolation to EU27 excludes nations that have considerable supply of renewable projects and/or limited green ambition*

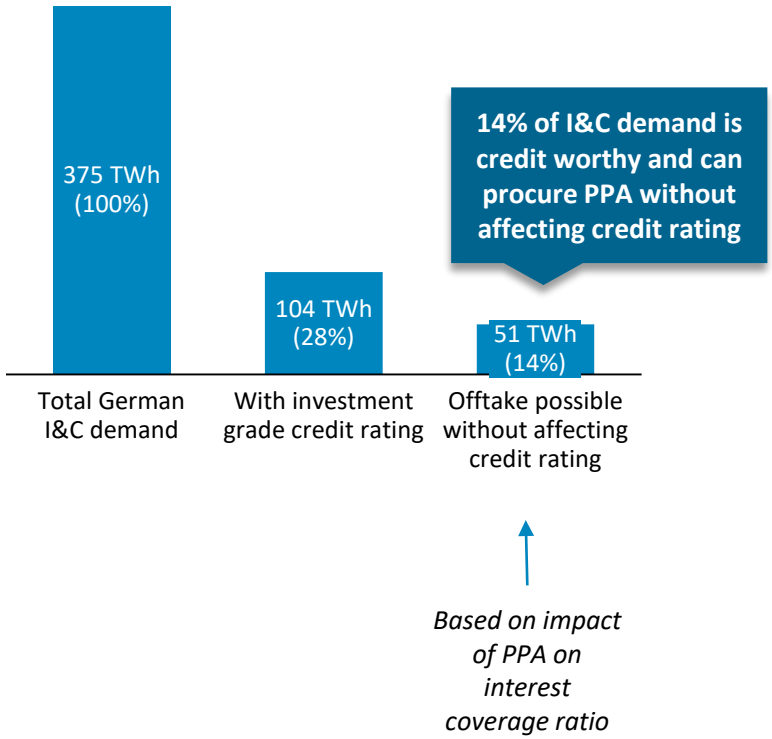
Credit worthiness, size, and risk appetite as proxies

Baringa

Between 14 and 16% of I&C demand is either credit worthy or suitable in size and risk appetite for a commercial PPA, based on case studies from Germany and the UK

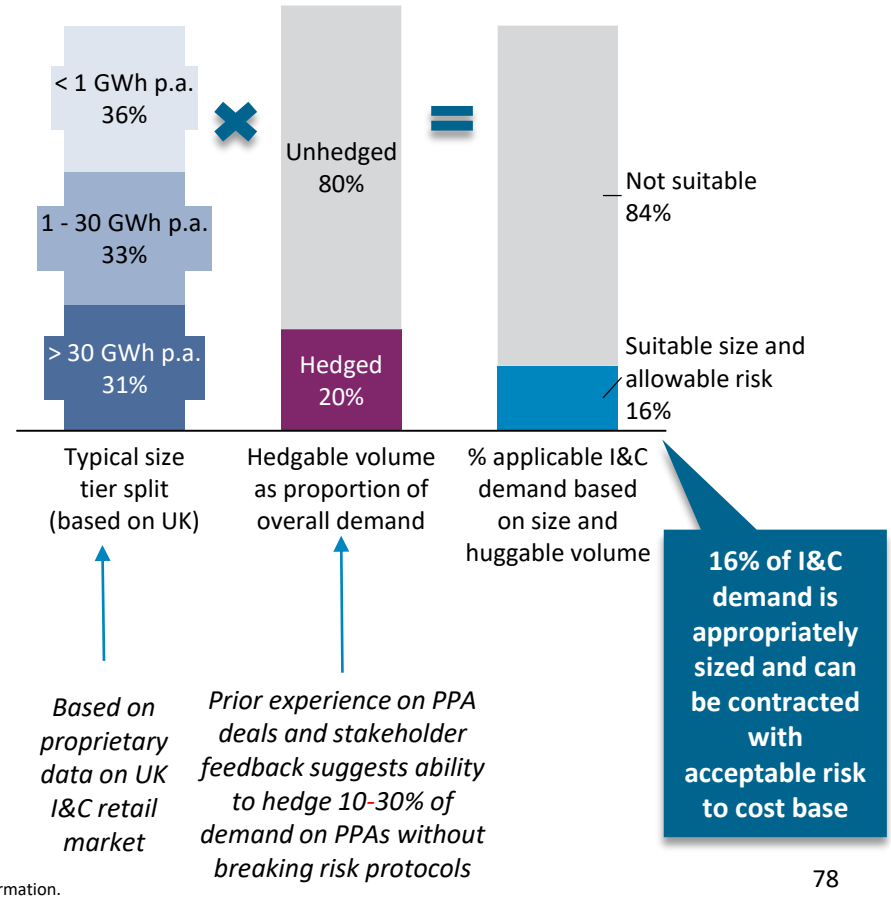
2 Approach 2: Assessing the % of credit worthy I&C demand

Germany as a case study for credit worthy demand



3 Approach 3: Size of energy user

Baringa previous experience in UK market



Source: Independent third party analysis, Baringa

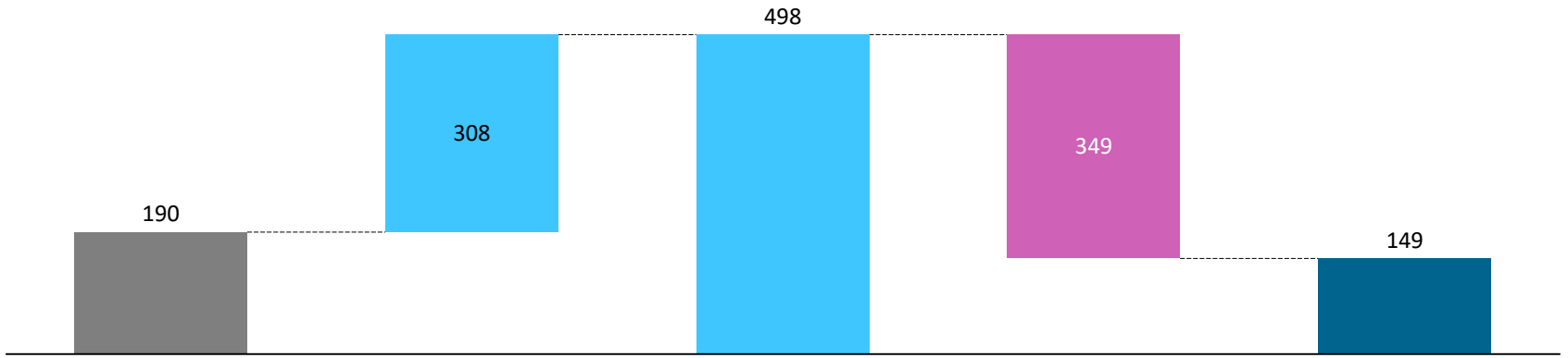
150 TWh of European demand based on RE100 shortfall

Baringa

Membership of the RE100 is expected to grow, increasing the shortfall of renewable energy needed to meet 2030 targets

4 Approach 4: Analysing RE100 shortfall in 2030 demand

Shortfall of current membership ✖ Shortfall of future membership ✖ Proportion likely to be sought in Europe = European RE100 demand



*Note: See Annex: Background PPA Materials for relevant data

Source: BNEF, RE100

Comparing against demand from offtakers

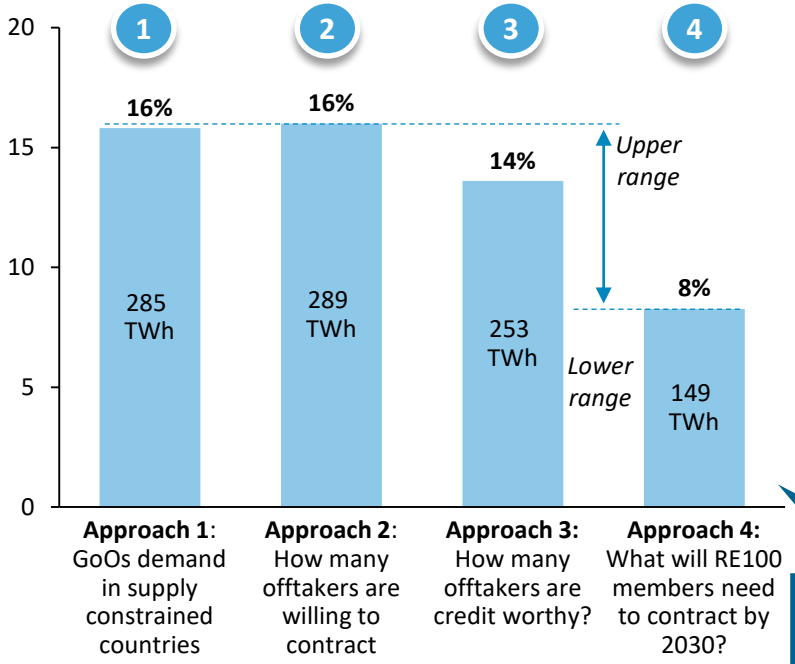
Baringa

Accounting for both generator and offtaker demand, we estimate a potential shortfall in offtaker demand of 190 TWh vs what generators may require

We used four metrics to triangulate underlying offtaker demand for commercial PPAs in the EU in the range of c.150-290 TWh

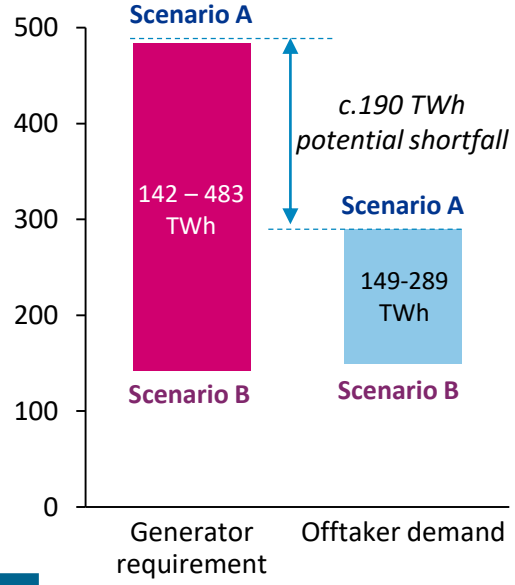
As a result there is a potential shortfall of in offtaker demand in the High PPA case, while there is a marginal shortfall in demand among generators in the Low PPA case

Underlying demand across four metrics
(TWH and % of 2018 EU non-domestic electricity consumption)



The European Commission is targeting 40 GW of hydrogen electrolysers by 2030; these may emerge as a large new pool of offtaker demand for renewables that have not been accounted for here

Comparing generator requirement with offtaker demand
Cumulative TWh commercial PPAs by 2030

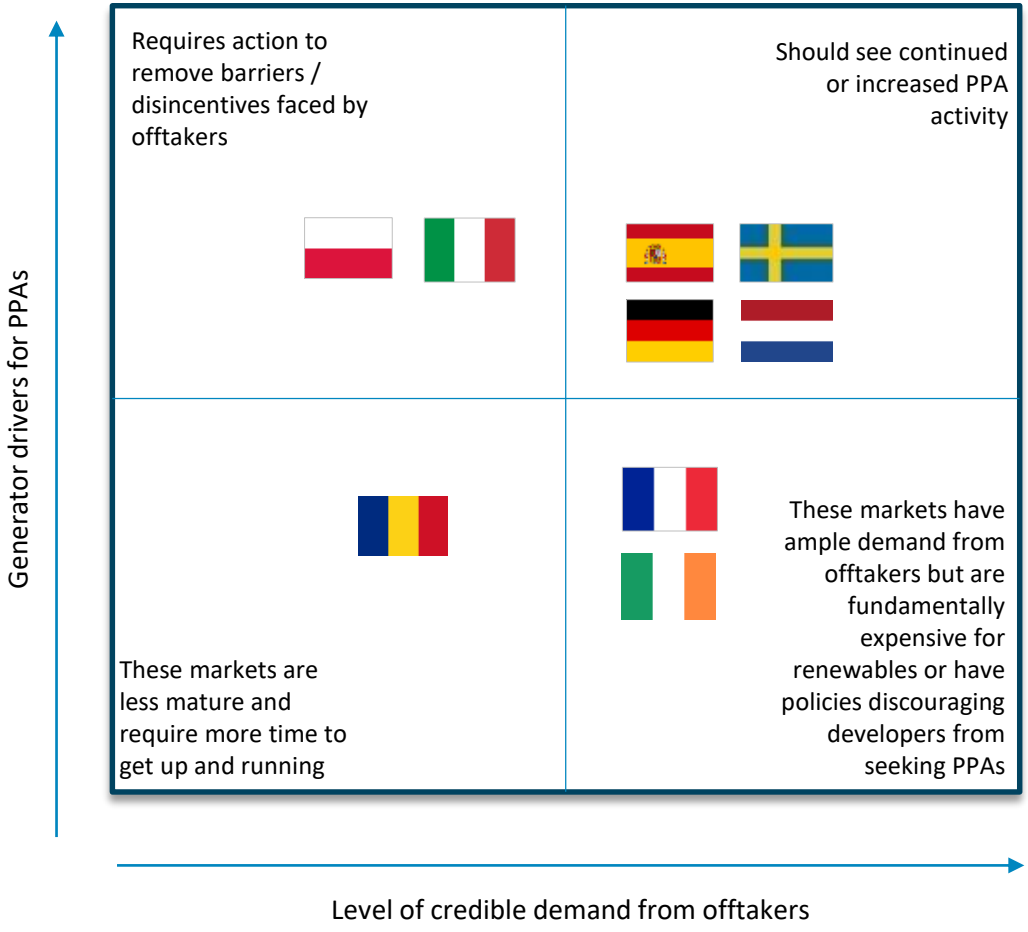


Summary of drivers at Member State level

Baringa

We have analysed nine Member States in depth to assess qualitatively where they are likely to be supply or demand or supply constrained

Generator vs offtaker drivers for commercial PPAs by country



Summary of drivers for each country analysed in depth

	Good pipeline of solar seeking PPAs and strong presence of global manufacturing brands
	Lack of incentives for generators to seek PPAs due to large auction commitments
	Strong economics but weak pipeline due to permitting constraints, and lack of cost-effective hedging services from utilities
	Strong pipeline and good economics in solar and wind; new policy expected to drive increasing demand among corporate end users
	Very strong economics but current policies heavily steer offtakers towards on-site build
	Strong pipeline and parity economics in wind and proven demand among offtakers
	Potentially competitive economics for some offshore wind with strong pipeline and demand from offtakers
	Strong economics but less mature renewables pipeline and less mature offtaker demand for green power
	Weaker economics despite ambitious PPA targets and strong presence of global technology majors and life sciences

4. Assessment of Instruments

A Market Study including an assessment of potential financial instruments to support renewable energy Commercial Power Purchase Agreements

Long list of financial instruments / interventions considered

We have looked in more detail at instruments which are core banking products and which address material barriers

Type of instrument	Description / Example	Is this worth focusing on for a public bank?	
1 **Project Debt & Equity**	Equity, debt structured finance to a project with a PPA, or where there is a clear link to a PPA product or strategy	✓	Core commercial bank capability addressing **limited price risk appetite** or issues with **clip size and forward start**
2 **Credit Guarantees / Insurance**	In favour of a corporate in relation to default risk under a PPA, or an intermediary in relation to default risk under a PPA (where link to capital deployment or recycling can be proven)	✓	Core commercial bank capability addressing **credit worthiness** of offtakers
	In favour of a project in relation to default risk under a PPA	✗	Not addressing a material barrier
3 **Corporate Finance**	To a platform or intermediary providing PPA or PPA related products	✗	Not an infrastructure financing product, no need identified for early-stage financing among platforms
4 **Derivatives / Risk Management**	Swaps or floor prices on power price, carbon price	✗	Banks are typically funders not power traders - not set up to manage long term or short term market risks
	Sleaving risk management products (volume, shape, basis, physical)		
5 **(Consultancy / Structuring)**	PPA advisory services to corporates, projects or commercial banks	✓	Can be considered in combination with a targeted financial product to address **complexity**
6 **(Advocacy / Market Change)**	PPA or Tariff Accreditation on credibility of green sourcing	✓	Can be considered in combination with a targeted financial product to address **additionality**
	Advocacy for regulatory reform to remove market regulatory barriers	✗	No major regulatory barriers specific to PPAs identified

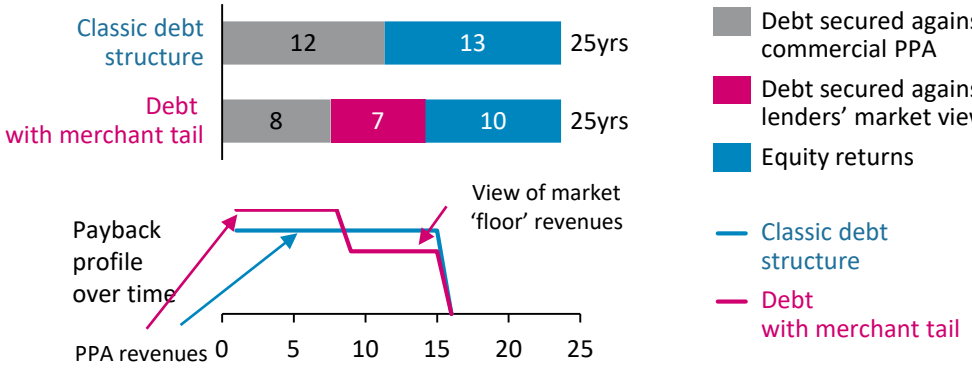
Structures proposed

Instrument 1a - project loans with merchant tail exposure

Debt (or guarantee on debt) to projects with shorter PPA tenors with a merchant tail could reduce the tenor required of PPAs

What kind of product could work?

- A bank could provide **debt or guarantees on debt to projects with shorter PPA tenors with a merchant tail**
- Where a 'classic' debt structure provides debt solely on commercial PPA revenues, this would provide additional debt based on the lender's view of maximum downside risk on power prices i.e. the 'market floor'
- These would open up shorter tenor PPAs by making these more viable to projects & their sponsors - Similar products already offered by some commercial banks in Spain, pushing PPAs down to 7-10 year tenors or into cap-and-floor pricing structures
- If deployed by a NPBI/IFI, the intention would be to encourage similar behavior in other purely commercial banks or sell down the portfolio of guarantees to commercial banks once relatively mature – this allows corporates with shorter business cycles to enter into PPAs
- The product would need to be **explicitly linked to a commercial PPA** with a defined minimum tenor i.e. not act solely as a means of transferring merchant risk from developer to bank, which brings no change in market behavior



What barrier is this addressing?

Price risk & Competition	Credit worthiness of offtakers	Corporate Recognition / additionality

What segment of the market would benefit most?

Countries	**Central and Eastern Europe** where economics are attractive for renewables due to relatively high cost of carbon and legacy of coal plant; further PPA volumes likely to be constrained due to conservative lending practices and limited risk appetite among offtakers
Technologies	**Solar and onshore wind** where economics are strongest
Offtaker Segment	Heavy industry, infrastructure, and fast moving consumer goods where competitive pressures on cost base are relatively high

Softer solutions that compliment or add-on

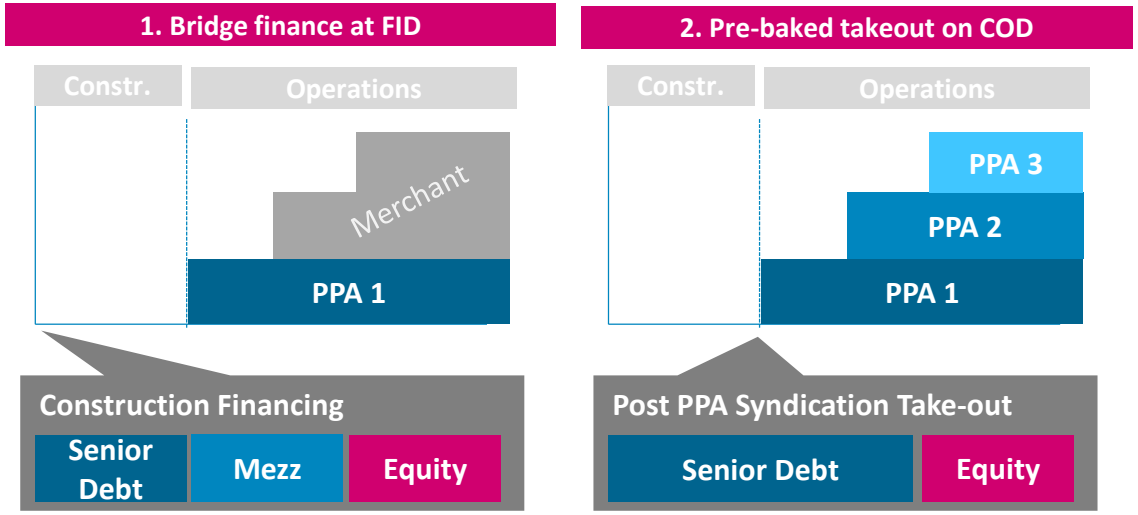
- Implicitly accredit additionality in project due diligence
- Work with Governments to implement incentives on sectors to sign longer term PPAs
- Foster greater transparency on targets and contracted position, giving competitors more confidence in taking more aggressive positions on longer term PPAs

Instrument 1b - mezzanine financing for construction

A high yield debt product targeting offshore wind assets in parity markets where contracting sufficient volumes of PPAs ahead of financial close is difficult given size of assets and length of construction

What kind of product could work?

- A NPBI or IFI offers high yielding / mezzanine tranche against an uncontracted or partially contracted asset on final investment decision (FID)
- Agreed PPA strategy and pipeline with the sponsor on PPA syndication (provider targeting sponsors that have a business model / supply footprint / trading model that will give it priority access to customers)
- Bridge tranche with structural protections (e.g. cash sweep, balloon, margin step-up) and pricing post FID that incentivizes refinancing at the point the asset is contracted
- Option to include a pre-baked refinancing of the bridge based upon and agreed PPA structure, debt sizing and pricing mechanics[1]



What barrier is this addressing?

2 **Forward Start / Clip Size**

4 **Standardisation of PPA terms**

Target countries / customer segments?

Countries	**Germany, Netherlands, Poland**
Technologies	**OFSW**
Offtaker Segment	**Large players**

Softer solutions that compliment or add-on

- Implicitly accredit additionality in project due diligence

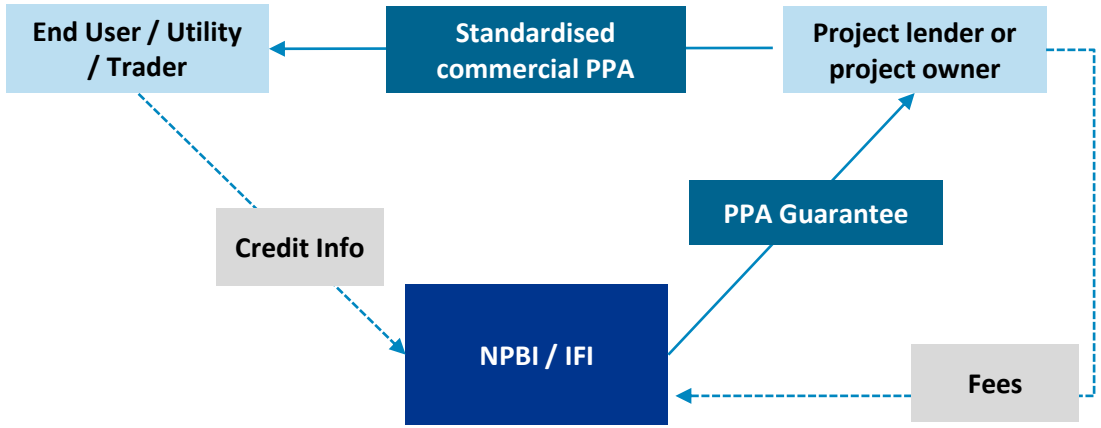
1 Similar structure can already observed for larger onshore wind/ solar portfolios in provided by commercial banks in Spain.

Instrument 2a - providing a credit guarantee

A guarantee that enables motivated corporates outside of the investment grade global cohort to contract long term in parity markets where credit quality on their own would not unlock capital

What kind of product could work?

- NBPI / IFI provides a guarantee to a project lender or project owner in relation to the liability of an offtaker in the event of default
- The project or the intermediary would specify the quantum of the guarantee - in terms of the % of the M2M liabilities in the event of termination
- Project pays a fee linked to the guaranteed quantum and credit strength of the end user
- Range of acceptable credit profile would need to be defined but a lower-risk target group would be users without a credit rating but with a long business cycle e.g. heavy industry plants
- Eligibility for the guarantee could be linked to projects that are additional of were the sponsor can provide that it will trigger investment in new capacity



What barrier is this addressing?

Credit worthiness of offtakers

Standardisation of PPA terms

Target countries / customer segments?

Countries	**CEE, Spain, Italy**
Technologies	**All - but primarily onshore technologies**
Offtaker Segment	**Mid market / end users & utilities**

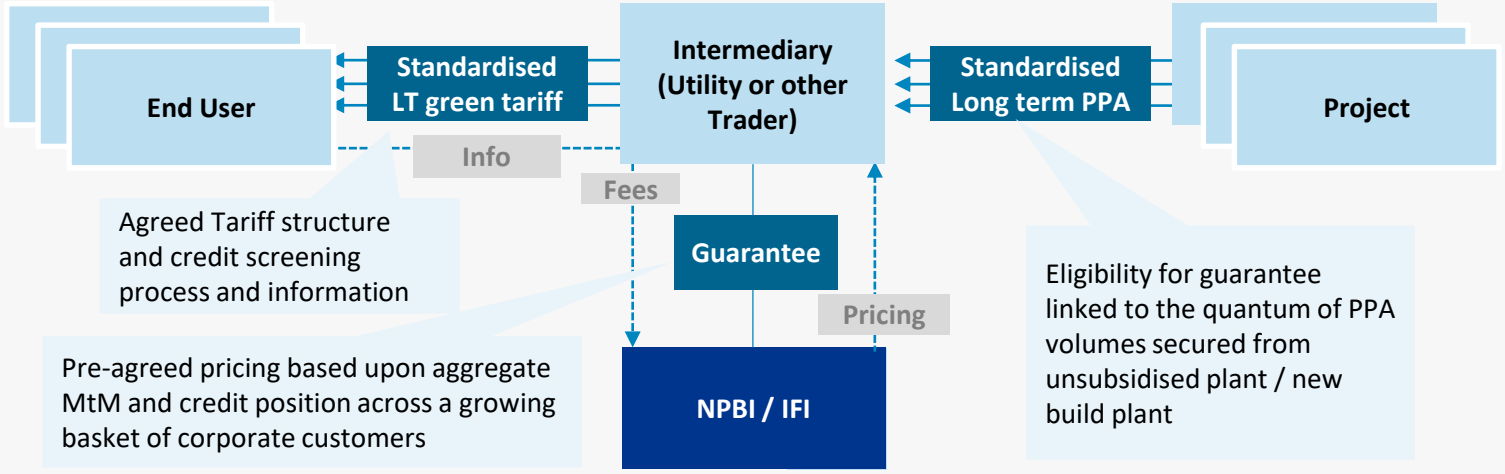
Softer solutions that compliment or add-on

- Foster greater transparency on targets and contracted position, giving competitors more confidence in taking more aggressive positions on longer term PPAs
- Work with aggregators attempting to group together smaller parties with poorer credit (see next slide)

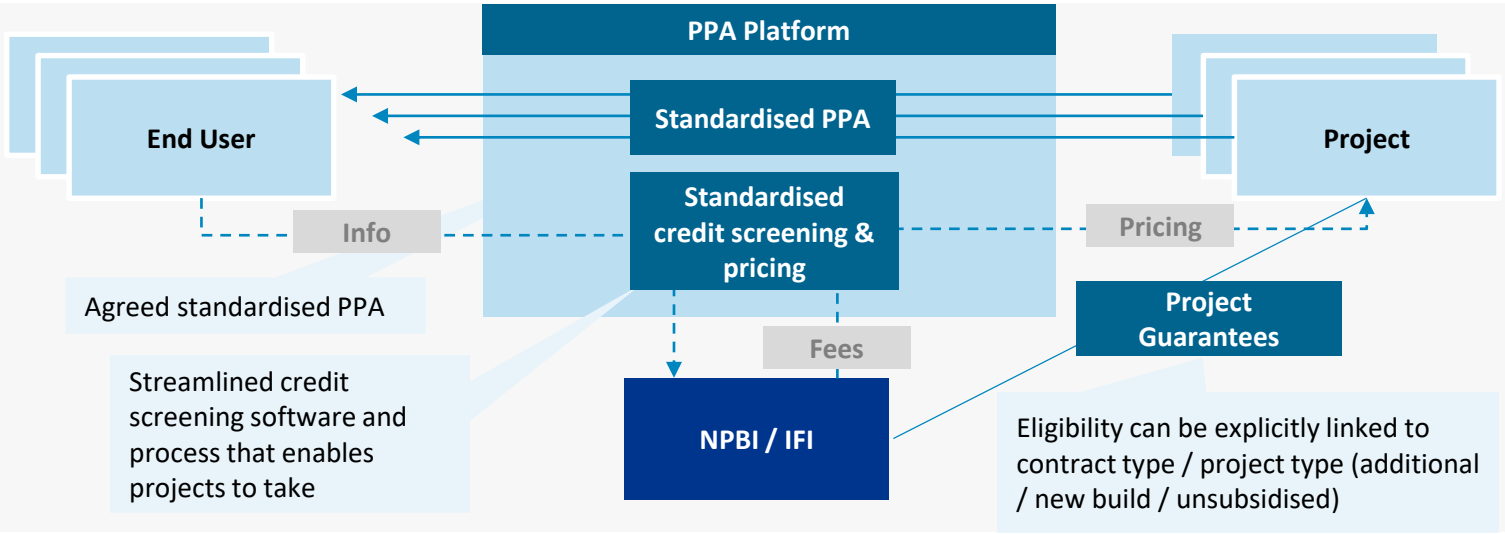
Instrument 2a - provide credit guarantee to intermediary

…however scale will be key to successful diversification of the credit risk which will probably require the provider to partner over time with intermediaries in the market

Aggregate through an Utility / Trading Intermediary



Aggregate through PPA Platform



Instrument 2b - creating intermediary utility

A more involved strategy is to create a utility purpose built for managing credit risk and introducing more long-term price risk into end user tariffs

Why a new utility?

- Utilities exist to buy power from generators and sell it to end users and as a result are best placed to i) aggregate end user demand, ii) efficiently manage market risk on behalf of end users, and iii) efficiently execute large contracts with generators
- An entity with these capabilities combined with the mandate to introduce more long term price risk among mid-tier consumers and the additional capability to manage credit risk would open up the mid-tier market currently constrained by the complexity, long tenors, stringent credit requirements and large clip size of bilateral PPAs
- There is little evidence of utilities who wish to increase risk bearing capacity among end users and address credit risk issues despite the market shifting from the 'old-world' in which generator and end user contracts were similar length to the 'new-world' where long term PPAs are needed for generators but are assumed unacceptable to offtakers

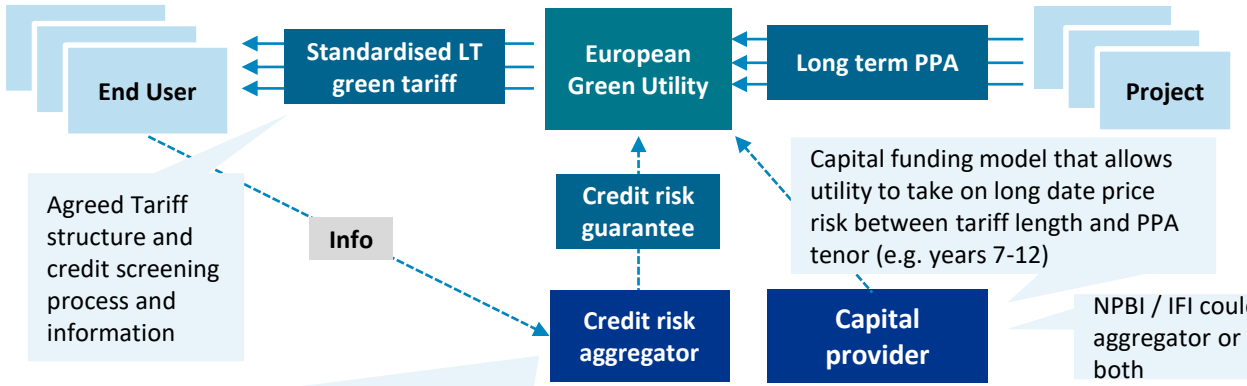
What barrier is this addressing?

Price risk and competition	**Credit worthiness**
Standardisation of PPA terms	**Corporate Recognition / additionality**

Target countries / customer segments?

Countries	**All**
Technologies	**All**
Offtaker Segment	**Mid market / end users**

Possible structure



Can be either NPBI/IFI leveraging risk assessment software (e.g. as used for P2P lending) or partnering with entities who are experienced in managing long term credit exposure of SMEs e.g. leasing companies and their banks. NPBI/IFI required to hold credit risk while demand is aggregated up sufficiently for risk pooling

Assessment of financial instruments

Credit risk instruments more likely to change market behaviour

Type of instrument		Primary rationale	Concluding assessment
1a	**Project loans (or guarantee on loan) with merchant tail exposure**	*Reduce price risk to acceptable levels for certain groups of corporates by moving it onto banks*	▲ Financing with longer merchant tails is being offered by commercial banks in more active markets, particularly in Spain. Additionally some of this lending activity is under terms EIB already considered risky. ▲ However, less mature markets where prices are still coal-driven and commercial banks are still yet to get comfortable with merchant risk are worth exploring further
1b	**Mezzanine financing for construction**	*Widen window for PPAs by delinking from close on construction financing*	▲ Financing bridging loans to offshore wind is already available through commercial banks and might arguably sit outside of a NPBI/IFI mandate ▲ Feedback from market participants on the potential efficacy of such an instrument is mixed, with some demand in Spain, but other participants noting that much offshore wind projects are financed by large utilities on balance sheet
2a	**Providing a credit guarantee**	*Widen access to PPAs to smaller offtakers by guaranteeing their long term credit worthiness*	▲ Worth exploring further as it is not currently available within the market i.e. is highly additional for EIB ▲ Two challenges i) requires significant scale (in EIB's case, beyond existing project financing activity) in order to pool enough parties together to reduce the effective risk; ii) assessing the credit worthiness of offtakers is not a capability typically held within the renewables market ▲ To explore further requires identification of suitable partners for assessing credit risk and aggregating demand
2b	**Creating a green utility**	*Widen access to long-term price risk by creating a utility focused on long-term tariffs underpinning renewable capacity*	▲ Same challenges and benefits to 2a but takes ownership over aggregating demand and executing PPAs ▲ Clearly more ambitious but allows most other barriers to be addressed alongside credit worthiness as the entity has the mandate to address additionality and end user price risk appetite through its operating model and product innovation ▲ Worth exploring further if no existing utility can be found which matches strategic goals of the desired green utility ▲ Can be sold off once the model has been successfully adopted by other utilities

Capital required for instruments

We have used two illustrative examples to show the scale of capital required for these instruments

If a loan **with merchant tail exposure** was provided to PPAs for c.5% of non-domestic power demand tomorrow…

How much debt that is unsecured against PPA revenues would be required?

- We use a very simple example where 100 TWh portfolio of projects originated now and geared at 70% of Capex with a bankable 7-year PPA backing 60% of repayments and a further 40% backing projected prices for years 8-15
- We use solar in Poland as an example where the 'floor' of power prices should not fall below EUR 35-40 / MWh, due to dominant coal fleet, and therefore favours lending against merchant tail over the coming decade

c. EUR 20bn of debt unsecured against a 'bankable' contract

If a **credit guarantee** was provided to offtakers PPAs for c.5% of non-domestic power demand tomorrow…

How much capital would be require to cover exposure to offtaker default?

- We use a simple example where 100 TWh portfolio of projects have a credit guarantee provided that covers c.60% of the M2M exposure of those contracts in case of default over a 10 year period
- We use UK solar as an example where strike prices are currently in the EUR 40-50 / MWh range and downside projections of power prices fall below EUR 30 / MWh by 2030

c. EUR 3bn required to cover default of counterparties if power prices reflect most bearish outlook

Merchant tail risk capital allocation

Using an illustrative example, EUR 22bn could be required to deliver a 100 TWh portfolio of offtakers

We estimate the capital required to fund the merchant-tail portion of a loan linked to a shorter PPA

- Assume a portfolio of loans with average PPA length of 7 years and 8 years of debt provided with merchant risk for Polish solar, where the merchant tail is attractive and shorter PPAs are likely to bring more offtakers to market
- We assume that the PPA price is the 'guaranteed' revenue for its duration and is similar to the wholesale power price of that market; we use Baringa Reference case for wholesale power prices
- To estimate how much debt could be provided per MWh of generation, we assume debt is provided against a 'guaranteed' volume of P90 of output and a Debt Service Cover Ratio (DSCR) of 1.25 against PPA revenues and 1.5 against (riskier) merchant tail revenues, based on prior experience in advising UK offshore wind projects
- This provides an illustrative view of % of debt which is on the merchant tail. We use some crude assumptions on capex costs, load factors and gearing (debt as % total capex) to show how much merchant tail debt would be required to fund 100 TWh of new solar generation

Solar project in Poland with 2021 COD	PPA							Merchant tail							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
'Guaranteed' price (EUR / MWh)	51	53	54	54	55	55	56	42	41	40	37	38	37	37	36
P90 volume as % total volume	75%														
DSCR	1.25							1.5							
Debt service level (EUR / MWh)	31	32	32	33	33	33	34	21	20	19	19	18	19	18	18

Merchant tail as % of total debt and interest	40%
Assumed leverage as % total Capex	70%
Typical Capex (EURm / GW)	700
Load factor	13%
Merchant tail debt on 100 TWh	**EUR 22bn**

= (40%)*(70%)*(700)*(13%)*8.76*100

Credit risk capital allocation

Using an illustrative example, up to EUR 3bn would be required at a minimum to guarantee a 100 TWh portfolio of offtakers

Methodology

We assume a simple estimate of required coverage based on default rate and mark-to-market (M2M) exposure for a 100TWh portfolio of 10 year PPAs originated in 2020

- Moody's default rates for 1 and 5 years for corporate bond issuers, which we use to assume an annual default rate are:

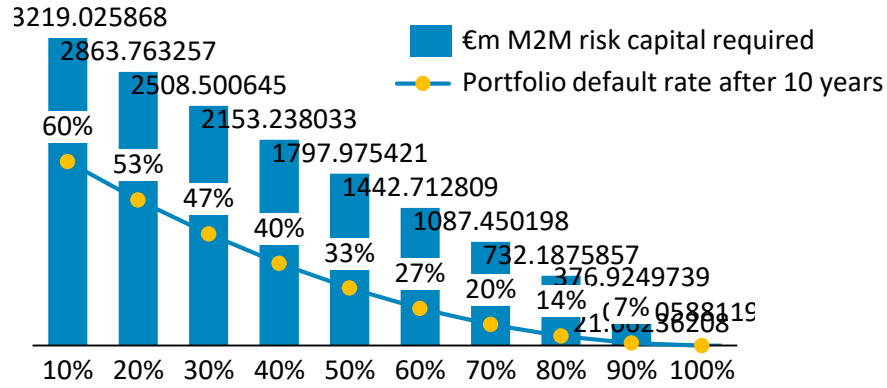
Moody's default rates (last 5 year average)	Last 5 years average Moody's default rate			
	1 yr	5 yr		Annual
Investment grade	**0.0%**	**0.2%**	=	0.04%
Non-investment grade	**5%**	**32%**	=	6%

- We use the UK as an example where our prior experience puts PPA strike price in the range of EUR 40-50 / MWh for PPAs on new solar over the next few years; we assume EUR 45 / MWh
- We estimate capital required against a Baringa Low price scenario, where capture prices decline from EUR 39 / MWh in 2020 to EUR 25 by 2030, and the guarantee covers 60% of expected output revenues (equivalent to debt against P90 with a DSCR of 1.25)
- The resulting capital required (undiscounted) to cover the expected exposure to defaults is:

$$\sum_{i=Year}^{10\ years} RM_i$$

R = annual default rate
M_i = M2M exposure on 60% of 100 TWh remaining in Year i

Estimate of capital required on 100 TWh



- Depending on the risk profile of the portfolio, up to c. EUR 3bn of capital would be required to cover M2M exposure
- For portfolios with a higher proportion of investment grade counterparties, the guarantee could be provided at an affordable rate

European Investment Bank
The EU bank

European Commission

European Investment Advisory Hub
Europe's gateway to investment support

Baringa