Danish Energy Agency

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Analysis of the Potential for Corporate Power Purchasing Agreements for Renewable Energy Production in Denmark

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For better energy projects

K2 Management

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2 Executive Summary

The global market for corporate power-purchase-agreements ("Corporate PPAs" or "CPPAs") is rapidly growing with the increased awareness among larger and smaller corporation of the need to address climate change, pollution and human well-being.

The important roles of policy makers and regulators across European, North-American, Latin-American and Asia-Pacific jurisdiction have been evident for at least a decade. Actions such as incentivising the development and implementation of renewable energy in the overall energy mix and discouraging the use of fossil fuels through taxes and coal power decommissioning have been carried out across these regions.

The growth of renewable energy capacity has contributed to lower technology and installation costs, and better integration with existing transmission networks. In addition, the cost of renewable electricity generation has come down to a level that in many developed and developing countries are competitive with conventional electricity sources. This has led to the phasing out of the subsidy systems of the earlier years and encouraged the greater use of "merchant pricing" of renewable electricity, including power-purchase-agreements ("PPAs"), whether CPPAs, utility PPAs or electricity trading.

This report is intended to discuss and project the prospects for CPPA growth in Denmark as part of accelerating the transition to 100% renewable energy consumption. As part of this objective, the report provides a map and description of the use of CPPAs, as of December 2018, on a global scale, providing an overview across multiple countries in Europe, the U.S., rest of the Americas and the Asia-Pacific region. An overall trend is the context of growing renewable energy capacity, fading subsidies and the significant initiatives of corporations and financing providers to facilitate contractual frameworks for direct power-purchases from physical assets and "synthetic" purchases with the participation of energy traders and public exchanges.

Across the jurisdictions, the relative price, availability and long-term predictability of renewable energy production are key drivers for corporations entering CPPAs. The growth in global usage of CPPAs are driven by major internet companies, like Google, Facebook, Amazon, Microsoft, that all need power for their data storage and processing centres.

With the use of power purchase agreements having its origin from other energy markets, it is of little surprise that countries like Norway and the United States remain at the forefront of using CPPAs; in the case of Norway, the abundance of cheap hydro power has provided for a more price-attractive transition to CPPAs for energy-intensive mining and mineral companies and an advantageous location for large data centres.

In Sweden, the choice of "Green Certificates" over "Feed-in-Tariffs" as government subsidy, has seen a more rapid uptake of CPPAs by its important paper manufacturing sectors, while in the U.S., linking subsidies to capital equipment costs up front rather than electricity generation revenues over time have created a vast merchant-pricing renewable energy market, often dominated by incumbent utilities of one or more States, but increasingly dominated by CPPAs for the renewable energy market.

The report similarly identifies significant barriers to the growth of CPPAs such as complexity of renewable energy asset ownership in the form of:

a) 3rd party financing structures of renewable energy assets that requires "bankable" CPPAs, and
b) Separate ownership of the roof on which the solar panels are installed, which could be either the landlord, a property owner or mortgage provider

At the same time, the sophistication of the CPPA market is growing with syndicates or consortia of corporate electricity buyers formed to enter CPPAs for larger capacity assets in the Netherlands, the U.S. and Australia, leading to greater financing and financial risk management options.

The cross-country mapping of market conditions and trends reveals a clear picture of a globally growing use of CPPAs. The tendency has created market standards and conventions with regards to pricing regimes, volume considerations

that take into consideration the patterns of wind speed and solar irradiation levels across the day and the seasons, and contract durations.

As these standards "globalise" by multinational companies and capital providers, it seems evident that more and larger CPPAs will be entered due to the comfort gained by corporations and institutional investors created by the current developments, which in turn should spread to more jurisdictions, smaller companies and a greater variety of renewable energy assets, e.g. technology solutions and capacity sizes.

The emerging contract standards, the possibility of CPPAs for smaller capacity sizes and the growing use of consortium CPPA structure, coupled with cross-border and synthetic CPPAs (limited data availability), are features of the CPPA market that would suit the Danish market conditions.

As one of the world's leading renewable energy nations, Denmark has been an early mover in onshore and the birth place for offshore wind production to the degree that the country has one of the highest percentages of renewable energy in its energy mix. The leadership is further demonstrated with the high contribution of other sources of renewable energy in the country's advanced district heating market.

Notwithstanding the renewable energy generation leadership and "green" energy policies of Danish companies, the country seems to be lacking other neighbouring countries in the use of CPPAs as a way for companies to purchase electricity long-term and contribute to lower carbon emissions.

Aside from having an advanced electricity market with considerable domestic and cross-border energy trading, Denmark's electricity market is characterised by few, large and dominant, energy intensive companies, like Lego (plastic toys), Carlsberg (brewery), Bestseller (clothing), Rockwool (building materials), Arla (dairy), Aalborg Portland (cement) and Novo Nordisk (pharmaceuticals), and a significant number of small- and medium-sized companies, most of which are operating in less energy-intensive sectors, such as light industry, industrial services and food and retail services. The CSR strategies and global environmental branding of the afore-mentioned corporate leaders participating in global organisations seeking to address climate change, like RE100, and advance the corporate use of renewable energy.

The ability of corporates to prove their use of renewable energy as part of their ethical policies and corporate branding have led to the pursuit of Certificates of Origin in their procurement of renewable energy and more recently the use of CPPA as contract proof, a solution with higher additionality than certificates, however less capital intensive than investing in renewable energy assets. Moreover, the recent introduction in other countries by CPPA syndicates of e.g. Google, Akzo Nobel, Philips Electronics and DSM, serves as an indication of the potential for smaller companies to establish syndicates or consortia for the purchase of renewable energy on, possibly, favourable terms and at lower transaction costs than were they to enter CPPAs bilaterally.

Thus, while the analysis confirms that many international drivers of CPPA use are applicable to the Danish market, there are barriers that, at least in the short term, will somewhat hold back the growth of CPPA usage.

One of the main barriers seem to be the well-established and developed market for corporates trading electricity with electricity suppliers and energy traders. The corporates may prefer to manage electricity price risks and green sourcing through their familiar channels given the convenience of this option. Even so, this particular barrier to CPPAs is not considered a barrier for the advancement of renewable energy, as many suppliers/traders will also offer renewable electricity sourcing. However, it should be noted that the additionality of sourcing through a supplier/trader is often lower than a CPPA.

Other barriers include the hesitation of many companies to spend time and money on negotiating power purchase agreements, and particularly if the energy consumption is relatively small and have limited implications on company earnings and, if listed, share price fluctuations. The lack of a transparent standard or framework for CPPAs creates contractual complexity that hold back many smaller companies, again partly due to the costs of internal and external resources, legally and financially, in managing the execution and risk management of such contracts.

This report evaluates how the individual drivers and barriers may contribute to a realistic or maximal scenario of how CPPAs will develop in Denmark until 2040.

In the so-called “Maximal Growth” scenario, it is assumed that all drivers will contribute to growth and barriers such as contractual standards and SME reluctance (via syndications) are being addressed. Furthermore, it assumes that financial support schemes are introduced by the Danish government, similar to what has been successful in Norway. The predicted CPPA share of the total corporate electricity consumption in Denmark is projected to reach approximately 36% by 2040 in our “Maximal Growth” scenario.

However, a more realistic growth scenario with data centres being the main drivers is more feasible based on the competition from utility PPA and energy trading as well as the reluctance or natural disincentives in the shorter term for SMEs to enter CPPAs. In our “Realistic Growth” scenario the predicted CPPA share of total corporate electricity consumption in Denmark is 29% by 2040.

In light of the importance of the renewable energy industry to the Danish economy and job creation, it seems to make sense to establish a financial guarantee conduit for the support of financing CPPA-backed renewable energy assets, at least for the tenors post 5 years to encourage more lenders to participate in the financing and attract more companies to the CPPA market.

2.1 Executive Summary (In Danish)

Det globale marked for private virksomheders køb af vedvarende energi i form af “corporate power-purchase-agreements" (“CPPA’er”) vokser hastigt i takt med virksomhedernes stigende fokus klimaforandringer og forurening.

Der er igennem de seneste år sket en markant stimulering af udviklingen af vedvarende energi samt nedbringelse af brugen fossile brændstoffer gennem øget beskatning og lukning af kulkraftværker.

Væksten i kapaciteten af vedvarende energi har bidraget til lavere omkostninger ifm. teknologi og installation af vedvarende energi samt bedre integration med eksisterende transmissionsnet. Derudover er omkostningerne til produktion af vedvarende energi faldet til et niveau, der i mange lande er konkurrencedygtigt med konventionelle energikilder. Dette har medført en udfasning af de tidligere års subsidie-systemer og fremmet brugen af kommerciel prissætning (”merchant pricing”) af vedvarende energi herunder PPA’er i form af CPPA’er, PPA’er med el-leverandører/elhandlere og elhandel på børser.

Denne rapport har til formål at diskutere og projektere udsigterne for CPPA-vækst i forbindelse med overgangen til 100% vedvarende energi i Danmark. Rapporten indeholder en redegørelse og en beskrivelse af brugen af CPPA'er på globalt plan pr. december 2018, hvilket giver et overblik over flere lande i Europa, USA, resten af Amerika samt Asien og Australien. En overordnet tendens er sammenhængen mellem stigende vedvarende energikapacitet, faldende subsidier og væsentlige initiativer fra virksomheder og finansieringsudbydere – initiativer der søger at udbrede de juridiske rammer for direkte strømkøb herunder fysiske aktiver og "syntetiske" indkøb med deltagelse af elhandlere og elbørser.

På tværs af landene er det tydeligt at den relative pris, tilgængelighed og forudsigelighed af vedvarende energiproduktion er blandt de vigtigste årsager til at virksomheder indgår CPPA’er. Væksten i den globale brug af CPPA’er er drevet af store energiintensive internetvirksomheder som f.eks. Google, Facebook, Amazon og Microsoft.

Eftersom brugen af CPPA’er har sin oprindelse fra andre energimarkeder end det danske, er det ikke overraskende, at lande som Norge og USA forbliver frontløbere indenfor CPPA’er. I Norges tilfælde har en signifikant mængde billig vandkraft tilvejebragt en attraktiv pris og dermed lettet overgangen til CPPA'er for energiintensive minedrifts- og mineralvirksomheder og gjort Norge til en fordelagtig placering for store datacentre.

I Sverige har valget af "Grønne certifikater" over "Feed-in-Tariffs" som støtteordning ført til en hurtigere optagelse af CPPA'er i den vigtige papirfremstillingsbranche, mens man i USA giver subsidier ifm. kapitaludgifter snarere end til indtægter fra elproduktion. Dette har over tid har skabt et stort marked for handel med vedvarende energi, der ofte domineres af etablerede virksomheder i en eller flere stater, men i stigende grad domineres af CPPA'er.

Rapporten identificerer desuden betydelige barrierer for væksten af CPPA'er, såsom kompleksiteten af vedvarende energiaktivers ejerskab i form af:

a) Tredjepartsfinansieringsstrukturer for vedvarende energikilder, der kræver "bankable" CPPA’er samt
b) Separat ejerskab af det tag, som solpanelerne er installeret er, hvilket kunne være enten en udlejer, en ejer eller et realkreditinstitut

Samtidig bliver CPPA-markedet mere sofistikeret med syndikater eller konsortier af virksomheder med henblik på at disse virksomheder kan komme ind på CPPA-markedet for store VE aktiver i Holland, USA og Australien. Dette medfører bedre finansieringsmuligheder samt finansielle risikostyringsmuligheder.

Kortlægningen af markedsforhold og globale tendenser viser et klart billede af en øget brug af CPPA'er. Tendensen har skabt markedsstandarder for så vidt prisregimer, overvejelser ift. volumen, som tager højde for både mønstrene af vindhastighed og solstrålingsniveauer i løbet af dagen, årstiderne og kontraksvarighed.

I takt med at disse standarder globaliseres af multinationale selskaber og finansieringsinstitutter, vil flere og større CPPA’er komme på markedet fordi virksomheder og institutionelle investorer bliver komfortable med disse.

De nyudviklede kontraktstandarder, muligheden for CPPA'er for mindre kapacitetsstørrelser og den voksende brug af konsortium CPPA-strukturen kombineret med cross-border og syntetiske CPPA'er (begrænset data-tilgængelighed) er alle funktioner i CPPA-markedet, der passer godt til de danske markedsforhold.

På trods af de danske virksomheders lederskab indenfor vedvarende energi og "grønne" energipolitikker synes Danmark at være bagud i forhold til dets nabolande i brugen af CPPA'er. CPPA'er kan bruges af virksomhederne til at indkøbe grøn elektrictet over en lang periode samt bidrage til lavere CO2-udledninger.

Udover at have et avanceret elmarked med betydelig indenlandsk energihandel samt handel på tværs af grænser er Danmarks elmarked præget af få store og dominerende energiintensive virksomheder såsom Lego, Carlsberg, Bestseller, Ørsted og Novo Nordisk. Derudover består elmarkedet af et betydeligt antal af små og mellemstore virksomheder, hvoraf de fleste opererer i mindre energiintensive sektorer såsom industrielle tjenesteydelser, fødevarer og detailtjenester. CSR strategier samt den globale miljømæssige branding af de førnævnte virksomheder kan inspirere små og mellemstore virksomheder til at følge trop.

Virksomhedernes behov for at dokumentere deres brug af vedvarende energi som en del af deres etiske politikker og branding har ført til brugen af oprindelsesgarantier i forbindelse med indkøb af vedvarende energi, og på det seneste også brug af CPPA'er som kontraktuelt bevis. Denne løsning er mindre kapitalintensiv end investering direkte i vedvarende energiaktiver. Desuden er den nylige introduktion af CPPA-syndikater i andre lande af f.eks. Google, Akzo Nobel, Philips Electronics og DSM formentlig en indikation af potentialet for mindre virksomheders deltagelse i syndikater eller konsortier til køb af vedvarende energi. Denne mulighed medfører potentielt gunstige vilkår og lavere transaktionsomkostninger, end hvis virksomhederne skulle indgå en CPPA-kontrakt bilateralt.

På trods af at mange internationale drivere af CPPA-brug finder anvendelse på det danske marked, er der også barrierer, der i hvert fald på kort sigt, vil holde CPPA-væksten tilbage.

En af de vigtigste barrierer synes at være det veletablerede og udviklede marked for virksomheder, der handler elektricitet med elleverandører og elhandlere. Virksomhederne vil muligvis foretrække at styre elpris-risici og grønt indkøb af el via deres velkendte kanaler, da denne mulighed er bekvem. Alligevel betragtes denne barriere for CPPA-vækst ikke som en barriere ift. at fremme vedvarende energi, da mange elleverandører / elhandlere også vil tilbyde vedvarende energiprodukter. Det skal dog bemærkes, at additionaliteten ved indkøb via en elleverandør / elhandler ofte er lavere end med en CPPA.

Andre barrierer består i at mange virksomheder tøver med at bruge tid og penge på forhandling af CPPA'er - især hvis energiforbruget udgør en forholdsvis lille del af de samlede omkostninger, og dermed har begrænsede konsekvenser for virksomhedens indtjening. Manglen på en gennemskuelig standardaftale eller juridisk ramme for CPPA'er synes at medføre øget kontraktmæssig kompleksitet, der tilbageholder mange mindre virksomheder fra at indgå CPPA'er. Dels på grund af omkostningerne til interne og eksterne ressourcer, både juridisk og finansielt, i forvaltningen og risikostyringen af sådanne kontrakter.

Denne rapport vurderer, hvordan de enkelte drivere og barrierer kan bidrage til et realistisk eller maksimalt scenarie af hvordan CPPA'er udvikler sig i Danmark frem til 2040.

I det såkaldte "Maximal Growth" scenarie, antages det, at alle drivere vil bidrage til vækst, og at barrierer, såsom mangel på kontraktmæssige standarder og modvilje fra små- og mellemstore virksomheder (via syndikationer), vil blive mindsket. Derudover antages det at den danske regering indfører finansielle støtteordninger - tilsvarende den succesfulde norske model. I "Maximal Growth" scenariet udgør CPPA'er en andel af det samlede elforbrug i erhverv svarende til ca. 36% i 2040.

Dog er et mere realistisk vækstscenario, med datacentre som primær driver, imidlertid mere sandsynligt baseret på konkurrencen fra utility PPA'er og energihandel samt tilbageholdenhed fra små og mellemstore virksomheder for på kort sigt at indgå CPPA'er. I "Realistic Growth" scenariet udgør CPPA'er en andel af det samlede elforbrug i erhverv svarende til 29% i 2040.

I lyset af den vedvarende energisektors betydning for dansk økonomi og jobskabelse synes det at være hensigtsmæssigt at etablere en finansiel garantiordning med det formål at støtte finansieringen af vedvarende energiprojekter baseret på CPPA'er. En ramme for en sådan ordning kunne adressere kontrakter med en varighed på mere end 5 år for at opfordre flere långivere til at deltage i finansieringen og tiltrække flere virksomheder til CPPA-markedet.

3 Introduction

The use of Corporate Power Purchase Agreements ("CPPAs") in a renewable energy context has existed for close to 15 years, with some of the first markets being Swedish wind projects and US solar projects. The market has developed rapidly and has expanded over the past five years as the capital costs of renewable energy have decreased, making renewable energy wholesale pricing more competitive with conventional power pricing.

The reduction and/or phasing out of subsidies in most European countries, has equally contributed to owners and developers of wind and solar energy projects seeking CPPAs with large and highly creditworthy companies. Such contracts would satisfy the "bankability" requirement of project finance markets, where CPPAs would qualify from a credit rating and long-term life perspectives.

This report analyses the potential for CPPA growth in Denmark starting with the mapping of global trends, drivers and barriers for the use of CPPA usage as part of growing renewable energy construction and production.

An expert review combined with interviews and desktop studies supplemented by relevant articles and literature have been used to screen the topic.

The deliveries for this report include:

- An overview of global trends within the usage of CPPAs in renewable projects in Europe, the USA, Latin America, and other selected countries with a focus on Denmark.
- Mapping of the structural differences among the countries analysed, thus comparing countries with a significant use of Corporate PPAs and countries with less CPPA usage in order to further understand the drivers and barriers.
- An estimation of historical volume of renewable energy capacity that is based on CPPAs in Denmark, Sweden, Norway, Finland, the UK, the Netherlands, and other European countries.
- An overview of the Danish electricity market in terms of its size, the share of renewable energy ("RE"), corporate consumption of electricity and the various participants in the electricity market, e.g. generators, suppliers, grid operator, energy traders and offtakers. The overview serves to provide the reader with the basic knowledge necessary to understand the analysis of drivers and barriers and the scenarios.
- An analysis of the identified drivers and barriers and a comparison of the potential use of CPPAs in Denmark to their use in neighbouring countries, like Norway, Sweden, Germany and the Netherlands.
- An evaluation of the main attributes of CPPAs and its comparison to other PPA arrangements currently being used between utilities, energy traders and corporate offtakers.
- An overview of the use of Certificates of Origin system and how the system functions in relations to CPPAs and utility green energy sourcing.
- Concluding the analysis of drivers, barriers and alternatives, the report provides a scenario analysis of how CPPA can contribute to the advancement of RE in Denmark from 2020 (today) to 2040, compared with the current outlook on renewable energy until 2040 provided by the Danish Energy Agency.

In terms of strengths and weaknesses of this report, the global coverage across multiple jurisdictions has contributed to the depth of the analysis. This includes the combination of internal expertise with insights from developers, energy traders and corporate electricity buyers. The report has also benefited from the availability of statistics and descriptive information of the Danish electricity market and detailed data information for the timeline reviewed, together with access to various market participants, e.g. energy traders, RE developers, corporate offtakers, industry associations and law firms.

In addition, through information gathered from the DEA, Energinet, K2 Management's global network, commercial partners, and desktop research, a comprehensive exercise based on potential future scenarios of the progression of CPPAs has been carried out. The so-called scenarios analysis (section 11) offers the reader a qualified projection, in numbers, of the main drivers and barriers highlighted elements in this report and their potential share influence on the share of renewable energy growth in Denmark over the next 20 years derived from the use of in the CPPAs.

The lack of publicly available data with regards to CPPA usage in specific markets has limited the ability to provide statistical evidence of the level of cross-border CPPA activity, albeit the report refers to examples where possible. Furthermore, the limited information on current cross-border offtake and PPA activity involving the Danish market has made it difficult to project the level of cross-border CPPAs in the future, notwithstanding that K2 Management see increased such activity. Equally, limited data on synthetic CPPAs has prevented material conclusions on this subject.

The limited information on a breakdown of energy consumption by corporates is a challenge when projecting the influence that each of the drivers and barriers have on the different sectors of the electricity market in Denmark. Similarly, it would have been advantageous to have access to information regarding current share of corporate electricity consumption linked to utility PPAs and other trading arrangements. However, this is an area of discretion for most counterparties, whether asset owners, traders or offtakers.

3.1 Abbreviations

C&I – Commercial & Industrial
CfD – Contracts for Difference
CPPA – Corporate Power Purchase Agreement
CSR – Corporate Social Responsibility
DEA – Danish Energy Agency (Energistyrelsen)
DSO – Distribution System Operator
EAC – Energy Attribute Certificates
ESG – Environmental, Social and Governance
FiT – Feed-in-Tariffs
GWh – Gigawatt-hour
ICT – Investment Tax Credit
IPP – Independent Power Producer
IRENA – International Renewable Energy Agency
IRS – Internal Revenue Service
KWh – Kilowatt-hour
LCOE – Levelized Cost of Energy
MC – Marginal Costs
MWh – Megawatt-hour
PPA – Power Purchase Agreement
PTC – Production Tax Credit
RE – Renewable Energy
SME – Small and medium-sized enterprise
TSO – Transmission System Operator
TWh – Terawatt-hour
WTG – Wind Turbine Generator

3.2 Terms

Terms	
Additionality	New renewable energy capacity that would not have been built without the use of a CPPA.
Behind-the-meter	A renewable energy generating facility that produces power intended for on-site use in a home, office building, or other commercial facility. The location of the facility is literally “Behind the Meter”, on the owner’s property, not on the side of the electric grid/utility. Usually linked to solar power.
Certificates of Origin	The Danish version of an Energy Attribute Certificate. For every MWh of renewable electricity produced, one certificate is issued. The certificate can then be sold (typically to electricity suppliers and corporates) to generate extra income for the renewable power generator with the purpose of supporting the production of renewables.
Contract for Differences	A subsidy scheme to support investments in renewable electricity. Schemes are paid a fixed "strike price" for each unit of electricity they produce, giving investors the promise of steady returns. If wholesale electricity prices are below the strike price, contracted schemes receive the difference as a top-up payment. If prices rise above the strike price, they must pay back the difference.
Collar Pricing	Provides a price floor for the producer, with a cap on the upside of the merchant price range.

Terms	
Distribution System Operator	The DSO owns the network between the transmission grid and the consumer. The DSO also has the exclusive right to transport electricity in its geographically demarcated grid.
Electricity Supplier	In Denmark, electricity suppliers purchase electricity on the wholesale market from energy traders or directly from producers, oftentimes through the Nord Pool exchange. The suppliers then resell the electricity to the final consumers and invoice the consumer.
Energy Attribute Certificate	Umbrella term for all certificates with the purpose of tracking the source of electricity for renewable products. Most EAC systems issue one certificate for every MWh of renewable electricity produced. The certificate can then be sold, thereby creating extra revenue for the renewable power generator thus supporting renewables.
Energy Trader	Energy traders typically trade electricity and other related commodities in the upstream markets, however in some cases they do interfere in the downstream markets managing the electricity need of large energy intensive corporates. Energy traders are concerned with risk management and take part in hedging activities in the forward/futures markets.
Feed-in-Tariff	Subsidy payments, designed to accelerate investment in the renewable energy markets, to ordinary energy consumers for the renewable electricity they generate.
Fixed Price	Agreed per MWh; fixed price can either be indexed or kept flat on a nominal basis.
Floor Pricing	Guarantees the producer a minimum price, while maintaining the upside potential to sell at market prices above the floor. Floor pricing usually comes at a fixed cost per MWh.
Greenification	The urge by corporates to become eco-friendly and reduce CO_2 footprint.
Levelized Cost of Energy	A measure of a power source that allows comparison of different methods of electricity generation on a consistent basis. It is an economic assessment of the average total cost to build and operate a power-generating asset over its lifetime divided by the total energy output of the asset over that lifetime.
Marginal Costs	The cost added by producing one additional unit of a product or service.
Offtake Agreement	An offtake agreement is an agreement between a power producer and a buyer of a resource to purchase or sell portions of the producer's future production. An offtake agreement is normally negotiated prior to the construction of the renewable energy facility, in order to secure a market for the future output as well as financing.
Transmission System Operator	Energinet is Denmark's transmission system operator and is responsible for transporting energy in the form of natural gas or electrical power on a national or regional level, using fixed infrastructure.
Utility	The electricity market structures differ significantly among countries, and outside Denmark, there is sometimes little distinction between electricity suppliers and energy traders as their roles are combined in some countries; thus, they are both referred to as utilities.

4 Definition of Corporate PPAs

As widely known across the renewables industry, a CPPA is a long-term contract under which a business agrees to purchase electricity directly from a power producer (e.g. a wind or a solar energy plant). This differs from the traditional approach of simply buying electricity from utilities that have an obligation to supply consumers via the electricity grid.

The aim of a CPPA as an instrument, seen from the view of the power producer, is to protect against volume and price volatility risks. CPPAs effectively also aid power producers to deliver more renewable energy on the grid. With reductions of renewable energy subsidies in multiple countries globally, CPPAs are further seen by many developers, equity investors and funders as an essential component for achieving a "bankable" project.[1]

4.1 Corporate PPA Structures

Generally, CPPAs can be divided into sleeved, synthetic and private wire CPPAs based on their structure as illustrated and explained in the following sections. However, as electricity market structures as well as regulations vary across jurisdictions, CPPA contracts and flows vary accordingly.

4.1.1 Sleeved Corporate PPA

Figure 1: Flow processes of a sleeved CPPA

This CPPA structure is sometimes also referred to as a physical off-site CPPA, however for the purpose of this report it will be referred to as a "sleeved CPPA".

There is no comprehensive definition of the sleeved CPPA applying to all jurisdictions. Please note that the exact flows of the sleeved CPPA will vary based on the market structures of the specific country/state. Jurisdiction specific market regulations will affect the feasible contracting options. As an example, the US electricity market is in some states regulated and in other deregulated, which naturally affect the nature of the CPPA contract thus sleeved CPPAs are mostly associated with deregulated markets.

In short, a sleeved CPPA involves a direct agreement between the corporate buyer and the power generator to purchase all or some of the electricity generated at a pre-determined price. How this contract will be implemented in practice is highly bilateral, discretionary and subject to individual offtaker requirements. For the purpose of this report, it has not been possible to refer to a specific sleeved CPPA.

In most cases, the corporate does not have the capabilities to manage the actual power offtake including the necessary balancing services. Thus, the corporate enters into a bilateral agreement with a utility, who will then act as the buyer's agent in managing the offtake and take care of all balancing services and grid access.

The utility will then credit this CPPA offtake against the corporate's electricity requirements and top it off if necessary. The utility will charge a management fee for its services in relation to the CPPA – sometimes referred to as a "sleeving fee". Summing up, the structure of the sleeved CPPAs is intended to mitigate risk for the corporate buyer by passing through balancing obligations and liabilities to the utility.[2]

As renewable electricity production is unpredictable in nature, the MWh produced by the power generator and the power consumed by the corporate offtaker in a given period will not match 100%.

[1] (DLA Piper, 2016)
[2] (Voltalia, 2018)

This leaves the question of who bears the price risk by selling or buying additional electricity in the spot market. This will be specifically agreed to in the contract. To demonstrate, two examples are elaborated below:

Example A

Contract terms: A corporate buyer commits to buying all the power produced from a wind farm at a predetermined price per MWh.

- Situation: The plant produces 120 MWh in a given interval, while the offtaker consumes only 90 MWh in the same interval. The residual electricity will be sold in the market by the offtaker's balancing responsible utility (as per agreed), however under this contract the offtaker will still need to pay the predetermined electricity price for the 120MWh to the power generator. Thus, the buyer is exposed to price risk. If the spot market price is below the fixed price, the buyer suffers a loss, if the spot market price is above the fixed price, the buyer comes out with a profit.

Example B

Contract terms: A wind power generator commits to supplying a given amount of MWh to the corporate offtaker across a contracted period at a predetermined price per MWh.

- Situation: If the wind farm produces less than the contracted volume in a given interval, the power generator will have to buy the residual in the spot market. Thus, the power generator is exposed to price risk. If in the spot market are above the fixed price, the generator suffers a loss. , and if the spot market price is below the fixed price the generator comes out profitable.

4.1.2 Synthetic Corporate PPA

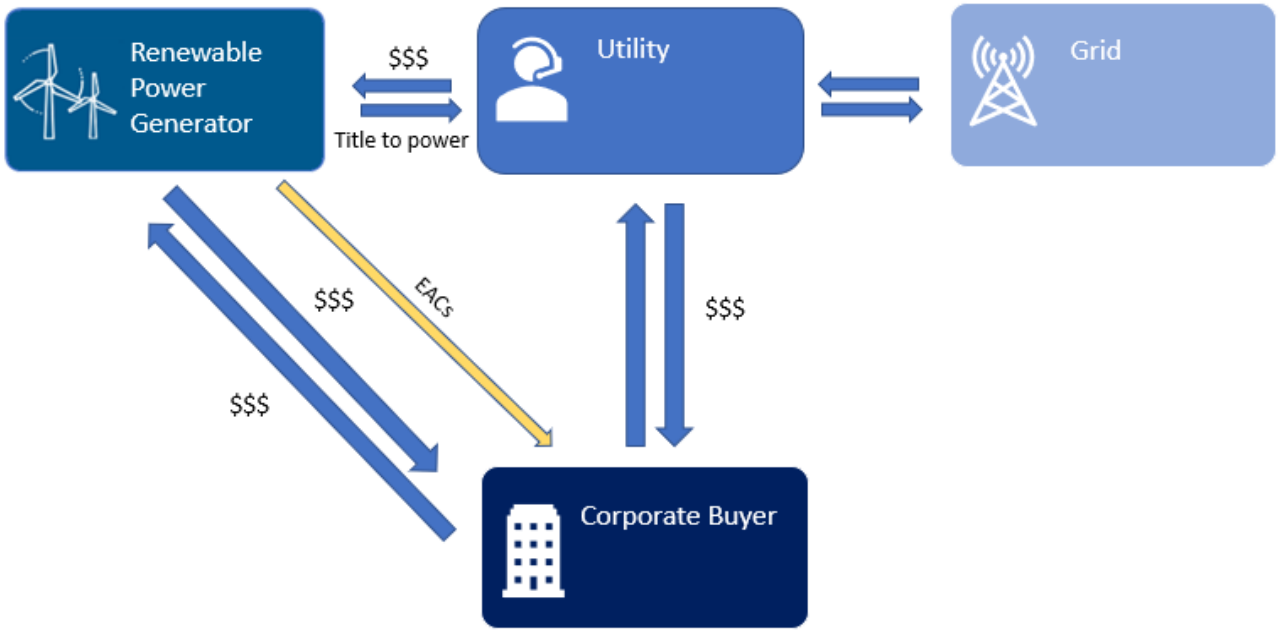

Figure 2: Flow processes of a synthetic CPPA

This CPPA structure is sometimes also referred to as a virtual or financial CPPA, however for the purpose of this report it will be referred to as a synthetic CPPA.

Several major international law firms define synthetic CPPAs as a financial derivative instrument under which the parties agree on a strike price, with payment flows being determined by comparing that strike price against a market reference

price. One commonly known feature of a synthetic CPPA is the 'contract for difference', where it is agreed that if the market reference price is higher than the strike price, the generator pays the difference to the buyer, and if the market reference price is lower, the buyer pays the difference to the generator. The volume contracted under the agreement is specified in a variety of ways and need not be tied completely to the actual power generation of the project.

Despite its name, there is usually one physical aspect in a synthetic CPPA. The corporate buyer will typically need the EACs awarded to the project for the purposes of demonstrating the renewable nature of the electricity to be delivered to the buyer. These certificates are used to record against overall electricity usage and demonstrate the performance of the corporate buyer against their commitments.[3]

4.1.3 Private Wire Corporate PPA

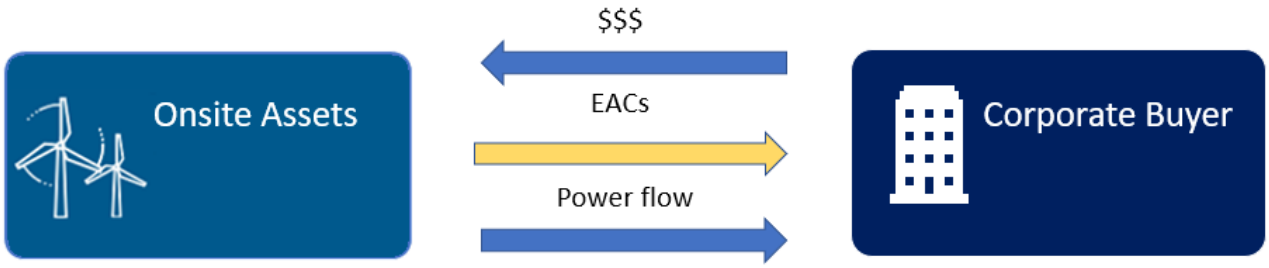

Figure 3: Flow processes of a private wire CPPA

This CPPA structure is sometimes also referred to as a physical on-site CPPA or a behind-the-meter CPPA, however for the purpose of this report it will be referred to as a private wire CPPA.

With the private wire CPPA, the generator delivers power directly to the corporate off taker via the consumer's site network and so there is no use of the distribution or transmission system for delivery of energy to the end user. This is seen mostly in developing countries, where the grid connection system is rather poor making a sleeved CPPA less attractive. Also, in some countries the law does not allow private parties to use the state-owned grid connections and hence the private wire CPPA is the only option e.g. Vietnam.

4.2 Corporate PPAs Compared to a "Normal Setup" in a Danish Context

As illustrated in the above sections, the flows of information and money between the corporate offtaker, the power generator and the utility differ based on the type of CPPA. Likewise, the "normal" setup would also differ as some electricity would be traded through the spot market at Nord Pool (Denmark's electricity exchange), while the rest would typically be sold through bilateral agreements with utilities/energy traders.
It is important to note that since electricity is a good that cannot be stored (efficiently), the physical flows and the economic/trading flows are separated. Disregarding the private wire CPPA, the physical flow of electricity in all trading setups (both CPPA and non-CPPA) is the same. Once electricity is generated, it is fed directly into the transmission lines, then transferred onto the lower-voltage distribution lines after which it is delivered to the final consumer (household or corporate).

[3] (Norton Rose Fulbright, 2017)

4.2.1 Normal Setup with Nord Pool

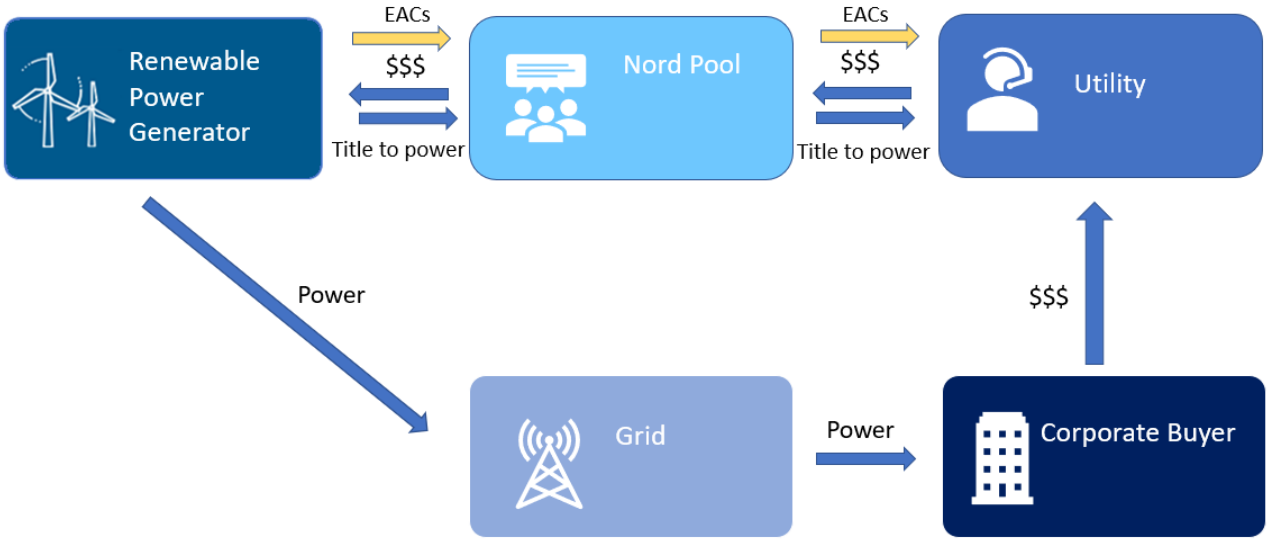

Figure 4: Flow processes in a normal setup including Nord Pool

In this setup, the RE power generator sells the electricity and the associated EACs through the Nord Pool platform to the utility (electricity supplier in Danish context). Note that although the illustration may display Nord Pool as an individual market player, Nord Pool is simply a trading platform, thus Nord Pool does not buy/sell electricity on its own. The illustration above shows the trading flow of electricity in the top and the physical flow in the bottom.

When the RE generator sells the power on the Nord Pool spot market (one day ahead), the price is determined by the actual supply and demand in that specific moment. Power generators and utilities asses the volume they will deliver/demand and at what price in a given hour. The trading system will then calculate the equilibrium price based on the bids using an advanced algorithm. After the prices are published, trades are settled. Thus, both parties have limited influence on the settlement price.

The utility hereafter resells the power to corporates and households with whom it has a supply agreement. Depending on the scale of electricity demanded, some corporates will find it beneficial to enter customised agreements with the utility providing a range of specialized products allowing the corporates to manage their exposure to the volatile electricity market.

Once the electricity is produced it is immediately fed into the transmission lines. The transmission lines in Denmark are owned, operated and developed by the transmission system operator (TSO), Energinet. Energinet is furthermore responsible for the overall stability of the Danish grid, and they ensure that the import and export stay within agreed limits. The final distribution from the national transmission grid to the consumer is controlled by the distribution system operator (DSO), which has the exclusive right to transport electricity within its geographically demarcated grid. Although the DSO physically delivers the power to the final consumer, the utility is responsible for billing the consumer and hence the DSO and utilities communicate through a common platform called DataHub.

To ensure the balance between the supply and demand of electricity, certain market operators are “balance responsible parties” reporting anticipated power flows to Energinet. In most cases, the balance responsible party would also be a utility.[4] 75% of all electricity is sold through Nord Pool.[5]

[4] (Energinet, 2016)
[5] (Forsyningstilsynet, 2019)

4.2.2 Normal Setup with Bilateral Agreement

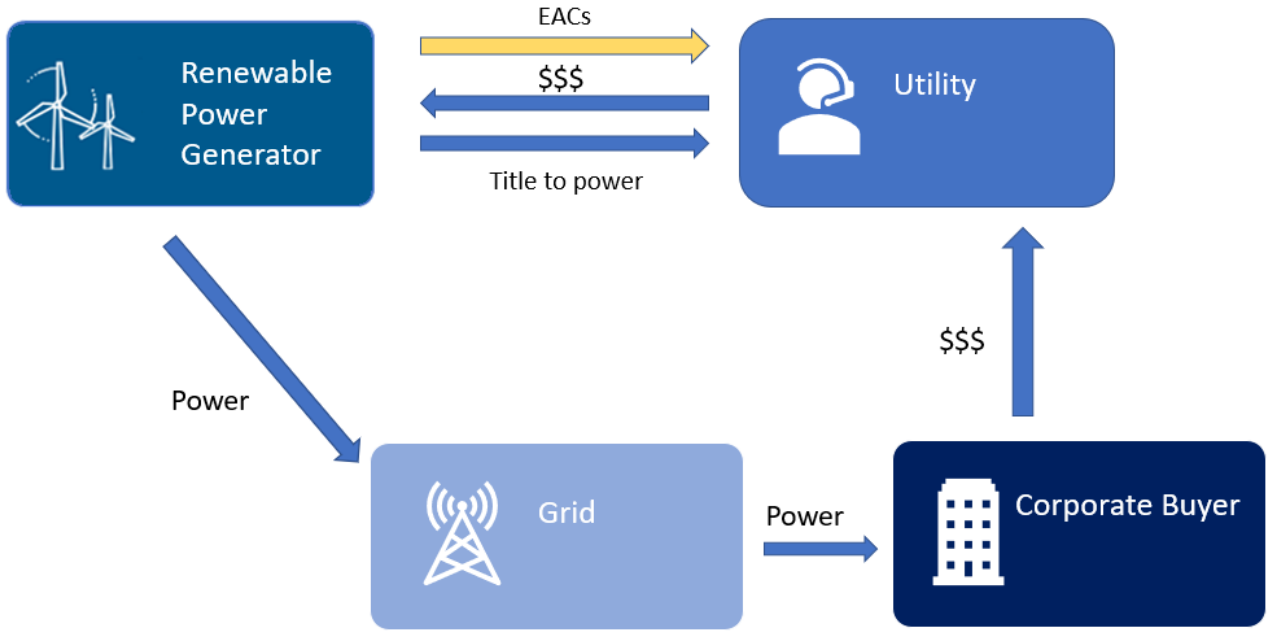

Figure 5: Flow processes in a normal setup with bilateral agreement

In this setup, the RE generator and the utility enter a bilateral agreement also known as a utility PPA. As with the CPPA, the generator and the utility agree on a predetermined price and quantity of electricity to be traded, however the utility PPA can be structured in many ways both in terms of price and risk allocation.

In this scenario, both the buyer and the seller are involved with power generation and trading as their core business, and hence the level of expertise and professionalism is higher compared to a CPPA in which case the corporate offtaker is oftentimes rather unexperienced. The duration of these contract varies, but in a Danish context the duration is normally shorter than a CPPA with a maximum duration of 10 years, while many contracts are only 3-5 years in length.

The flows between the utility and the consumer, as well as the physical flow is the same as in the above Nord Pool example.

4.2.3 Corporate PPA flow deviations

Comparing the flows associated with a CPPA with those of a normal setup (as outlined above) it is important to note that the physical flows are unchanged, expect for the private wire CPPA. The power will flow from the RE generator through the transmission lines, then through the distributions lines upon which it is delivered to the final consumer.

With regards to the economic/trading flows, the deviations depend on the type of CPPA entered.
Looking at the sleeved CPPA, the flow of money and title to the power between the RE generator and the utility is changed compared to the normal setup. In the normal setup, the utility would buy power from the RE generator through Nord Pool or directly.
In the sleeved CPPA the corporate offtaker sits in-between the RE generator and the utility. Thus, the money and power title flow from the RE generator through the corporate and then onto the utility.
This change in flows will also affect the billing between the corporate and the utility, as this delivery from the corporate to the utility will need to be credited against the corporate's total electricity requirements.

For a synthetic CPPA, the generator would physically sell the electricity either on Nord Pool or through a standard PPA/bilateral agreement with a utility at market price. The corporate offtaker would not change supply method either, as they will still purchase electricity from the utility under a standard market price agreement. Hence, these flows are unaffected by the CPPA.

However, in parallel to these conventional contracts, the power generator and the corporate offtaker enter into a contract for difference, option or other financial hedge in which they agree a fixed "strike" price for the renewable electricity produced by the power generator. The generator and the offtaker will regularly settle the difference between the strike price and the market price, and thus the money flow would depend on the market price; if it is above the strike price, the generator would compensate the offtaker, while if the market price is below the strike price, the offtaker would compensate the generator. This new flow of money between RE generator and corporate offtaker is specific to the synthetic CPPA and happens in addition to the normal setup flows.

5 The Corporate PPA Market

5.1 The Global Drivers of Corporate PPAs

Number of companies actively sourcing renewables (in top ten countries)

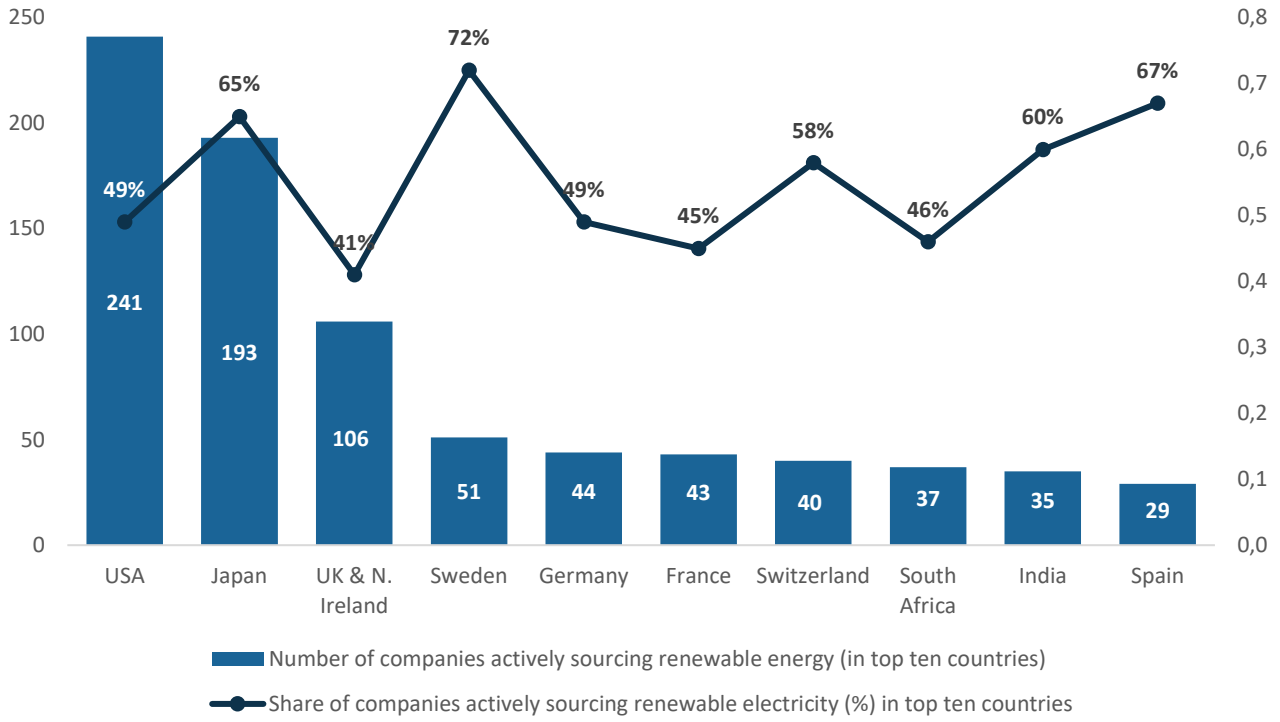

Figure 6: Number of companies active sourcing renewables by headquarter location (in top ten countries)
Source: IRENA, 2018

Note: The information in the figure is based solely on data reported by 2410 companies in 2017. The bars represent the number of reporting companies actively sourcing renewable electricity based on the headquarter location of the company in the top ten countries. The line with dots represents the percentage of reporting companies in the sample, within the country, that are actively sourcing renewable electricity. The share of companies actively sourcing renewable electricity includes all kinds of renewables sourcing such as utility green procurement programmes, the purchase of renewable energy attribute certificates (EACs) and PPAs including CPPAs.
In most developed countries, with the massive growth of renewable energy capacity over the past decade and the associated ability to bring down technology costs, the price of electricity from renewable energy sources like onshore wind and solar PV is nowadays competitive with electricity from fossil fuels like natural gas.

As a result, governments have increasingly removed the subsidies, originally introduced to support the clean energy transition, forcing new generation capacity to enter electricity offtake agreements on market competitive terms.
The development has seen an emerging growth in the use of CPPAs across many jurisdictions between the renewable energy production plant and the immediate offtakers, such as TSOs, electric utilities and electricity traders, or the ultimate consumers, retail energy utilities and industrial consumers.

The latter segment, industrial consumers that are the focus of this document, continue to have the choices of buying their electricity from utilities or make use of "captive" onsite electricity production, while they may manage their energy risks through various hedging mechanisms, such as trading on public exchanges or via energy traders, e.g. Centrica, Statkraft, Eon, Energi Danmark, Equinor and others.

The corporate consumers - offtakers - are faced with multiple considerations when determining if their energy consumption should be "green" and the growth of CPPAs in the renewable energy market is driven by the following:

5.1.1 Nature of Energy Needs

The country-by-country overview below of CPPA use points to the dominance to-date of power intensive companies like the major IT firms, like Facebook, Amazon, Google and Microsoft and, more market dependent, the basic industries like mining and minerals. Other CPPA users are considering the use of renewable power in their energy mix for diversification, ESG and "green" transition and balancing reasons, whether seasonal or daily.

5.1.1.1 Energy Prices

While corporate offtakers may have other considerations like "greenification" (see below), the price of their energy consumption is considered one of the most important drivers, when it comes to their choice of energy source.

Hence, the pricing of CPPAs must be relatively comparable to the electricity prices available from utilities, energy traders and public exchanges, e.g. Nord Pool. The pricing under CPPAs can be broadly categorised as follows:

Fixed pricing; a fixed price is agreed per MWh, which can either be indexed or kept flat on a nominal basis

Floor pricing; a floor guarantees the producer a minimum price, while maintaining the upside potential to sell at market prices above the floor. This flexibility usually comes at a fixed cost per MWh or some upside sharing with the buyer

Collar pricing; a collar structure also features a price floor for the producer, but rather than charging a fixed cost for the provision of the floor, there will be a cap on the upside of the merchant price range. From the buyer's perspective, subsidies are favourable as they will typically lead to lower energy prices.

Nord Pool

Denmark, Norway, Sweden and Finland have a shared transmission grid, which makes it possible to easily transfer energy across borders.

The energy is traded on the platform Nord Pool - Europe's leading power market and offers solutions in trading, clearing, settlement and associated services in both day-ahead and intraday markets across nine European countries.

The organisation provides efficiency and liquidity to clients through its intraday markets and a variety of services.

Due to the shared transmission system and the efficient trading platform, the Scandinavian power market is both liquid and transparent – two factors that have contributed to lower energy prices for renewables compared to the rest of Europe.

This has attracted tech giants looking for locations for data centres, and as these data centres have high electricity requirements, the shared transmission system becomes important as it eases cross-border corporate PPAs.

Currently, 380 companies from 20 countries trade on Nord Pool's markets, both Nordic and Baltic regions as well as UK and Germany.

The organisation consists of the commercial power exchange function, Nord Pool, and the Market Coupling Operator function, European Market Coupling Operator.

Nord Pool is owned by the Nordic transmission system operators Statnett, Svenska Kraftnät, Energinet Danmark and the Baltic transmission system operators Elering, Litgrid and AST.

Source: Nord Pool, 2018

According to K2 Management's extensive network, more CPPAs to date have been priced based on a discount to the long-term market price, possibly as a way of encouraging corporate offtakers to enter contracts for longer durations. This being a supply-demand consideration, it is likely that with more corporate offtakers pro-actively entering CPPAs the more pricing could shift to a premium over spot prices for long-term contracts.

A key driver of discounted CPPAs is likely to be the requirement for lenders to have long-term, secured cash flow and debt service, for which project sponsors, developers and equity investors are willing to compromise their return expectations.

5.1.2 Volume, Duration & Security of Supply

Historically, electricity volumes of PPAs have been fixed and linked to the production capacity of a single or multiple wind and/or solar energy assets.

One of the main challenges with fixed volumes have nevertheless been weather seasonality and hourly volatility. In its simplest form, this has led to limitations of the fixed volume agreed in CPPA as percentage of total capacity that ensures the volume of electricity supply can be delivered at any point of time during a year. In situations where the wind speed or solar irradiation, and therefore electricity production, are not meeting the guaranteed/contracted levels, the energy producer is bound to cover any additional costs and damaged related to the offtaker buying the electricity from the grid. Current variations of fixed volumes are volume ranges, seen in the more advanced CPPA markets, where monthly volumes are linked to weather seasonality as well as the variable energy consumption levels of the corporate offtakers.

The duration of CPPAs are often determined, based on the type of energy consumption of the underlying assets of the corporate offtakers, the duration of their energy procurement plants and the longevity of the locations or facilities for which they are purchasing the electricity. The datacentre and mining offtakers are characterised, according to Eric Domenico of AIP Management, a Danish infrastructure fund manager, as energy intense consumers of electricity for large physical assets, like data centres and mining sites and are therefore positioned to plan the energy purchasing long-term, e.g. 15-20+ years, and for individual sites or for entire portfolios.

The Swedish wind market, like Norway are benefiting from publicly trading Green Certificate subsidies. Sweden has historically seen the participation of the pulp and paper industry that has been faced with the move of paper manufacturing to the Southern Hemisphere, resulting in PPAs of typically 5 years in line with these companies' investment plans and energy risk management. These participants have also considered the need to balance the pricing risks of electricity and the longer-term pricing risk with the certificate market.

At the other end of the spectrum, the CPPA markets in countries such as the US and UK have struggled to move beyond 3-5 years until recently. This is likely due to:

1) The wider and differing nature of the energy needs of the corporate offtakers and their shorter-term energy and financial risk management procedures (I.e. buyer-driven consideration) and/or
2) Anticipation of price changes of the generation company and concerns of longevity of electricity requirements (I.e. seller and lender-driven considerations).

Due to the phase out of fossil fuels, corporates are looking to increase the share of renewable energy in their energy mix to secure long-term reliable and predictable supplies.

Contractually, the sellers of electricity under CPPAs are typically protected against an offtakers decision to close down a physical facility, as the contract is entered by a legal entity of the corporate (with a parent company guarantee), if not entered with the parent company itself. As such, the risk associated with the physical move of an offtaker is limited to the period after the expiry of the contract, which while dealt with commercially, may involve risks associated with changes in market prices as well as the overall demand from electricity from the specific installation. It may be the case that the risk is close to eliminated due to growing demand for green electricity.

5.1.3 Contracting & Financing

From a project developer's, point of view the longer duration of a CPPA the better the financing conditions are likely to be. Such conditions are often termed in the industry as "bankability".

CPPA contracts are not standardised. Various jurisdictions have different legal traditions of contract drafting. However, independent developers and energy traders are seeking to secure corporate offtake arrangements as a trusted

structure. To ensure CPPAs as a credible alternative to CfD auctions, e.g. the UK and Germany, have expressed a desire to have a market standard, as a way of simplifying the process of securing the CPPA and reduce the internal and external legal and commercial costs involved. Smaller corporate offtakers would see similar future benefits in having some level of standardisation, while several law firms with experience in CPPAs for renewable energy are working on standardising their respective "versions". A continuous development in standardisation would potentially from an industry perspective be welcomed by investors.

As mentioned by Eolus AB, the Swedish wind development company, in order to attract bank financing, CPPA contracts are not only there to secure the price, the volume and the duration with the offtaker, but also to "tie up all loose ends". The contracts will therefore typically include items such as Delivery point, Definitions of product traded, Base load, Pay-as-produced, availability and nature of GoOs and green certificates, the Price mechanisms (see Energy Prices above), Responsibility for balancing services, Termination fees, possible Collateral from seller and buyer and Availability warranty.

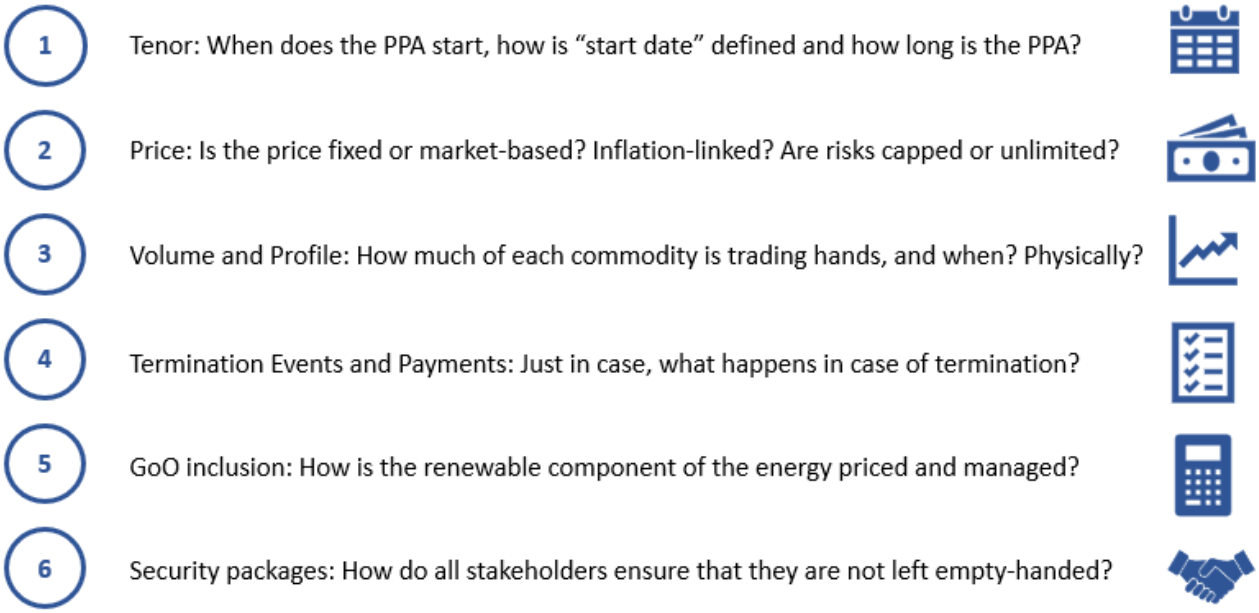

Figure 7: Key issues to negotiate in a CPPA

5.1.4 Third Party Involvement in CPPA Contracts

CPPAs, in the absence of FiT and other subsidy schemes, are known to contribute to risk mitigation and greater bankability due to the "pre-sold" volume of electricity on pre-agreed pricing terms. Even so, CPPAs may still represent commercial risks to the lenders and owners related to credit risk of the corporate offtaker, shorter durations, pricing and volume terms.

From the seller's point of view (I.e. owner and its finance providers), there will always be credit risk associated with the buyer's ability to fulfil the contract and make good on the agreed future payments. These credit and contract risks increase with the duration of the contracts.

Thus, in order to further mitigate the risk related to the CPPA, government-owned and supranational financing providers, like Export Credit Agencies and the United Nations' MIGA, have been providers of CPPA guarantees, in the case of MIGA for developing countries only.

In Norway, the Norwegian Guarantee Institute for Export Credits (GIEK) has been involved in several guarantee provisions that have contributed to the growth of CPPA usage. In these situations, GIEK provide guarantees to the seller of electricity protecting against the buyer's non-fulfilment of the power contract.

In October 2017, Alcoa Norway, the aluminium producer, entered a CPPA to buy energy from the wind power plants at Raudfjell and Kvitfjell consisting of 67 WTGs with a capacity of 281.4 MW. For this contract, GIEK has provided guarantees to power sellers to meet Alcoa Norway's obligations under the power agreements for an amount of EUR 55.8 million.[6]

5.1.5 Green Policies

According to a survey among the members of RE100, the most important driver for using renewable energy was CSR and the need to manage greenhouse gas emissions. As an important barrier, policy environments were voted as important by 86% - mostly due to the close association with the cost of renewables. However, as many companies aim to emphasize their own CSR efforts the customers are experiencing an information overload on this topic.

To stand out from the crowd the businesses must show that their efforts are adding value and making a difference. This demand has led to the creation of several proactive climate-friendly initiatives such as the RE100 and Low-Carbon USA. While these initiatives are working towards a greener world by committing to reduce carbon-emission and by interfering in policy debates, they are also creating publicity and branding for the companies involved.

RE100 – Large corporations working towards 100%

RE100 is a group of influential companies all committed to using 100% renewable energy. Most members are leading global companies with large energy needs, and there is currently 155 members across all regions.[35] The companies all commit to reaching the goal of a 100% renewable energy by a specific date set upon admission. Examples of members include IKEA, Apple, Bestseller, Citi, Carlsberg and more.

According to IRENA, two thirds of global electricity is used by the commercial and industrial sectors. Hence, it is crucial for the demand of - and investments into renewable energy to get these sectors involved.

By joining RE100 the companies are not only increasing demand for renewable energy, they can also use the opportunity to share best practice, learn and inspire others. Moreover, many members are also engaging suppliers and some even intervene in policy debates.
In 2017, the members were creating a demand for 188 TWh of renewable energy, while 72 TWh of renewable energy was sourced.

Taking a closer look at the sourcing strategies of the members, energy attribute certificates (EAC's) were still in the lead, however corporate PPA's account for an increasing share of the energy sourced. In 2017, CPPAs accounted for 16% of the renewable energy sourced – that corresponds to 9 TWh and is almost double compared to 2016.

Breaking down PPA use down by region, the US is in the lead as 20% of all renewable energy sourced by US RE100 members was sourced through a corporate PPA. India follows, with 17% while in Europe, so far only 5% of the energy wad sourced by using PPAs.

Earlier this year Etsy, Apple and Swiss RE signed an aggregate corporate PPA in the US. This deal is worth noticing, as it enabled Etsy to sign one of the smallest corporate PPAs in record.[35] These so-called buying groups or buying consortiums is likely to become an important factor in future energy demand, as they decrease the risks and costs for each company involved, and hence allow smaller players with lesser means to enter corporate PPAs.

Source: RE100, 2018

The CPPAs have some advantages compared to other ways of sourcing renewable energy as it can be used as a key instrument in achieving "additionality". Having signed a CPPA can be the difference for a developer between having a bankable project or not. Thus, companies can show that they are adding value and making a difference by sourcing renewable energy this way.

[6] (GIEK, 2017)

6 Global Trends in Corporate PPA Usage

Figure 8: Overview of the global CPPA development in GW
** as of August*
Source: Bloomberg New Energy Finance
Note: Onsite CPPAs not included, APAC number is an estimate. Pre-market reform Mexico CPPAs are not included.

6.1 Corporate PPAs in Europe

As shown in the chart above, Europe (EMEA) is still significant behind the Americas (mainly USA), when it comes to the usage of CPPAs in renewable energy deals. Differences in market structures, regulatory systems and support regimes has made CPPAs less attractive and less necessary to European developers and corporate offtakers.[7]

However, some European countries have succeeded in creating a market for the usage of CPPAs. Among them are The Netherlands, Norway and Sweden – each of which showed strong activity in 2017. In the case of Norway and Sweden, this is based on a 10-year evolution of the overall PPA market.

In recent years, the above countries together with UK and Ireland, have had growing activity. In Sweden, the costs for building wind parks are among the lowest in Europe and there have been recent political decisions with the aim to create further incentives to invest in renewable energy sources. In the Netherlands, Royal Philips, AkzoNobel, DSM and Google partnered up to purchase renewable electricity to develop part of their operations.[8]

Other, large renewable energy markets have seen little activity for CPPAs. In Germany, CPPAs have not been very attractive so far due to beneficial subsidy schemes and certificates of origin for renewable energy in traditional electricity supply agreements.[9]

The Italian market has seen recent action with the signing of subsidy-free solar CPPA between UK-based renewable energy investor Octopus and Shell Energy Europe. The five-year-fixed-price CPPA covers six sites that add up to a total

[7] (Norton Rose Fulbright & FinAdvice, 2017)
[8] (Baker McKenzie, 2018)
[9] (Bird & Bird LLP, 2018)

capacity of 70.5 MW. The CPPA signed also includes a GoO, requiring the energy producer to provide information to customers on the source of the energy provided. In addition to this, Octopus has announced its two-year PPA signed with Italian power aggregator Ego. The entire Italian portfolio held by Octopus amounts to a total capacity of 170MW, which is relatively large compared to the market.

One of the main reasons Norway and Sweden are leading Europe in terms of CPPAs is Scandinavia's popularity with data centre owners. With cool weather and a strategic position (low-risk area), the Nordic countries have attracted technology giants such as Facebook and Google, who are heavily investing into running 100% on renewable energy.

This month in Poland, thanks to its renewable energy scheme that enables suppliers to either offer their electricity on the market or to sell it as part of a CPPA, VSB and Mercedes-Benz entered the country's first major, long-term cross-border CPPA in the country. Wind Europe CEO Giles Dickson said: "Renewable PPAs provide corporate energy consumers with reliable and competitively-priced power and enable them to lock in their energy costs at fixed prices over a long period. They also provide stable revenue for wind plants which reduces financing costs. So, it's win-win all round".[10]

The European Union Renewable Energy Directive (RED II) intends to identify and remove any barriers to CPPAs, lifting the CPPA market in Europe.

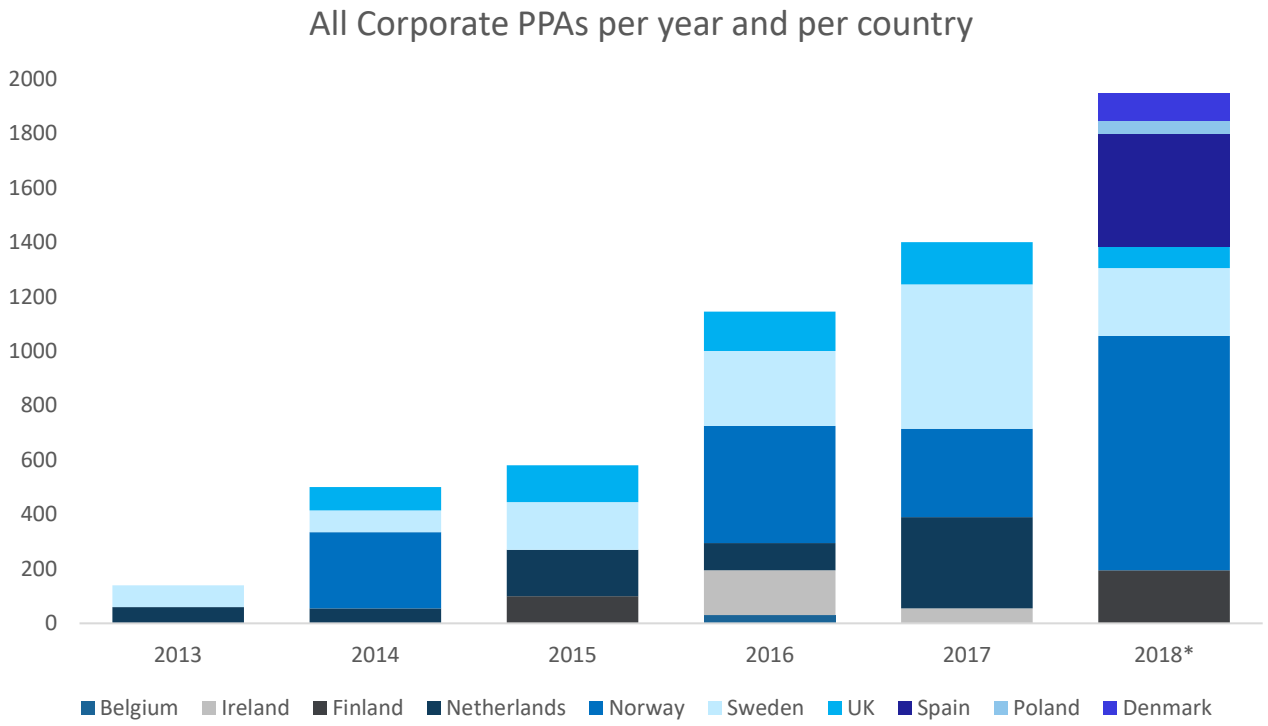

Figure 9: Overview of CPPAs in Europe in MW divided by country
** as of October*

Note: In the figure above, Denmark is represented with a capacity of ca. 120MW in 2018. This is corresponding to the capacity of the CPPA signed by Novozymes and Novo Nordisk for Denmark's largest offshore wind park, Kriegers Flak which is being developed in the Baltic Sea. The deal with Novozymes and Novo Nordisk covers approximately a fifth of the farms total production of 600MW.

[10] (Inspiratia, 2018)

In the past, FiT regimes across the continent provided high fixed rates, however, recent subsidy cuts are forcing developers in those markets to grow an appetite for CPPAs. "We expect the post-2020 Renewable Energy Directive to have a positive effect on the development of the Corporate renewable PPA market in Europe," said WindEurope public affairs adviser Viktoriya Kerelska. "And European governments will have to outline in their 2030 National Energy Plans concrete policy measures to incentivize Corporate renewable PPA uptake. All of this will help".[11]

Demand from US corporations is also a driver for the increase in CPPAs in Europe. Microsoft has executed a 15-year PPA with General Electric to purchase 100% of the wind energy from its new, 37 MW wind plant in Ireland, and it also entered a 10-year PPA with Vattenfall for the output of the 180 MW wind plant in the Netherlands.

Google is a large player in the CPPA market in Scandinavia. The company has entered several CPPAs in both Finland and Sweden and looking at Europe in General Google has a total contracted capacity of 710 MW. In September 2018 Google signed a PPA to buy energy from three new wind plants in Finland with a total capacity of 190MW (price and duration not published).

Many companies recognise that the post-2020 Renewable Energy Directive (by the EU) had an important role to play in the future of CPPAs, which remains relatively unexplored in Europe compared to the United States.

Other markets to watch in Europe are France, Italy and Spain. In 2017, Spain experienced onshore wind auctions (CfD like) going as low as €34 ($40) per megawatt-hour. While France is a relatively high-value market that has recently started to introduce auctions.[12]

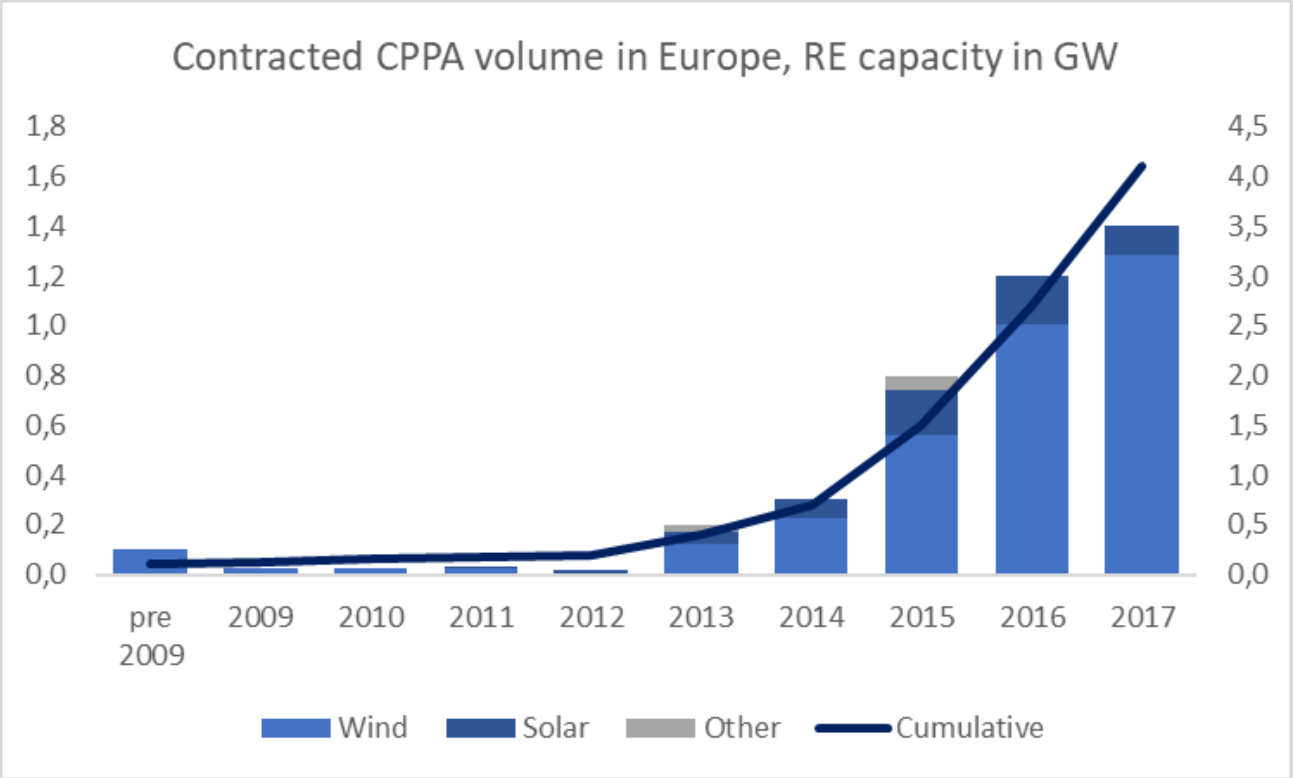

Figure 10: Contracted CPPA volume in Europe by energy technology
Source: Bloomberg New Energy Finance, company information, HSH Nordbank

It is evident from the figure above that by far most of the CPPAs in Europe are based on wind energy. The reasons are to be found in the geographical origin of the CPPAs. Most of the total CPPA volume is signed in Scandinavia, the UK and the Netherlands, which are all countries relaying mainly on wind energy rather than solar power.

[11] (Green Tech Media , 2018)
[12] (A Word About Wind, 2018)

6.1.1 Corporate PPA Usage in Germany

6.1.1.1 Overview and Trends

With the strong presence of Germany's Renewable Energy Sources Act - the Erneuerbare-Energien-Gesetz support schemes –, CPPAs have not yet been extensively used. The act contains a series of regulations that encourage the generation of renewable energy and enable better returns for generators. The act protects generators by covering the difference between the wholesale market price and the higher fixed remuneration rate. The difference is then paid by the final consumers via their energy bills. The aim of the act is to reach higher levels of electricity that are generated from renewable energy sources. The act has imposed targets for green energy generation relative to gross electricity consumption:

1. 40-45% by 2025,
2. 55-60% by 2035 and
3. >80% by 2050.

Source: BMWi, 2017

Another reason for the slow growth of CPPAs in Germany is the fact that corporate consumers can enter a traditional electricity supply agreement, which includes the sale of certificates of origin for renewable energy in addition to the electricity sold. With this agreement, the corporate consumer can buy green electricity at a fixed price.

Support schemes are in most cases the reason for a weaker presence of CPPAs, mainly evidenced by small wind parks delivering energy to small- and midsized utilities (e.g. Greenpeace Energy or Stadtwerke München GmbH). Tendencies towards growth in the German CPPA market from 2020 are foreseen as the FiT will be ending for many wind existing energy plants after that period.

Across wind energy plants, there are estimated 4,500 WTGs coming off subsidies in 2020-2022 (MW unknown) while there are 16,000MW of capacity coming off subsidies in the period 2021-2025, which is equivalent to around 30% of the total German onshore wind energy capacity.

The German consulting firm Horváth & Partners estimate that of the WTGs coming off subsidies in 2020, around 80% will enter CPPAs adding to an estimated 20-30% of new installations.

Despite the act, there are still possible scenarios in which CPPAs could come into play in Germany. Without the support schemes formerly provided by the Renewable Energy Sources Act, some RE generators will be forced to find other financing options such as a CPPA. Of course, there is also the option for generators to set aside the support schemes and use CPPAs instead.

6.1.1.2 Major Players in CPPA Market

Mercedes Benz cross-border wind CPPA mentioned earlier demonstrates the interest of a large German corporation to embrace the CPPA market, in this case to ensure renewable energy consumption for an electric vehicle production plant. Furthermore, German corporate food retailers such as Aldi and Lidl are active in the UK C&I solar market based on local, physical properties. With the anticipated CPPA growth after 2020 associated with former subsidies wind energy plants, these companies and their industry peers are likely to be more actively involved.

6.1.1.3 Terms and Pricing of CPPAs

The fees of the Renewable Energy Sources Act account for approximately 23% of consumers' final bills, making it the largest initiative within Germany to increase usage of green energy.[13] The chart below depicts the sums of the electricity trading price and the Renewable Energy Sources Act surcharge in a scenario in which the electricity trading price is

[13] (Reuters, 2018)

assumed to be constant. For 2019 and 2020, CPPA pricing will have to compare to the price levels in the chart for it to be see faster adoption, while arguably the “additionality” may help to counter slightly higher CPPA pricing.

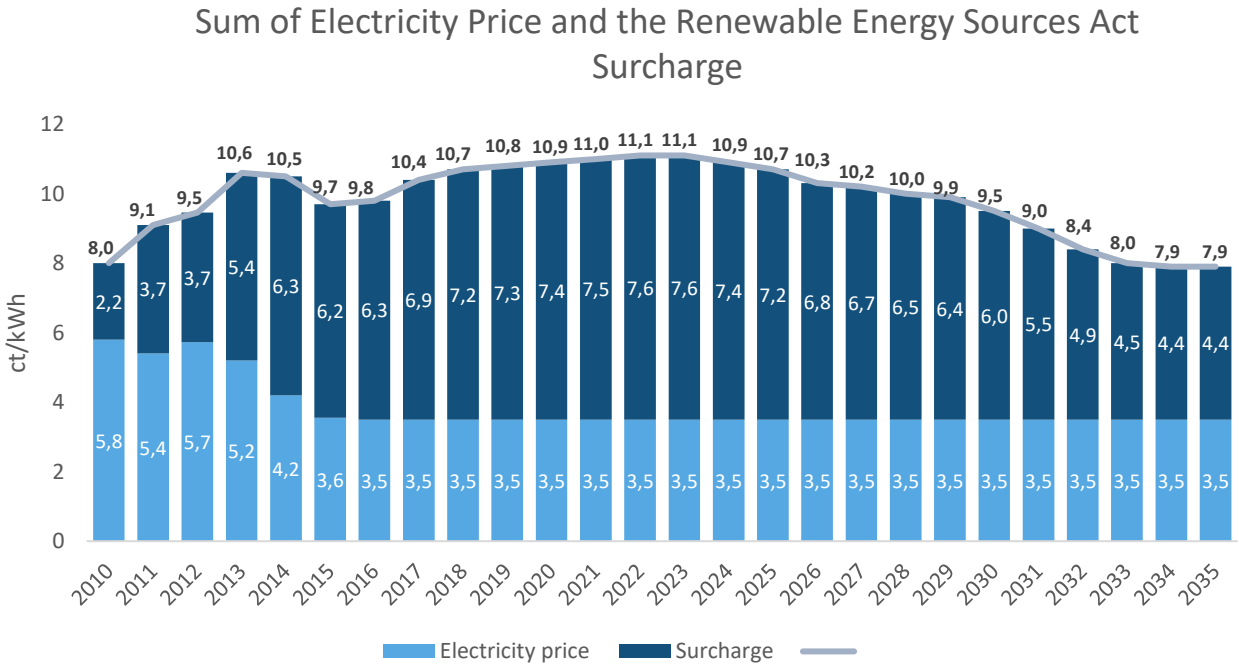

Figure 11: Sum of Electricity Price and the Renewable Energy Sources Act Surcharge
Source: EEG Surcharge Calculator (Oeko-Institut 2015)

6.1.1.4 Future Outlook for CPPAs

Approximately 4,500 German WTG will be left without subsidies from 2021 onwards due to the Renewable Energy Sources Act, therefore, projections for CPPAs in Germany exhibit some optimism with many projects exiting their period of the support scheme. Additionally, aggressive auction biddings are expected to lead to lower prices being awarded. Germany and the Netherlands have witnessed offshore projects being awarded with (almost) no subsidy at all, except for the indirect financial support of not having to fund the connection. The trend of low prices could make long-term CPPAs with fixed price a very attractive option for generators in Germany in the future.

6.1.2 Corporate PPA Usage in the Netherlands

6.1.2.1 Overview and Trends

In the Dutch CPPAs market, mandatory unbundling requirements allows for generators and corporate consumers to enter a CPPA without the need of a utility "back-to-back" PPA, as the "sleeving" of the energy is done by the grid operator, rather than by the utility. Instead of entering a "back-to-back" PPA with a utility, the corporate consumer can transfer its “program responsibility” to a trading or balancing party, e.g. energy trader or utility, in order to reduce its costs of energy consumption.[14]

[14] (Bird & Bird LLP, 2018)

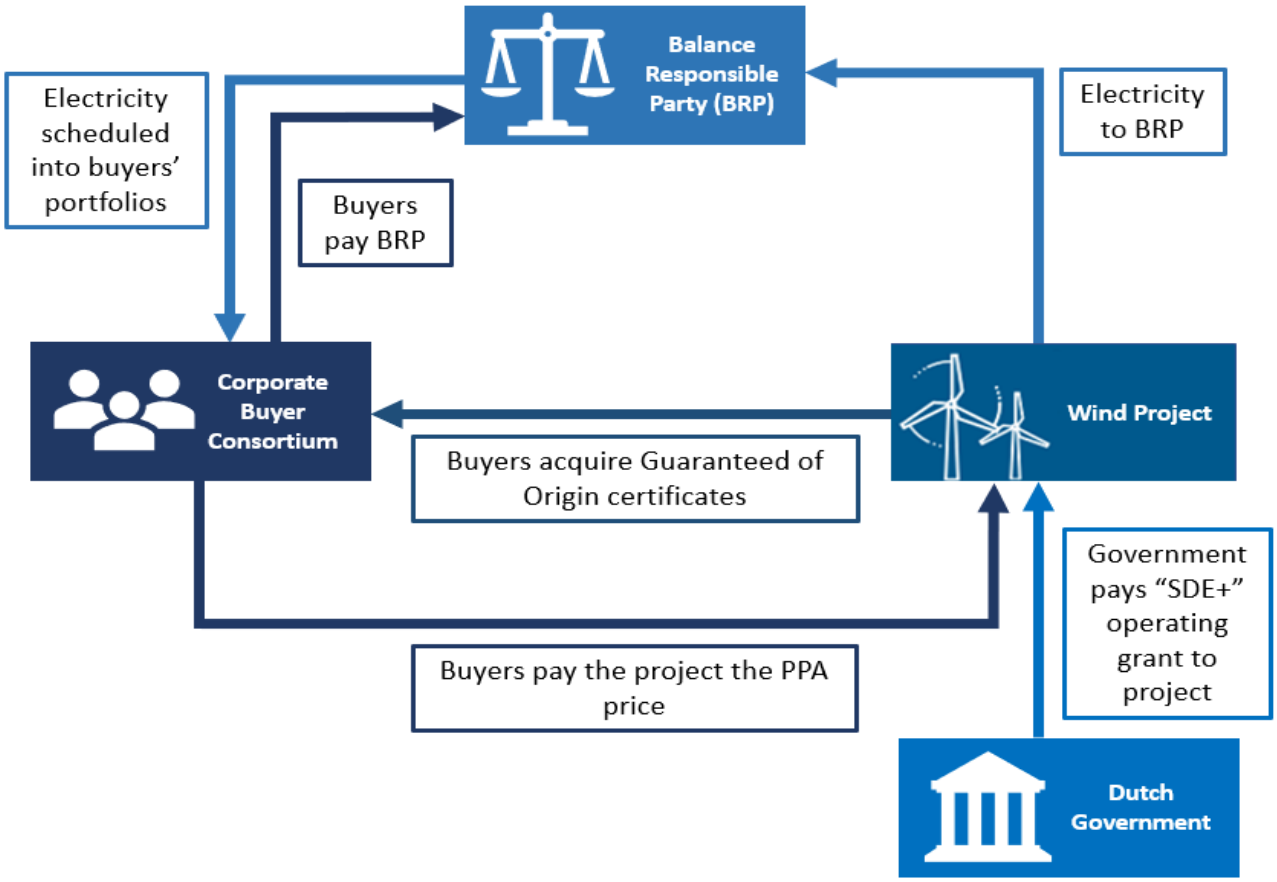

Figure 12: Overview of flows and process

Google, AkzoNobel, DSM, and Philips have together formed what it is known as the "Dutch Wind Consortium". The partnership has as its main goal the negotiation of CPPAs of wind projects in the Netherlands. The consortium model offers a range of benefits, such as economies of scale, saving and sharing costs, portfolio diversification and risk management, and an easily replicable structure.[15]

The Netherlands have shown great commitment into increasing their renewable energy footprint and have set goals of generating 14% of its energy from renewable sources by 2020, increasing to 16% in 2023 and reducing its total energy consumption by 1.5% on an annual basis.[16]

6.1.2.2 Major Players in CPPA Market

The main players in the CPPA market in the Netherlands are Google, AkzoNobel, DSM and Philips. The companies are responsible for a significant contribution in Netherlands' effort to meet their 2020 renewable energy target of 14%. The Dutch Consortium have signed long-term CPPAs of two wind plants that totalled 140 MW in capacity, enough to power approximately 140,000 households.[17]

6.1.2.3 Terms and Pricing CPPAs

The prices paid by the consortium members on CPPAs are based on the wholesale electricity prices traded on the Dutch APX energy exchange. Hedging price oscillation due to supply and demand on the market, the consortium members and

[15] (Rocky Mountain Institute, 2017)
[16] (Bird & Bird LLP, 2018)
[17] (Philips, 2018)

the developers have negotiated a price collar. Meaning that, when prices go below a preestablished floor, or above a ceiling, the parties cover the differences.[18]

A series of measures and regulations have been implemented by the Dutch government to support renewable energy projects in The Netherlands. Some of the schemes include: Stimulation of Sustainable Energy Production and the Energy Investment Allowance.

The Stimulation of Sustainable Energy Production operates as a feed-in-tariff subsidy, and it covers the difference between the cost price of generation and the market value of the electricity. While the Energy Investment Allowance, allows companies to deduct 55% of the investment costs from the fiscal profits, on top of any permitted depreciation.[19]

6.1.2.4 Future Outlook for CPPAs

The consortium CPPA described earlier underpins the activity levels and the sophistication of the growing CPPA market in the Netherlands.

6.1.3 Corporate PPA Usage in Sweden

6.1.3.1 Overview and Trends

Sweden's renewable energy market is continuously growing, and Sweden is currently on track to meet their 2030 renewable energy target of having 49% of energy coming from renewable sources – they may reach this goal already by the end of this year.

As one of Europe's largest countries by landmass, Sweden benefit from even more available and suitable land for wind energy than Norway. Like Norway, Sweden has a large, heavy industry consisting of paper, chemicals, minerals and automotive manufacturers and a vast supply chain of component manufacturers that with globally, recognisable brands like Volvo, Electrolux, Ikea and others are increasingly embracing the transition to clean energy consumption. Thus, as there is a large demand from corporates, this leaves a large potential for CPPAs in the future.

Since 2003, Sweden has had a support scheme for renewable energy based on a quota mechanism, which is combined with a trade in certificates for electricity from renewable energy sources – the so-called green certificates. In 2012 Norway joined this model and thus Sweden and Norway have had a common market for these green certificates since.

The producers of renewable energy receive on green certificate for each MWh produced over a maximum of 15 years. These certificates are then sold in a market where the prices are determined by supply and demand. Hence, the producers receive the income from green certificates in addition to the production income – the energy price.
The demand for these certificates is generated through the law, which requires energy suppliers (utilities) and certain electricity customers to buy green certificates corresponding to a certain proportion (quota) of their electricity consumption. The cost of buying these green certificates are passed on to the electricity end users, as this cost is included in electricity bills and hence all pay for the development of renewable energy.
Every year, the market participants with quota obligations must notify the authorities of the number of certificates required to fulfil their quota and show that they have that number in their green certificate accounts. Afterwards, the certificates will be cancelled, which means that they are deleted and cannot be re-used and hence this creates new demand for green certificates.

In conclusion, this system does not secure the owner/producer of the energy a specific price or subsidy for the power generated. Hence, there is a significant amount of price risk associated with dealing in the Swedish market, and thus, to obtain financing, most financiers will require the producer to somehow hedge this risk.

[18] (Rocky Mountain Institute, 2017)
[19] (Bird & Bird LLP, 2018)

The CPPA is a known tool for hedging the price risk associated with selling energy on the spot market, and hence this system promotes the use of CPPAs to secure a stable source of revenue.[20]
Through the electricity certificate system, the government has supported the development of large wind energy plants to ensure sufficient supply of renewable energy in the future.[21] In June 2018, Sweden updated its Electricity Certificates System to include 18 TWh of wind capacity to be made available by 2030, and hence to be supported by green certificates until 2045.

Overview of subsidy systems across Europe

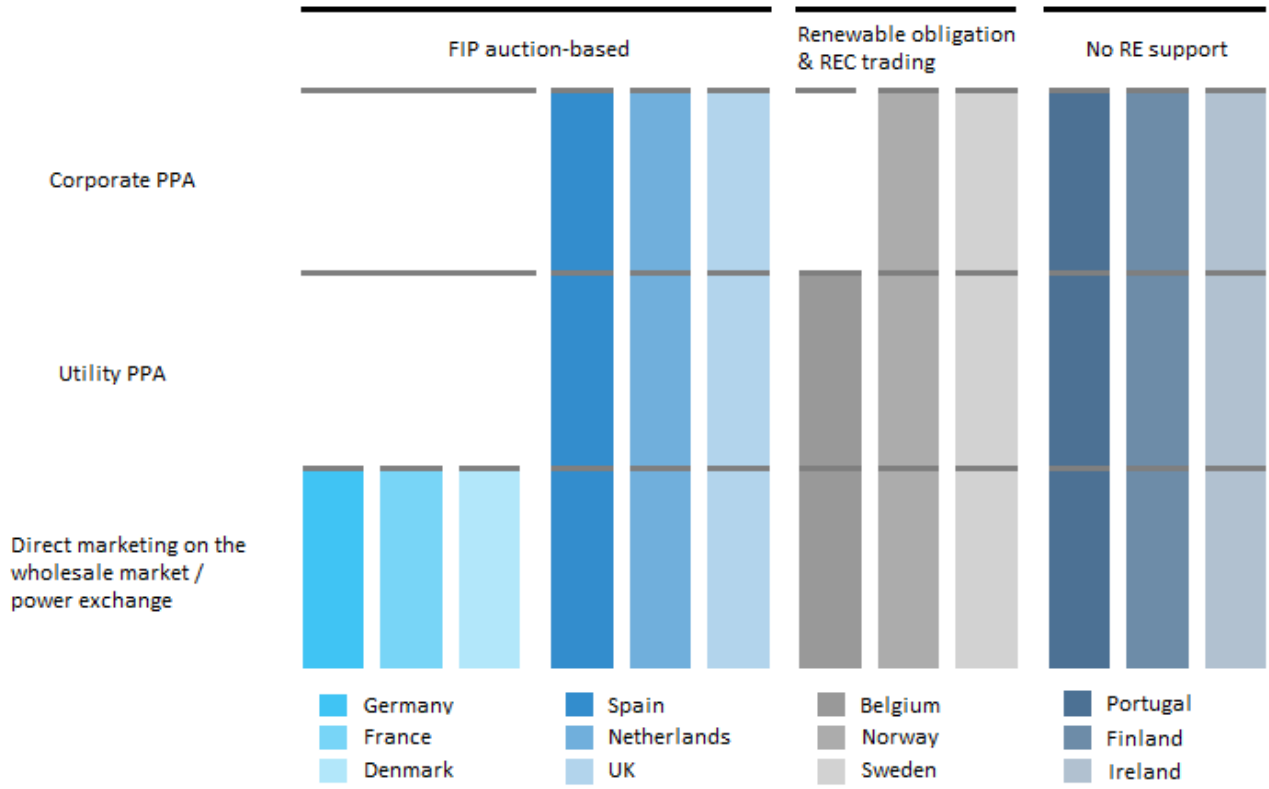

Figure 13: Overview of subsidy systems across European countries
Source: HSH Nordbank, 2018

The figure above provides a summary of the constraints for PPA transactions in selected EU countries. In principle, CPPAs are allowed in all EU countries, however the situation differs from country to country and the usage of CPPAs in a specific country will typically depend on the respective legislation with regards to renewable energy subsidies. The EU RED (Renewable Energy Directive) provides constraints and guidelines on the support systems for renewable energy.

6.1.3.2 Major Players in CPPA Market

Google is a major player in the Swedish market for CPPAs having signed several agreements during the past 5-6 years. In 2013, Google signed a 10-year CPPA covering all output from the 72 MW Maevaara wind plant, to be used in another Nordic country. In 2014 Google signed another 10-year PPA with the Swedish developer, Eolus, for the entire output from a group of wind plants in Sweden totalling 59 MW. This deal was followed by another deal with Eolus for a 76 MW wind plant in 2015[22], and with the new tax law released in 2017 Sweden is only becoming more attractive to the world biggest tech companies. Hence, this development could lead to more record-breaking PPAs in the future.[23]

[20] (Bird & Bird LLP, 2018)
[21] (A Word About Wind, 2018)
[22] (EMEA Nordics, 2016)
[23] (Quartz, 2017)

The Swedish pulp and paper industry were an early and large participant in the establishment of the Swedish CPPA market, allowing institutional investors and project finance providers to debt finance wind energy assets, despite the merchant-pricing nature of the market. While finance providers were seeking longer tenors of the CPPAs, these paper manufacturers, due to structural changes in the industry and the cyclical nature of paper manufacturing revenues, had limitations with regards to their willingness to commit to longer term power purchases, which to some extent until five years ago held back the growth of renewable energy and CPPAs despite the vast amount of land and the attractive wind conditions available.

Aside from the large technology companies, Sweden is also home to range of big industrial corporate groups as mentioned above.

6.1.3.3 Terms and Pricing of CPPAs

In recent years, the tenors of CPPA have extended beyond its historical 5-10 years limit. In 2017, a 19-year CPPA was entered between Norsk Hydro and the Markbygden wind plant in Northern Sweden, at the same time breaking the record as one of the largest corporate wind PPAs.

With regards to prices, Sweden has a similar structure as Norway. Prices of energy for non-household consumers in Sweden are almost half of the prices in other parts of Europe such as Germany and Italy.[24]

The approximate average duration of a CPPA contract in the Nordics is 16 years, based on data from the largest public deals in 2015-18.

6.1.3.4 Future Outlook for CPPAs

The future of CPPAs in Sweden will continue the evolvement of an increasing use of number of CPPAs and likely also scale. The combination of the decrease in energy taxes, large industrial companies, datacentres and other corporates with a demand of power combined with new releases of renewable energy capacity means that both the supply and demand for renewable energy will increase and with that additional growth of CPPA.

6.1.4 Corporate PPA Usage Norway

6.1.4.1 Overview and Trends

Norway's renewable energy production is already at a 98% level mainly due to its large hydropower resources. However, the CPPA market remains strong with corporations purchasing a record volume of clean energy in 2018.[25]
CPPAs signed in 2018 by companies such as Alcoa, Facebook, and Norsk Hydro in both Norway and Sweden amount to approximately 1.4 GW capacity, almost equal to the total capacity of CPPAs signed in the whole of the rest of Europe in 2017.[26]

As Norway has been an established CPPA market for some years, several long-term contracts look to expire in 2020. Thereafter, creating opportunities for CPPA extensions, new PPAs, possibly with new offtakers at updated pricing and other terms will be reality in a matured CPPA market. The Norwegian financial broker firm, the Norwegian Water Resources and Energy Directorate (NVE) is currently developing a knowledge base about consequences of onshore wind energy production. Part of this study involves due diligence analysis to identify areas that are most suitable for wind power generation. The final report is expected to be released in 2019 and the findings could lead to "additionality" qualifying CPPAs.[27]

[24] (A Word About Wind, 2018)
[25] (EMEA Nordics, 2016)
[26] (Baker McKenzie, 2018)
[27] (Pareto Securities Corporate Finance, 2018)

Since 2012, Norway and Sweden have had a joint support system for renewable energy based on a quota mechanism, which is combined with a trade in certificates for electricity from renewable energy sources – the so-called green certificates.

The producers of renewable energy receive on green certificate for each MWh produced over a maximum of 15 years. These certificates are then sold in a market where the prices are determined by supply and demand. Hence, the producers receive the income from green certificates in addition to the production income – the energy price.
The demand for these certificates is generated through the law, which requires energy suppliers (utilities) and certain electricity customers to buy green certificates corresponding to a certain proportion (quota) of their electricity consumption. The cost of buying these green certificates are passed on to the electricity end users, as this cost is included in electricity bills and hence all pay for the development of renewable energy.
Every year, the market participants with quota obligations must notify the authorities of the number of certificates required to fulfil their quota and show that they have that number in their green certificate accounts. Afterwards, the certificates will be cancelled, which means that they are deleted and cannot be re-used and hence this creates new demand for green certificates.

In conclusion, this system does not secure the owner/producer of the energy a specific price or subsidy for the power generated. Hence, there is a significant amount of price risk associated with dealing in the Norwegian market, and thus, to obtain financing, most financiers will require the producer to somehow hedge this risk. The CPPA is a known tool for hedging the price risk associated with selling energy on the spot market, and hence this system promotes the use of CPPAs to secure a stable source of revenue.[28]

In 2016 the Norwegian Government considered ending the certificate system from 2021, but after severe criticism they decided to retain the original agreement with a target of 13.2 TWh. Unlike Sweden, Norway has not increased its quota, however Norway has pledged to increase its support for renewable energy in other ways. One way is with the use of government-supported guarantees issued by GIEK as mentioned in section 5.1.4.

[28] (Bird & Bird LLP, 2018)

Announced	Seller	Off-taker	Site	Size (MW)	Duration (Year) '15 '17 '19 '21 '23 '25 '27 '29 '31 '33 '35 '37 '39 '41 '43 '45 '47 '50	Volume/Year (GWh)
May-18	Vatenfall	Hydro	Blakliden Fäbodberget	353	19 years	660
Jul-18	Engie & Susi Partners	Hydro	Tonstad	208	25 years	700
Feb-18	Credit Suisse	Hydro	Fosen	1000	19 years	600/1000/700**
Jul-18	Macquarie	Hydro	Sundsvall	235	29 years	300/550***
Nov-17	Macquarie & General Electrics	Hydro	MarkbygdenETT	659	18 years	650
Mar-18	Eolus	Alcoa	Øyfjellet	330	15 years	1200
Oct-17	Prime Capital	Alcoa	Kvitfjell/Raudfjell	281	15 years	1000
Jul-18	BlackRock	Alcoa	Guleslettene	194	15 years	700
Dec-15	MunichRE	Google	Jenäsen	76	10 years	280
Jun-16	BlackRock	Google	Tellenes	160	12 years	550
Oct-16	AquilaCapital	Google	Lehtirova	103	10 years	490
Jun-13	Allianz	Google	Maevaara	105	10 years	-
Sep-18	Neoen & Prokon	Google	Hedet	81	10 years	-
May-18	Luxcara	Facebook	Bjerkreim*	294	15 years	1000
Sep-18	AquilaCapital	Vatenfall	Kråktorpet	163	15 years	570
Jul-18	Vatenfall	Novo Nordisk	Kriegers Flak	120	Duration not announced	540

Figure 14: Selected Nordic PPAs
Note (*): Bjerkreim consists of Gravdal, Skinansfjellet and Eikeland-Seinsland wind plants. Note (**): 0.6 TWh in 2020, 1.0 TWh in 2021-2035 and 0.7 TWh 2036-2039. Note (***): TWh in the period 2021-2031 and 0.55 TWh from 2031-2050
Source: Pareto Securities, 2018

6.1.4.2 Major Players in CPPA Market

The major players in the Norwegian CPPA market include: Norsk Hydro and Alcoa Norway, Yara International ASA, Evry AS, Jotun AS, Elkem AS, Orkla ASA, Telenor ASA, Borregaard AS and DNB ASA.[29]

6.1.4.3 Terms and Pricing of CPPAs

According to Alexandra von Bernstorff, Managing Partner of Luxcara (Asset Management firm) “Scandinavia offers a predictable and reliable regulations framework. Additionally, the power market is very liquid and transparent”. Von Bernstorff mentioned that one of the drivers for such an increase in the use of CPPAs in Scandinavia is the relatively low energy prices when compared to its European peers. A related driver is suggested to be long-term price certainty offered by the CPPAs due to the price volatility that comes with the liquidity of the Scandinavian electricity market.
Norwegian government has cut energy taxes and backed the rollout of new renewables projects, and according to Eurostat, the Norwegian electricity prices for non-household consumers at end of 2017 was EUR 0.06-0.07/kWh compared to EUR 0.15/ kWh in countries such as Germany and Italy.[30]
The approximate average duration of a CPPA contract in the Nordics is 16 years, based on data from the largest public deals in 2015.

6.1.4.4 FutureOoutlook for CPPAs

As mentioned earlier, a large number of CPPAs are expiring from 2020 and beyond opening up considerable opportunities for CPPA growth supported by new capacity listed in figure 15.

[29] (EMEA Nordics, 2016)
[30] (A Word About Wind, 2018)

Early Stage Projects in Norway (as of September 2018)

Name of Project	MW	Stage	Owner
Davvi	800	Public hearing notification	Grenselandet
Nordkyn	750	Examination program fixed	Statkraft Development AS
Skjøtningsberg	400	Examination program fixed	Norsk Miljøkraft AS
Hyllfjellet, Sognavola of Markavola	281	Applied	E.on wind Norway, Branch of e.on wind Norway
Grøndalsfjellet	200	Examination program fixed	Vindkraft Nord AS
Sandvassheia/Follaheia	200	Examination program fixed	Ulvig Kiær AS
Eggjafjellet/Åsfjellet	200	Applied	E.on wind Norway, Branch of e.on wind Norway
Borealis	200	Notified	Finmark Kraft AS
Snefjord	160	Applied	Finmark Kraft AS
Mariafjellet	150	Examination program fixed	Vindkraft Nord AS
Brungfjellet	150	Applied	Trønderenergi Kraft AS
Ulvegreina	138	Applied	Statkraft Agder Energy Vind DA
Laksefjorden	100	Applied	Fred Olsen Renewables AS
Digermulen	100	Applied	Fred Olsen Renewables AS
Kallursdalsbrottet	69	Notified	Trønderenergi Kraft AS
Kroken	60	Examination program fixed	Fred Olsen Renewables AS
Bjørnevatn	60	Examination program fixed	Troms Kraft Produksjon AS
Risavika	24	Examination program fixed	Norsk Vindpro AS
Arfafjellet	20	Examination program fixed	Arfafjellet Vindpark AS
Utsira II	15	Applied	Solvind Prosjekft AS
Valsneset (ny utvidelse)	10	Applied	Viva AS
Lindesenes - reetablering	8	Public hearing notification	Norsk Miljø Energi AS

Figure 15: Early stage Norwegian projects in MW

6.1.5 Corporate PPA Usage in Finland

6.1.5.1 Overview and Trends

Despite the potential, CPPA are still quite uncommon to the Finnish market. This situation could change as of 2018 and onwards as a new subsidies system is being proposed by the Finnish government, which likely will position CPPA as attractive to Finnish power generators.

The proposal for a new support system, if approved, will transform the subsidy system from a FiT system to be replaced by competitive auctions. The power generators will have to bid on the auction in order to win subsidies, the so-called market premiums. Premiums will be determined based on the generators' bid for the premium required, when the market price is less than the reference price of 30 EUR/MWh.

Not only, will this lower the subsidies for generators, there is also a cap on the amount of capacity eligible for subsidies for the period of 2018-2020. The cap of 2 TWh, is relatively small and hence it is likely that it will be exhausted before the end of 2020.[31]

6.1.5.2 Major Players in the Market

Google has for its data centres in Finland in September 2018 signed a new CPPA to buy energy from three new wind plants in Finland with a total capacity of 190 MW. Neither of the projects involved will receive government subsidies, and hence the deal was first of its kind for Google, as they have never purchased subsidy-free renewable electricity in Europe up until now.

Other Finland based industrial energy-intensive companies, such as Nokia, UPM Nordic Aluminium and Metso. Wartsila, has committed to use 100% renewable energy by joining RE100, why several more CPPAs are expected.

6.1.5.3 Terms and Pricing of CPPAs

Finland takes part in the Nordic wholesale electricity market, Nord Pool, which means that Finland's power transmission grid is connected to the Nordic and Baltic countries, and directly interconnected with Sweden, Norway, Estonia and Russia.

This common market creates price transparency and a high degree of liquidity by increasing both supply and demand of energy. This will impact the usage of CPPAs, as the it lowers the price of renewable energy, which will then incentivise generators to seek other revenue sources such as CPPAs. Furthermore, it opens for the possibility of entering cross-border PPAs.

The approximate average duration of a CPPA contract in the Nordics is 16 years, based on data from the largest public deals in 2015-18.

6.1.5.4 Future Outlook for CPPAs

Given the proposed subsidy changes, the power generators could be looking towards a future, where they will be without subsidies by 2020. Of course, the cap on subsidy capacity is subject to changes, however this "threat" of a 2020 without subsidies could still have a significant impact on the future usage of CPPAs in Finland.

6.1.6 Corporate PPA Usage in the UK

6.1.6.1 Overview and Trends

CPPAs have been present in the UK for some time, and the structure of the centralised electricity grid as well as the regulatory framework has led to "sleeved" PPA as being the most commonly used form of CPPAs in the UK. Among the early adopters, energy providers seeking to be protected from unpredictable and volatile wholesale market prices, and to secure revenue certainty, were keen to contract fixed-price CPPAs to hedge market exposure. One of the most appealing features that attracted developers into CPPAs in the UK were subsidy instruments, such as FiT, that provided relatively high and fixed long-term prices for their projects.[32]

In total, 687 MW of CPPAs have been completed in the UK throughout the years.[33]

[31] (Bird & Bird LLP, 2018)
[32] (Burges Salmon, 2016)
[33] (Norton Rose Fulbright, 2017)

6.1.6.2 Major Players in CPPA Market

Shell Energy Europe has been active in the Corporate PPA market in the UK announcing a CPPA in the UK for the largest solar plant in the country, with a 69.8 MW capacity. "The UK is one of our key markets for power and we've been exploring ways to increase our power presence in the country on both the buy and sell side," said Jonathan McCloy, general manager at Shell Energy Europe, one of Europe's largest owners of onshore wind energy. Due to corporate social responsibility and protection of a volatile market, other major players in the UK CPPA market include: BT, M&S, EE, Unilever, Mars, Ford, Sainsbury's, Nestle, McDonalds, HSBC, Lloyds and Nationwide are present in the UK CPPA market.[34] Mars, a US corporation and a member of RE100, recently entered a CPPA with Eneco UK, a subsidiary of the Dutch utility, to buy power from Eneco's 60MW wind plant in the Scottish Highlands over a period of 10 years, and BT announced earlier this month a 30MW solar CPPA with Lightsource, one of Europe's largest owner of solar PV assets, and 30% owned by BP, the oil major.

6.1.6.3 Terms and Pricing of CPPAs

While the UK market, similarly to other European markets, has benefited from FiT (solar PV since 2010) and ROC, these subsidies were phased out by March 2017. Since then, major UK renewable energy companies have adopted strategies to focus on either the CfD auction market or the utility PPA or CPPA markets, Fixed price CPPAs have become attractive while generators still prefer the CfD auction market over the CPPA route due to clarity of process and despite the relatively low chance of success. As Simon Wallop of REG Power Ltd. Says: "The CfD auction markets across Europe allows us a clear and known process, which despite the lower chance of success, is often a better use of resources than a lengthy and costly negotiation process with potential corporate offtakers."

Government backed CfDs have mostly seen onshore wind and solar PV projects left out future CfD auctions, guiding developers into CPPAs.

6.1.6.4 Future Outlook for CPPAs

The CPPA market in the UK is benefiting from its close vicinity to the investors, lenders and law firms in the City of London, and the potential to develop a contractual framework for CPPA that will a "Smartest Energy see CPPA as the key to enabling new build renewable assets and provide budget certainty to supply customers. The Corp PPA transaction structure and terms plus underlying credit guarantees will be essential in enabling the sector to scale up" – Chris Smith, Smartest Energy.

6.2 Corporate PPAs in the USA

The US market is known as the market where CPPA were initially developed. Starting as early as the 2000's, the first CPPA of significance was signed by Google in 2010, buying a majority stake of a wind plant in Iowa. Since then several major corporations such as Microsoft, Apple and Walmart have followed, and the CPPA is now a well-known source of revenue.[35]

With this progress, CPPAs have increased the "bankability" of projects and improved the chances for achieving favourable project finance terms. Usually, CPPAs are signed with a 20-year duration. However, there has been a trend towards a duration of 10-15 years, which could affect project financing terms negatively.

Due to the large geographical scope of the US market, synthetic CPPAs are more common than the sleeved CPPAs as they do not require that the developer and the off taker are connected to the same grid. However, the private wire CPPA also has its advantages, as it shows a clearer link between the project and the off taker, which can then be used for branding purposes.

[34] (Bird & Bird LLP, 2018)
[35] (DLA Piper, 2016)

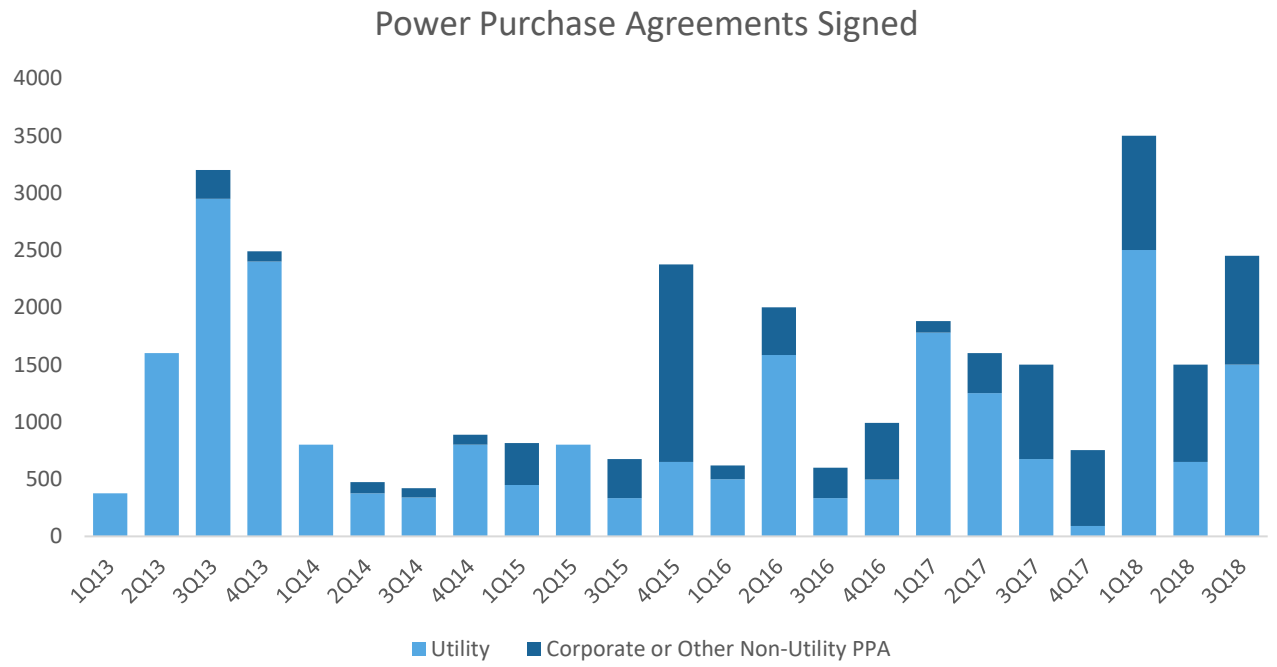

Figure 16: PPAs signed in the US
Source: AWEA, 2018

Project developers signed 2,467MW of CPPAs in the third quarter, contributing to a total of 7,550MW for the year. PPA volume for the first three quarters of 2018 already exceeds total activity in each of the last four years and is just shy of total levels in 2013.

Nine utilities signed contracts totalling 1,522MW of wind capacity in the third quarter, including Eversource Energy, National Grid, and Unitil's CPPA for 800MW of the Vineyard Wind offshore wind project.

Corporate and other non-utility customers accounted for 38% of 2018's third quarter PPA capacity, with 11 companies signing up for a total of 945MW. Eight companies purchased wind energy for the first time, including Smucker's, Boston University, and Royal Caribbean Cruise Lines. Repeat customers included Facebook, Kaiser Permanente, and Novartis.

Corporate and other non-utility customers have signed 2,904MW so far in 2018, making it the most active year for non-utility PPAs. In total, these buyers have signed contracts for more than 10,600MW of wind energy.[36]

In this section, the insight on solar and wind are separated starting with wind, due to significant differences in subsidy systems. Note, this concerns only the US market.

6.2.1 Corporate PPA Usage in Wind, USA

6.2.1.1 Overview and Trends

Appetite for renewable energy remains strong in the US among large corporations and has resulted in North America as the global leader in CPPA for both wind and solar. PwC reported that 72% of large companies in the US are actively pursuing renewable energy solutions to offset their consumption needs.[31] Utilities are evolving to meet this demand, and many are actively updating their regulations to allow corporations to directly purchase renewable energy through direct or synthetic PPAs as well as behind-the-meter energy assets.

[36] (AWEA, 2018)

CPPA accounted for 40% of the total PPAs signed in 2017, worth approximately 2,200 MW of wind capacity. To date, over 9,100 MW of CPPA have been signed for wind energy plants across the US.

Corporate Offtaker	Est. MW of Wind
Google	1335
Amazon Web Services	711
Nestle	601
Dow Chemical	599
Owens Corning	506
Walmart	502
Hewlett-Packard Company	500
Microsoft	463
Kimberly-Clark	455
AT&T	436
Johnson and Johnson	412
Target	376
T-Mobile	299
Anheuser-Busch	298
Salesforce	277
General Motors,	250
Mars	211
Facebook	204
QTS Reality Trust	200
General Motors	155
Steelcase	147
PPL EnergyPlus LLC	128
Procter and Gamble	126
3M	120
JPMorgan Chase	100
Digital Realty	50
Valero Energy	50
Yahoo!	48
Iron Mountain	40
Intuit	38
California Portland Cement	24

Figure 17: Wind corporate offtakers

The federal Production Tax Credit (PTC) has had a considerable impact on the growth of wind energy in the United States. Originally implemented in the 1990's, the PTC provides a 2.3- $cent tax credit per kilowatt-hour produced by a wind energy plant for the first 10 years of operation. The PTC was renewed on a one or two-year basis continually through 2015, and the uncertainty of the tax credit in some years led to severe volume decreases for installation of wind energy plants. In 2016 a five-year extension of the tax credit was granted with a phase out period designed to provide tax credit certainty while still encouraging wind energy developers to compete with brown energy on an unsubsidized basis upon completion of the phase out.

The phase out is set to 80% of the original value of the PTC for projects that begin construction in 2017 and a 20% step down in subsequent years ending in 2020. The Internal Revenue Service (IRS) has issued guidance that for the PTC to be utilized, the wind energy plant must start construction to qualify for the PTC in a given year and must be fully built and interconnect in four years. In order to qualify for the PTC, the wind energy plant must spend 5% of the total construction budget or demonstrate continuous construction over the 4-year period. Most developers opt for the former, as demonstrating continuous construction can be difficult and expensive.[37]

[37] (AWEA, 2018)

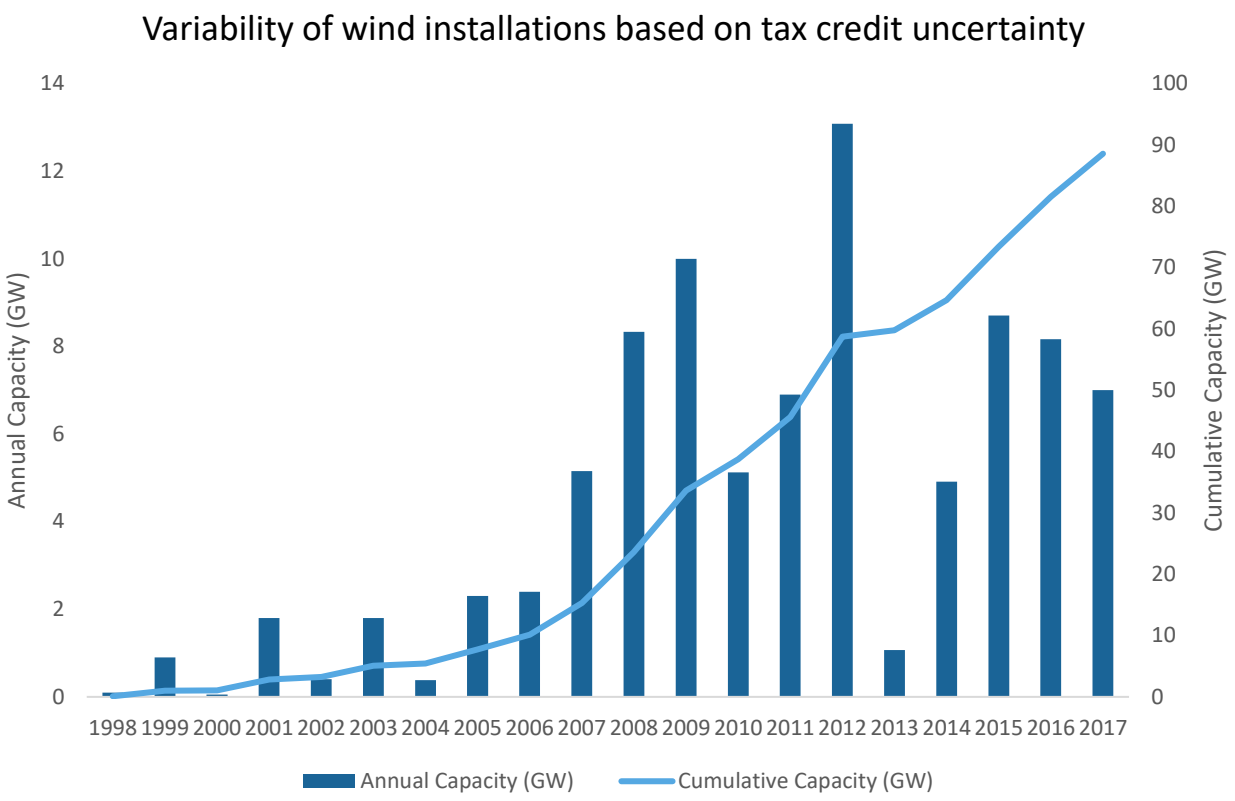

Figure 18: Variability of wind installations based on tax credit uncertainty
Source: AWEA, 2018

6.2.1.2 Major Players

Google continues to lead the market with over a GW of renewable energy CPPA. They now claim to be 100% powered by renewable energy, with 95% coming from wind energy. Fifteen technology companies account for approximately 70% of all CPPA, as the need for manufacturing and data centres leads to high energy consumption. See figure 15 for an overview of wind corporate offtakers.

6.2.1.3 Terms and Pricing of CPPAs

The length of PPAs has been shortening as of late, with the average length between 10 and 15 years in deregulated wholesale and retail markets, whereas three to five years ago CPPA were typically in the 20-25 years length. In regulated markets, the length is between 12 and 15 years and are more dependent on technology.[38]

There are a few reasons why CPPA's are shortening:

1) Credit Risk: signing a long term 20-year PPA with an investment grade utility is considered lower risk by financing institutions because not only are they stable, but energy is their core business. Signing a long term PPA with a corporate, even if it is investment grade, may be considered higher risk. If the PPA is for a specific data center, there is a possibility that the data center may not be there in 15 years due factors outside of the energy business.
2) Financing terms: Lenders want to see a tail between the PPA and the term debt. Term debt tenors have decreased due to lower capital costs and low interest rates, so the PPA has been able to shorten accordingly. Interest rates are rising but capital costs continue to decrease, so this trend should still hold true.

[38] (Interview, 2018)

3) Contract Risk for the Corporate: While signing a 15-20-year PPA will mitigate against future energy price increase or volatility, it is still longer than most (if not all) supply agreements signed by corporates. There is a possibility that in the latter stages of the PPA, the PPA pricing is out of market, and the corporate is tied to a contract that is costing them money. Signing a 10-year PPA still gives them the pricing stability they are looking for and also sheds some of the long-term contract risk.

Pricing of C&I PPAs very greatly based on the market and technology. Metro areas with high demand (California, Boston & New York) have higher PPA prices, often in the USD60-100 / MWh range. Rural areas with high wind resource (Texas, Oklahoma) often are in the USD20-40 / MWh price range. [39]

6.2.1.4 Future Outlook for CPPAs

The outlook for wind PPA demand among corporates remains strong. The phase out of the Production Tax Credit will decrease the amount of wind installed after 2022, however, evolving regulations from utilities and regulatory bodies will encourage CPPAs through more transparent and valuable EAC programs. The tenor of C&I PPAs is expected to continue to shorten, allowing corporates to reduce long-term contract risk while still providing short-term price certainty and a hedge against rising natural gas prices. Some large corporate offtakers are lobbying for more firm "shaped" PPAs to account for resource variability and a more transparent and ubiquitous commoditization of renewable energy procurement. These factors, combined with the strengthening demand for zero carbon footprint from shareholders and executives, are expected to drive demand for CPPA over the next 5 years.

6.2.2 Corporate PPA Usage in Solar, USA

6.2.2.1 Overview and Trends

Solar energy account for 5% of the total renewable energy CPPAs, solar is often viewed as the most flexible form or renewable energy, allowing companies to develop large scale projects remotely or place solar panels on their roof, directly offsetting consumption.

Behind-the-meter solar energy has been growing in demand over the past few years as solar energy prices continue to drop. CPPAs have allowed many mid to small size business to utilize solar energy without the responsibility of the capital costs or the need monetize the tax credits (see below). These CPPA are often structured differently than utility scale wind energy and solar energy PPAs, where the solar energy plant is constructed onsite, often on the roof or land of the corporates' premises. A third party PPA provider will provide the capital for the solar energy plant and lease the space from the company where the solar energy plant is to be installed. The solar energy directly offsets the company's energy consumption, and any energy not used will be purchased from the utility. Often the solar energy production can offset 100% of the company's energy cost, however, the company will pay the PPA provider for every kWh used or sent back into the grid at a predetermined price, often at a set discount to utility rates. Through this mechanism, the PPA provider will recoup the capital cost of the solar energy plant and generate a return.

The federal solar energy tax credit has gone through the same expiration/extension cycle as wind tax credits, with a 5-year extension signed in 2016. The solar energy tax credit is utilized differently, and while solar energy plant owners may choose the PTC, most opt for the Solar Investment Tax Credit due to the high capital cost to production ratio. The Solar Investment Tac Credit is a federal tax credit equal to 30% of the total capital cost and can be taken in a single year, whereas the PTC is taken over a 10-year period. The PTC is being phased down, with a value of 26% in 2020, 22% in 2021 and then will be at 10% in perpetuity starting in 2022.

[39] (Interview, 2018)

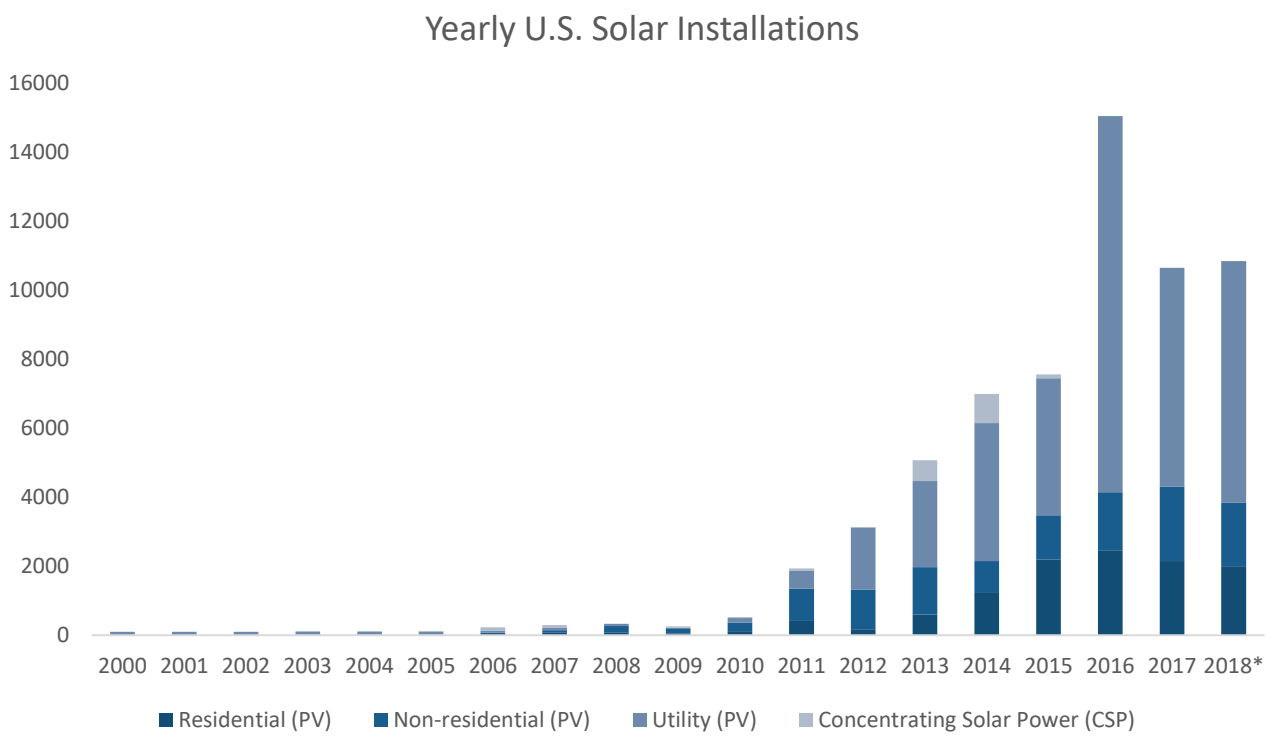

Figure 19: Graph depicting the variability of solar installations based on tax credit uncertainty
Source: SEIA/Wood Mackenzie Power & Renewables U.S. Solar Market Insight

6.2.2.2 Major Players

Retail stores have led the way for solar energy adoption, with Walmart and Target as the top solar energy purchasers. In Walmart's "Approach to Renewable Energy" report, Walmart states: "At Walmart, renewable energy is about our customers and helping them save money, so they can live better." Increasingly, procurement of solar energy is seen as a method of cost reduction as much as it is seen as a moral obligation or corporate initiative.

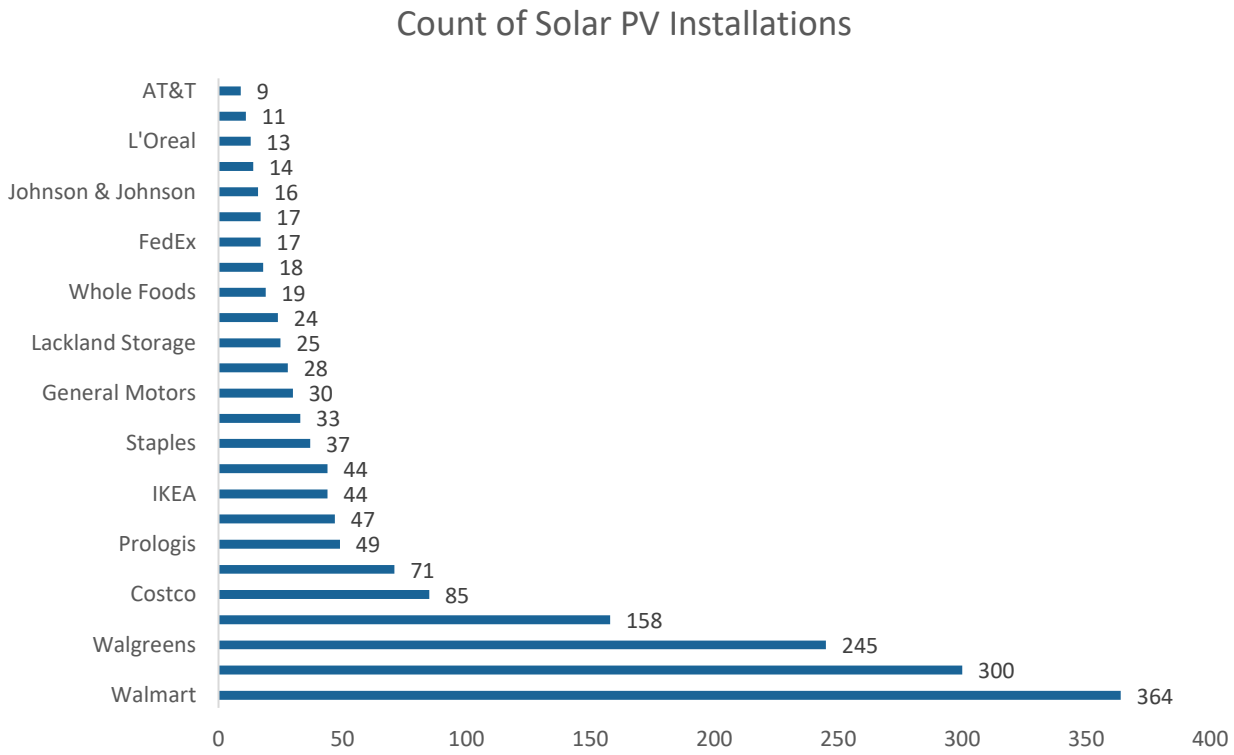

Figure 20: Solar Installations by Company, 2016

6.2.2.3 Terms and Pricing of CPPAs

Terms for solar energy PPAs are similar to those of wind energy PPAs, with the contract tenor shortening into the 10-15 years range. PPA prices are on average slightly higher than for wind energy as the cost of solar energy installations remain at a slight premium to (onshore) wind energy. For private wire CPPAs, pricing is often structed as a percent savings based on utility rates, often offering a 5-10% decrease in energy costs. Terms for private wire CPPAs are still in the 20-25 years range.

6.2.2.4 Future Outlook for CPPAs

The outlook for solar energy CPPA remains bright. With a slightly longer runway for the tax credits, many financiers are shifting their focus from wind to solar energy in 2019 and 2020. This should lead to an increase in solar energy installation with corporate offtakers being a primary driver for offtake contracts. In addition, decreasing solar energy costs will lead to more companies installing solar energy plants onsite over the next few years, especially as solar energy panel tariffs expire.

6.3 Corporate PPAs in Selected Regions/Countries

This section will provide insights on other renewable energy markets of interest with regards to CPPAs.

6.3.1 Corporate PPA Usage in Latin America

6.3.1.1 Overview and Trends

The volume of CPPAs in Latin America is expanding as a result of corporate demand for sustainable and economical energy commitments and because of new regulatory changes. Latin American countries are still in the early stages of the development of CPPAs, and the trend towards deregulation of electricity markets in countries such as Brazil, Chile, Colombia, Mexico, Peru, and Argentina, are encouraging the use of CPPAs in the region.

The 2016 Energy Reform in Mexico deregulated its electricity market that had state-owned utility company CFE controlling the rights to all transmission and distribution of electricity in Mexico. The reform triggered competition and an increase in the execution of CPPAs. In November 2018, ENGIE signed a 15-year CPPA in Mexico to deliver power to steel producer, Gerdau. The 130 MW solar plant is in Northern Mexico and will supply Gerdau with 100% clean energy for its industrial processes. Furthermore, a 35.4 MW solar project in Durango was completed in September 2018. The project will sell electricity to Mexico's leading pharmaceutical chain, Farmacias del Ahorro, under a long-term CPPA. Lastly, Bimbo Group, a multinational bakery product manufacturing company, has indicated that it will cover its electricity consumption with renewable energy and that CPPAs are one of the main ways of achieving this goal.

In Brazil, consumers with loads of 3 MW can execute a CPPA, and the government intends to pass a bill that allows buyers to enter a CPPA contract with loads as low as 300kW.

Due to excessive supply and historical low prices of electricity in Chile, companies that were under regulated tariffs started negotiating directly with the generators, thus increasing the usage of CPPAs across Chilean markets.

Colombian government arranged a policy that awards long-term PPAs to generators that achieve high levels of environmental benefits through their energy projects.

The Argentine government have introduced new regulations that aims to have, by 2025, 20% of the national electric energy consumption coming from renewable energy. The current number is below 2%, therefore it is expected that the required investments will provoke a future CPPA market in Argentina.[40]

6.3.2 Corporate PPA Usage in Australia

6.3.2.1 Overview and Trends

The Australian renewable energy market is having quite a slow start compared to other markets such as the US and some of the European growth markets. Currently, 46% of Australian businesses are using renewable energy, however for those users about two-thirds use only 10% or less.[41] There seems to be confusion with regards to upsides/downsides of using renewable energy. In 2017 the Australian Renewable Energy Agency surveyed more than 90 large Australian energy buyers on their reasons for switching to RE. The three most nominated drivers were: Reducing costs, reducing the risk of volatile prices and improving their social license. At the same time, the most nominated driver for not using renewable energy was the higher cost.

Looking at some of the larger CPPA contracts concluded in Australia, approximately 54% of them are based on solar energy, while 9% is a mix of wind and solar energy, and the remainder being wind energy. Since 2016, CPPAs have supported projects with a combined capacity of almost 3,200MW. Among some of the largest off takers, there are the Commonwealth Bank of Australia, BlueScope Steel and several universities including University of New South Wales and University of Queensland.[42]

[40] (Norton Rose Fulbright, 2017)
[41] (ARENA, 2017)
[42] (Energetics, 2018)

The Australian version of EACs are currently divided into Small-scale Generation Certificates and Large-Scale Generation Certificates that can be obtained by a power station producing renewable energy and then sold or transferred to companies with liabilities under the renewable energy target with no government-imposed floor price.[43] It is anticipated that the Generation Certificate cap is met by 2020 and thus the value of these certificates will flatten and decrease out to 2030. However, they are expected to be somewhat replaced by the Emission Intensity Scheme – a scheme providing certificates to renewable generators and obliging CO_2 intense generators to buy additional certificates.

6.3.2.2 Major Players in CPPA Market

Commonwealth Bank of Australia became the first Australian company to join RE100. The bank commits to sourcing 100% renewable energy globally by 2030 and the bank is already on track with the CPPA concluded with a 270MW wind plant in New South Wales.[44]

BlueScope Steel recently signed the largest corporate solar offtake agreement in Australia. A 7-year PPA with ESCO Pacific's 175 MW Finley solar plant. BlueScope has contracted for 66% of the output including the LCG's.[45]

Apart from these recent large CPPA deals, Australia is also observing another interesting trend; several deals were signed with the off taker being a so-called "Buying Group" rather than a single company.

For example, Coca-Cola, ANZ, Monash University, Melbourne University and Telstra combined their needs for renewable energy in the consortium Telstra Club 1. With the scale obtained by joining a group, the companies can lower their individual transaction costs and furthermore increase their bargaining power and secure a lower price.

Hence, buyers' groups can be beneficial not only for smaller players, but also larger ones as seen in the Telstra group. Right now, there is a growing number of offers in the market for loads of 5-50GW per year.[46]

[43] (Autralian Government: Clean Energy Regulator, 2018)
[44] (The Climate Group, 2018)
[45] (ESCO Pacific, 2018)
[46] (Energetics & Norton Rose Fulbright, 2018)

6.3.2.3 Terms and Pricing for CPPAs

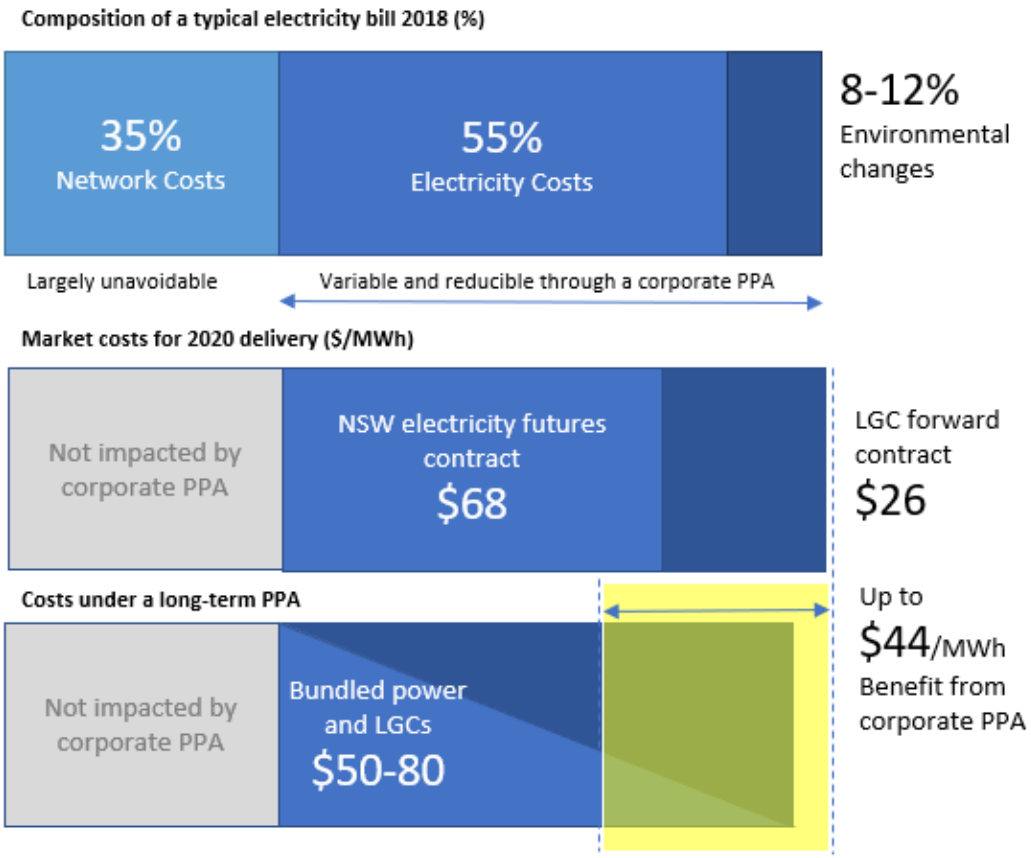

Figure 21: Potential savings from a CPPA compared to futures and forward contract market prices
Source: Energetics & Norton Rose Fulbright, 2018

According to the figure above, a CPPA can give the offtaker savings of up to USD44 per MWh. One of the biggest challenges for renewable energy developers have been the short tenor of the PPAs. Although the contracts have been extended from a typical length of 5 years, before the Renewable Energy Target to a length of 10-12 years now, it remains a challenge for renewable energy developers to achieve reasonable financing terms.

In terms of pricing, it is most common to have a fixed price with inflation indexation against the consumer price index. However, there is a trend towards more flexibility.[47]

6.3.2.4 Future Outlook for CPPAs

There are several reasons to believe that CPPAs has strong potential in Australia.5 With regards to legislation, the Renewable Energy Target requires that at least 20% of Australia's energy consumption in 2020 must come from renewable sources. And while the cost of renewable energy is decreasing, it is noticeable the increasing costs of energy from customary sources both in Australia and internationally.[48]

[47] (World Business Council for Sustainable Development, 2019)
[48] (Bird & Bird LLP, 2018)

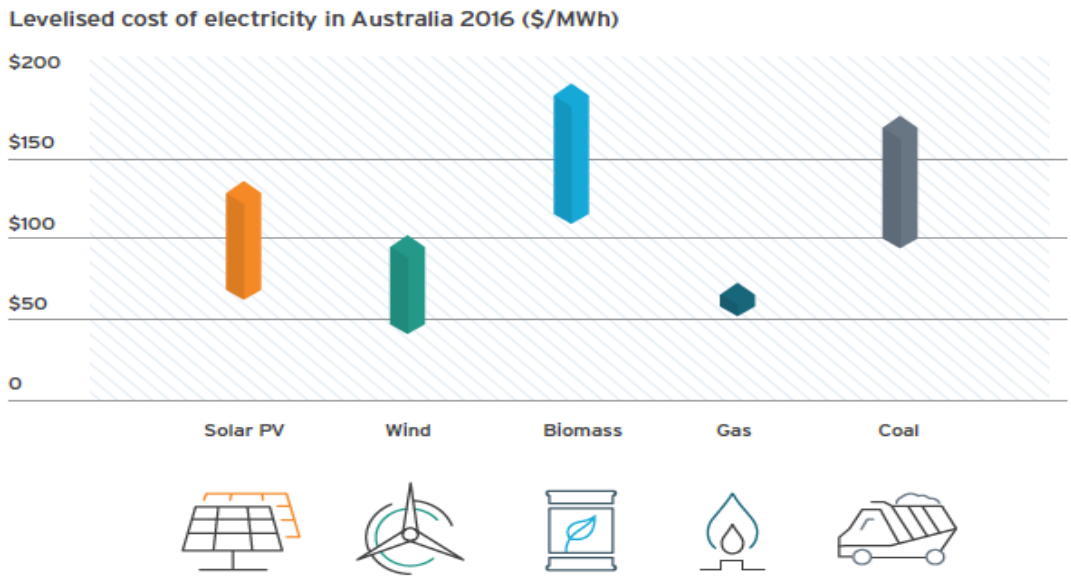

Figure 22: Levelized Cost of Electricity in Australia
Source: ARENA, 2017

The challenge of the rather short PPA tenors, leaves a gap in the market that could potentially be filled by large corporate off takers.[49]

Furthermore, there is a trend in Australia where the market is moving from a quite centralized market dominated by large utilities towards more local level production and consumption.

Looking towards the consumers, there seems to be a large interest in companies' using renewable energy. Eight out of ten Australian consumers believe big businesses should be using more renewable energy and more than 75% would choose a product or service made from RE over a comparable product not using RE.[50]

6.3.3 Corporate PPA Usage in Asia

6.3.3.1 Overview and Trends

In general, the Asian region is very fragmented, and the trends depend very much on the jurisdiction. In many Asian countries the regulation is not clear, when it comes to the use of CPPA.

For example, in Vietnam, the transmission grid is controlled by Vietnam Electricity (EVN) a state-owned power company and they do not allow companies, who enter a PPA to use their transmission grid. Hence, CPPAs are simply not an option for large scale renewable energy projects.

The countries with most CPPA activity within renewable energy are Thailand, Singapore, Malaysia, and Taiwan. China is seeing growing activity but remains a very closed market and most companies dealing here are Chinese.

So far, private wire CPPAs have mainly been seen in Asia. Most of the projects with a CPPA seems to be small in scale, and many are located directly in connection with the facility of the corporate offtaker.

Again, the subsidy systems differ a lot between jurisdictions and the mechanisms of power exchange or free trade are still a policy to be implemented. As an example, in Taiwan, the new Electricity Law allows consumers to buy electricity directly from producers including renewables. But most producers prefer to sell all power to government-controlled

[49] (DLA Piper, 2016)
[50] (ARENA, 2017)

utility company with fixed FiT. Hence, there is no strong incentive in place to attract consumers to buy power from producers, so far.

6.3.3.2 Major Players

The offtakers are typically large multinational companies, many of them members of RE100 – so that is for example Microsoft, Apple, Facebook, Coca Cola (very involved in CPPAs) and several large banks. When it comes to developers, activity comes mostly from regional players such as Vena Energy, CleanTech Solar, Symbio Energy and Sunseap Group.

6.3.3.3 Terms and Pricing of CPPAs

The contracts for CPPAs differs greatly across countries, but within each jurisdiction it would probably be one of the easier documents to standardize. The tenor of the contracts differs, but ideally it is longer than 10 years. However, it depends on supply and demand of respectively RE projects and corporates interested in CPPAs and the bargaining power of the individual parties; overall the duration seems to be getting shorter.

Whether CPPAs increase bankability depend on the market. If you are dealing in a market where you are mainly selling energy to government/or partly government owned utilities that do not have good credit-ratings, a CPPA might be a way to improve bankability.

Leading legal advisors would be Watson Farley, Baker McKenzie, Hogan Lowells and local law firms such as VILAF.

6.3.3.4 Future Outlook for CPPAs

According to IRENA, the outlook for renewable energy in Asia will show an explosive growth that could also give rise to more activity within CPPA.[51]

		ASEAN	Unit	2014	Reference Case 2025	Remap 2025
Energy Production and Capacity	Power Sector	**Total Installed Power Generation Capacity**	GW	195	387	422
		Renewable capacity	GW	51	124	180
		Hydropower (excluding pumped hydro)	GW	39	79	82
		Wind	GW	1	6	12
		Biofuels (solid, liquid, gaseous)	GW	6	13	18
		Solar PV	GW	2	13	55
		CSP	GW	0	0	0
		Geothermal	GW	3	10	11
		Marine, other	GW	0	3	3
		Non-renewable capacity	GW	144	263	242
		Total Electricity Generation	TWh	856	1656	1674
		Renewable capacity	TWh	173	459	580
		Hydropower (excluding pumped hydro)	TWh	129	289	303
		Wind	TWh	1	24	40
		Biofuels (solid, liquid, gaseous)	TWh	22	54	81
		Solar PV	TWh	2	19	81
		CSP	TWh	0	0	0
		Geothermal	TWh	20	59	67
		Marine, other	TWh	0	9	9
		Non-renewable capacity	TWh	683	1202	1094

Figure 23: Total Power Capacity and Electricity Generation divided by energy technology
Source: IRENA, 2016

[51] (IRENA, 2016)

Hopefully, the legislation on CPPA will soon be updated to include clear rules on the use of CPPA as a large demand from multinational companies (many members of RE100) in Asia for CPPA is detected.
Corporate PPA

7 Corporate PPA Usage in Denmark

The Danish electricity market is known for its high proportion of RE sources. Most RE is generated from wind, with a smaller contribution from solar, hydro, biofuels and other sources. Wood, straw, biogas and waste are renewable feedstock increasingly used by the utilities as base load contribution.[52]

Due to the ambition indicated in the 2018 Energy Agreement, to achieve 55% of renewable energy share by 2030, a complete phase-out of coal by 2030, and a fossil fuel free energy supply by 2050, the role of coal in the electricity production and over time also natural gas market will decrease rapidly. For the past few decades, the coal contribution to the electricity output has been decreasing at an average pace of almost 7% per year. On the other hand, the renewable energy sources share on the electricity market has been at constant growth, averaging over 12% in each year.[53]

Specifically, the renewable energy share growth can be attributed to wind energy. Currently, energy derived from wind accounts for around 47% of total gross electricity consumption in Denmark, and it is expected to reach around 92% by 2040. The current wind energy capacity of 5.5 GW is expected to increase to approximately 9.8 GW in 2030, reaching 13 GW in 2040.[54]

According to the DEA, in 2018, total gross electricity consumption in Denmark amounted to 32,920 GWh, and this number is expected to grow to 56,993 GWh by 2040 – a percentage growth of 73%. While the growth in traditional consumption is modest, the growth can be attributed to hyperscale data centres, which will increase electricity demand by 22% in 2040. Furthermore, electricity demand by heat pumps is expected to increase, primarily due to the government's tax reliefs and technological advancements. Electrification of the transport sector is expected to gain momentum during the second half of the period, primarily driven by technological advancements

The figure below serves to provide an overview of the flows and the stakeholders involved in the Danish electricity market.

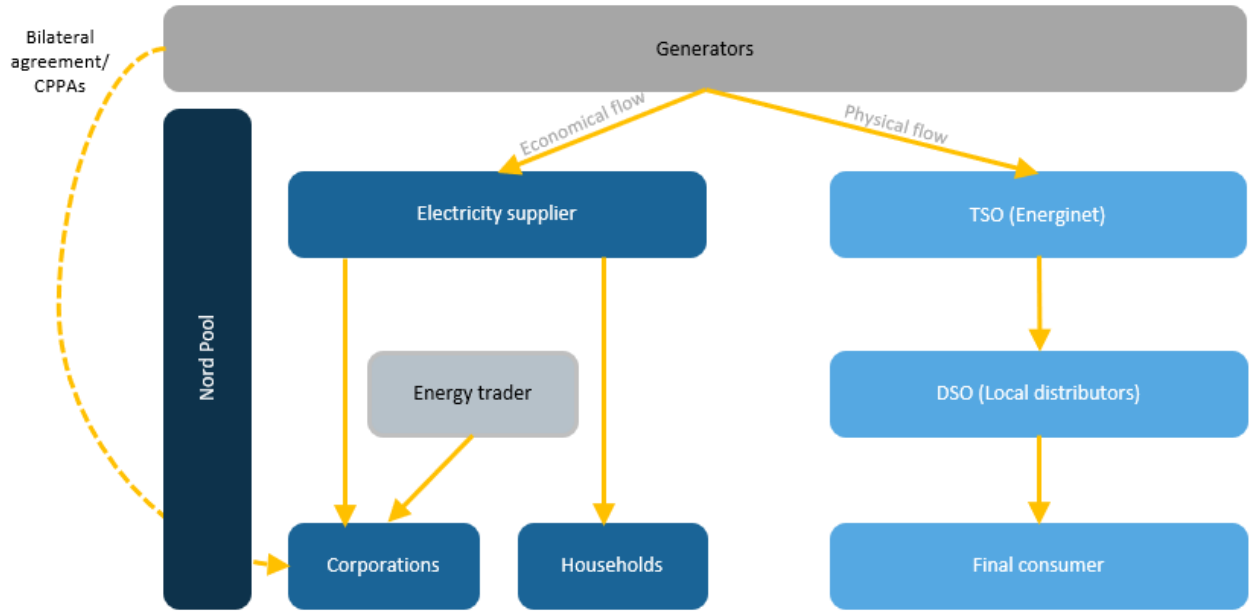

Figure 24: Illustration of the physical and economic supply chain in the Danish electricity market

[52] (Energinet, 2017)
[53] (Danish Energy Agency, 2017)
[54] (Danish Energy Agency, 2018)

As of 2018, there are 16 ready state central power plants in Denmark. Most of the plants are owned by Ørsted A/S (the incumbent national power generation company, listed on Copenhagen Stock Exchange) or the local authorities. In terms of ownership of wind and solar assets, the landscape is scattered. There are some big players in the market with many renewable assets in their portfolio, however there are also many smaller independent owners.

Some of the bigger players in the market include Ørsted with a total capacity of 941.8 MW and Vattenfall AB (the Swedish state-owned utility) with a total capacity of 965.4 MW, combined constituting approximately 35% of the total wind capacity in Denmark.

The production of RE from wind and solar assets and solar assets naturally depends on weather conditions, and thus the exact production output from the installed capacity varies throughout the day, month and year. Generally, the wind speed is lower at night time and higher during the daytime, which matches electricity consumption patterns well, nonetheless there is still too much production at night time leading to unutilized electricity. The same applies to seasonality of production, seeing as wind production is higher during wintertime and lower during summertime.[55]

When it comes to the physical flow of electricity, both the transmission system operator (TSO) and the distribution system operators (DSO's) are not subject to competition. The transmission lines in Denmark are owned, operated and developed by the transmission system operator (TSO), Energinet. Energinet is an independent public enterprise owned by the Danish Ministry of Climate and Energy. All DSO's are holding natural monopolies within their area, and they are heavily regulated and supervised by the authorities.[56]

In terms of the economic flow, the electricity suppliers are the main players. Since 2003, the market for electricity supply has been one of free competition. In 2016, a new market design was introduced, deregulating the consumer prices further and thus stimulating competition between the suppliers.
The electricity suppliers buy electricity through PPAs or through Nord Pool and sell the electricity on to the ultimate consumers – they are also responsible for billing the consumers.

Since the market for electricity was liberalized in 2003, energy traders have been critical to the energy market. The demand for the services offered by the energy traders has increased throughput the years, leading to a growth in the market for energy trading. Major utilities and energy groups across Europe are increasingly involved in the trading of electricity and have been very active in the Scandinavian market as well. Large Danish energy traders such as Danske Commodities (acquired by Equinor AS in 2019) and NEAS (now part of Centrica Plc) have led trading in the Danish market together with regional utilities like Energi Danmark, the European market for energy trading has become more integrated in recent years.

Looking at the upstream trading for an electricity supplier there are two ways for them to procure electricity. They can either buy electricity through Nord Pool or by securing bilateral agreements with power generators or energy traders, however it is worth noting that 75% of the electricity in the Nordics is traded through Nord Pool.[57] Nord Pool is the electricity exchange of the Nordic and Baltic countries. Since the transmission grids of these countries are all connected, the electricity can be traded across all countries. The bilateral agreements between power generators or energy traders and electricity suppliers can be structured in many ways both in terms of price and risk allocation. Some of these agreements would be recognized as utility PPAs.

7.1 Supporting Renewable Energy

To support the development of renewable energy, support is given to different types of renewable energy. DEA develops the framework for support schemes.

[55] (Danish Wind Industry Association , 2001)
[56] (Forsyningstilsynet, 2019)
[57] (Forsyningstilsynet, 2019)

So far, the subsidies for renewable energy have been given either in the form of a price supplement, a fixed settlement price, a contract for differences, a fixed yearly payment or construction aid.[58]

- The price supplement is a fixed amount given as an addition to the market price. This support can be awarded with or without an upper limit, whereby the price supplement decreases if the market price reaches a predetermined level and completely lapses if the upper limit is reached.

- With a fixed settlement price, the support varies with the market price, however the price for the producer remains the same. It is calculated by subtracting the electricity spot price from a fixed settlement price.

- For auctioned offshore wind turbines, the support is based on a "contract for differences" structure. That means that the wind generators are to sell the electricity on the market themselves. The subsidy is calculated as the difference between the spot market price and the offered price.

- The fixed yearly payment is given as a fixed amount every year.

- The support for construction will typically cover a given percentage of the construction costs.

DEA has made a calculation of the current support for electricity production from various RE technologies. The calculation describes the differences in real support per kWh during the lifetime of each technology for systems installed before February 2018.

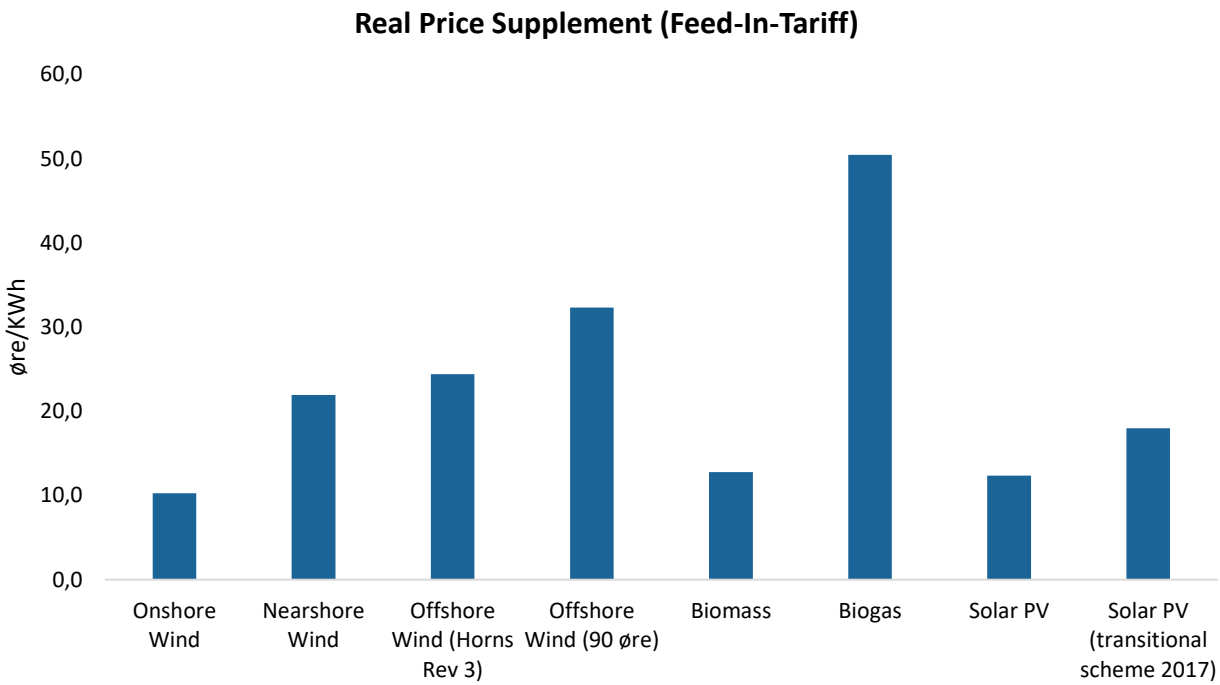

Figure 25: Real price supplement added to spot price as a feed-in-tariff, broken down by technology
Source: Danish Energy Agency, 2017

The current subsidy schemes for onshore wind expired in February of 2018, and later, in June, a new energy agreement for 2020-2024 was concluded as a broad political agreement.

With the Energy Agreement, a total of 4.2 billion DKK (2018 prices) will be allocated for technology-neutral procurement of solar PV, onshore wind, offshore wind near coasts, wave power, and hydroelectric power in the period 2020-2024.

[58] (Danish Energy Agency, 2018)

The energy agreement states that in the future subsidies will be subject to price ceilings. Subsidies will also be subject to competition in open tenders where RE technologies will compete to deliver the cheapest possible renewable energy. Subsidies within this framework may also be granted to new electricity production based on biomass and biogas, given that they can compete with the other RE technologies.

Further examination will be required to determine the feasibility of a suitable and legally sound model, in which bidders can submit offers based on a model with a fixed price subsidy as well as a model with contract for difference (CfD). If not possible, the parties will assess the future RE subsidy model after the completion of the technology-neutral tender in 2018.

The results of the tenders will serve as a ceiling for subsidies for new electricity production from biomass- and biogas-based combined heat and power plants; these subsidies will be fixed for the first five years of the subsidy period and subsequently adjusted according to the results of the latest technology-neutral tender.

Furthermore, the new energy agreement is promoting the use of offshore wind based on the expectation that offshore wind will be able to produce electricity on market conditions without subsidies within a few years. The parties agree on the procurement of a new offshore wind farm with a capacity of approximately 800 MW, with planned grid connection in 2024-2027. In addition to the procurement of the biggest offshore wind farm in Danish history in 2019-2020, the parties will establish two additional offshore wind farms by 2030.

At the same time, the parties have agreed to significantly reduce the number of onshore wind turbines during the agreement period and in subsequent years, while gradually intensifying the prioritisation of offshore wind production, based on an expectation that prices and technological advances will support this shift.[59]

7.2 Certificates of Origin

As a supplement to subsidies, Energinet issues Certificates of Origin (a type of EAC) which guarantee the source and method of production of a unit of energy. For every MWh of electricity produced by renewable assets one certificate of origin is issued, hereby representing the volume of green electricity produced.

The certificates serve to promote the use of renewable energy sources, by providing additional incentives for the usage of renewable energy. The Certificates of Origin can be sold in the marketplace, and hence they provide extra income for the RE generator which makes RE more attractive and can help finance, for example, the construction of the wind turbine or the ongoing operation.

The certificates are typically purchased by electricity suppliers, who can then choose to keep them or resell them to corporate consumers looking to improve their environmental standing. Only the party in possession of the certificate can use it as a proof for buying RE.

For increased transparency to the end-users it has been politically decided that all electricity suppliers should publish a declaration of the electricity sold showing the electricity suppliers that have voluntarily chosen to purchase Certificates of Origin. This allows consumers, through their choice of electricity supplier, to influence their own CO_2 emission. It gives consumers an opportunity to choose an electricity supplier that supports the expansion and maintenance of renewable energy.[60]

Corporate consumers can choose to buy Certificates of Origin directly from electricity traders/suppliers. Most traders/suppliers specialised in providing energy solutions to corporates will have some type of “green deal” that involves Certificates of Origin.

For example, with Energi Danmark corporates can purchase RE originating from both wind turbines and hydro power plants. A company can choose to procure electricity from a specific named turbine (less than two years old), otherwise

[59] (Energi-, Forsynings- og Klimaministeriet, 2018)
[60] (Det Økologiske Råd, 2019)

one can purchase electricity from a specific named turbine (older than two years) or from an unspecified turbine. With hydro power, companies can choose to procure power from a named facility or from an unnamed facility. All hydro power is delivered by Swedish, Norwegian and Finnish hydro power plants with whom Energi Danmark has PPAs. According to Energi Danmark, there are branding benefits of being able to name the wind turbine or hydro power plant, and this is documented by buying Certificates of Origin. In addition, Energi Danmark will issue a certificate of their own. If a company buys enough Certificates of Origin to cover their consumption, they can brand themselves as being CO_2 neutral.

Energi Danmark is not the only electricity supplier offering sustainable solutions on electricity. For example, Aura Energy also has the option to buy electricity from Danish wind turbines for an extra charge, while Ørsted uses their Danish Offshore wind farms as a significate component in their branding strategy. In most cases, the documentation is done through acquiring Certificates of Origin.

Although this system of using Certificates of Origin to promote the use of green power may seem rather intuitive, there are various issues associated with the current use of the certificates.

Firstly, the additionality of using Certificates of Origin is generally low. In their report on Corporate sourcing of Renewables, IRENA rates unbundled EAC's to be very low and uncertain in terms of additionality. [61] Per definition, Certificates of Origin can only be sold by (and thus benefit) owners of wind turbines/solar panels that are already commissioned. Thus, the argument of additionality is weakened in this case as the certificates are not actively part of securing new RE capacity. Today you would be able to buy Certificates of Origin from a 10 years old wind turbine supported by government subsidies, where is the additionality in that?

Secondly, the price of the certificates is often quite low, due a lack of demand, thus decreasing the already modest economic profit for the RE owners.

Lastly, the system is generally lacking transparency – both for the corporates using Certificates of Origin and for the end-consumers influenced by the branding of these corporates.

The corporates buying Certificates of Origin through their electricity supplier may not be fully aware of the actual influence of the certificates in terms of additionality. Furthermore, looking across the electricity suppliers offering green electricity, the underlined advantages for the corporate customer (the selling argument of the certificates) seems to be advantages in CSR policies and branding. With the current regulation, a company can claim to be CO_2 neutral if they buy Certificates of Origin corresponding to their electricity consumption. Moreover, a corporate buying certificates from a named turbine, would use this in their branding saying that they are "buying" electricity from that specific turbine. Although this is not incorrect, it can be misleading in the sense that these branding statements would (in the eyes of the consumer) falsely imply a high additionality.

Favouring CPPAs, the Certificates of Origin included in a CPPA contract would have a high element of additionality. However, as of right now you would not be able to tell the difference as they are labelled the same way as certificates from older RE plants. Hence it can be difficult for both corporates and consumers to navigate in the landscape of renewables sourcing.

Based on the above issues one could argue that a new and more transparent labelling system for corporate sourcing is needed. A labelling system differentiating/classifying certificates based on additionality would make the system more transparent at the same time encouraging corporates to engage in green sourcing strategies with higher additionality.

[61] (IRENA, 2018)

8 Legal Considerations for Corporate PPAs

The usage of corporate PPAs is highly influenced by the regulatory environment and the subsidy schemes of individual countries and within the EU member countries applicable EU policies. Referring to section 7.1 on supporting RE in Denmark, this section revolves around the legal and contractual considerations.

Like planning and grid connection are legislated nationally, so are the laws applying to CPPA contracts unlike the regulation of EU members' energy markets that are governed overall by EU regulations, in line with the structures implemented in the 1990s for regulated separation of generation, transmission and distribution.

Notwithstanding, the contractual framework for CPPAs are often "aligned" between EU member countries as it would make sense given the cross-border trading of electricity and the ability to benefit from cross-border subsidy schemes. In line with this, the EU Commission has recently proposed a requirement for member states to outline plans for PPA uptake and remove disproportionate and discriminatory procedures to PPAs in their National Energy and Climate Plans.

If implemented it would provide clarity for power generators, investors and corporate offtakers, thereby decreasing the risks associated with regulatory changes in the CPPA area.[62]

8.1 Contractual Matters

Elaborating on the PPA contract structured introduced in earlier (figure 5), these are the key components of a CPPA:

1. Tenor – When does the PPA start, how is "start date" defined and how long is the PPA?
2. Price – Is the price fixed or market-based? Inflation-linked? Are risks capped or unlimited?
3. Volume and Profile – How much of each commodity is trading hands, and when? Physically?
4. Termination Events and Payments – Just in case, what happens in case of termination?
5. GoO inclusion – How is the renewable component of the energy priced and managed?
6. Security packages – How do all stakeholders ensure that they are not left empty-handed?

Price is a key driver of any purchase decision, however the volume of power contracted and the profile in terms of tailoring volume supply to when needed are also key decisions. The obligation associated with the length of the contract (which corporations seek to match with their known financial plans and long-term outlook) is a significant concern as well. All the above-mentioned considerations are time-consuming when entering CPPA's and, for that matter, other PPAs.

Through interviews with experienced CPPA contractors, it has been noted that the negotiation of the price is, perhaps not surprisingly, the prime deciding factor when contracting. Whether it is a fixed, floor or collar pricing structure there are large number of options for variation in terms of e.g. benchmarking of the price and so on. Furthermore, the electricity market is a market of high volatility in terms of spot price and thus the timing of the contract conclusion could be critical. It is a question of finding a level where the fixed price makes sense in the long term, relative to the outlook for electricity prices and the purchasing company's risk management policies weighed against environmental policies and any acceptance of "a cost of going green".

Currently, legal practitioners are unsure whether the laws of Denmark would consider some CPPAs as financial instruments. If Danish law makers and regulators decide that CPPAs are indeed financial instruments, the laws and regulation applying to other financial instruments would become applicable to CPPAs. These extra requirements would introduce considerable financial reporting, governance and administration that would be considered a barrier in the medium term for the growth of CPPAs. However, while this may be considered by national and EU authorities, it remains in its early days and it is unclear whether it will be resolved in the foreseeable future. Therefore, it has not been considered as part of the Drivers and Barriers discussion below.

[62] (BNEF, 2018)

In terms of Termination and Disruptions, the standard clause leaves the responsibility of "Disruptions due to on-site issues" with the seller and disruptions due to grid connection and other off-site issues with the buyer.

The corporate offtaker will in most cases also receive the Certificates of Origin related to the contracted production of RE from the wind or solar assets. The certificates follow the electricity and provides the buyer with an extra proof of the green sourcing as they can retire the GoO's in their name.

An important consideration for the use of CPPAs are the credit risks associated with the offtaker. The CPPA market is still novel with regards to the SME corporate segment. While the credit risks for the major corporates leading the use of CPPAs are well accepted by lenders, the lower creditworthiness associated with smaller companies reduces the prospect of financing, despite security packages associated with the assets. According to Philip Graff, partner in the law firm Bird & Bird's Denmark office, another issue revolving around CPPA contracts is the inexperience of lending community involved in the financing of RE. For CPPAs to be deemed "bankable" in project finance terms, they must meet the requirements of lenders. However, as of today the CPPAs remain relatively new to many lenders entering the sector.

To compensate for this credit issue, developers and owners of RE assets could request for corporate offtakers with weaker creditworthiness to provide collateral. However, such requests involve additional costs affecting the economics of the CPPA and tend to cool of corporate interest in the CPPA route, when deciding on their use of RE. The issue of credit risk is discussed as part of drivers and barriers of CPPAs in sections 9.1 and 9.2. From a contract perspective, and due to the importance of financing, banks typically play an important role in the structuring and negotiation of CPPAs adding to the legal complexity, time and costs.

While offtakers may represent risks to the project owners and finance providers, the CPPAs are also posing risks to the offtakers themselves. Committing to buying electricity at a certain agreed price and volume for several years, larger offtakers with active energy risk management will often seek economic hedging of their forward purchases, while not being supplied the agreed physical volumes represent a critical risk that can only partly be hedged in the financial markets. Hence it is common for offtakers to have a second priority lien behind the lenders' security package allowing them to "step into" the control of the power generating asset in the case of not being supplied electricity in accordance with the contract.

9 Analysis of Drivers and Barriers Applicable to the Danish Corporate PPA Market

Various significant drivers and barriers to the global CPPA usage were identified and briefly introduced in section 5.1 and throughout section 6. In this section, these drivers and barriers are described in greater details and analysed, as they closely apply to the characteristics of the Danish market.

The table below summarises the drivers and barriers as well as their suggested implications and importance for sellers (power generators, developers and operators) and buyers (corporate electricity buyers/offtakers) including possible solutions. The analysis of these drivers and barriers applicable to the Danish market is also driving the scenario analysis in section 11.

Drivers	Significance Rating (1-5)	Seller Implications	Buyer Implications	Suggested Initiatives
Zero-subsidy Market	5	In zero-subsidy markets the bankability of projects is under pressure. Without FiT's the seller is largely exposed to price risks. A CPPA can improve the bankability of the project, but also expose the seller to offtaker credit risks.	The zero-subsidy conditions provide corporate offtakers with the opportunity engage in a new type of green sourcing strategy, while hedging the electricity price.	N/A
Green Energy Transition of Corporate Consumers	4	The green energy transition of corporates is an important element in securing a sufficient level of demand for CPPAs.	The green transition of offtakers has led to increased awareness in the market giving rise to new organizations such as RE100 ensuring extensive commitments from some of Denmark's largest corporations. Additionality has become a key word.	New labelling system for Certificates of Origin could improve transparency and raise awareness to additionality.
Syndications and Consortia	3 (have not taken place in Denmark yet)	Selling electricity to a group of corporate offtakers (consortium) under a CPPA contract, will diversify the risks related to offtaker credit ratings.	Consortia enables SMEs to enter CPPAs. Together smaller offtakers can reach the critical volume necessary for a CPPA and share the transaction costs. The downside is the complexity associated with setting up the consortium.	Publication of legal guidelines to setting up a consortium for CPPA purposes under Danish law.
Financing Mechanisms	3 (great potential if implemented)	A power purchase guarantee scheme, like the Norwegian, would significantly reduce a critical risk factor in CPPAs, namely offtaker credit risk. A project with a guarantee backed CPPA would have a lower risk and thus a lower WACC.	A power purchase guarantee scheme would enable SMEs with weaker creditworthiness to enter CPPAs, thereby increasing the demand for CPPAs and create a more efficient market.	Introduction of a Danish power purchase guarantee scheme for RE.

Barriers	Significance Rating (1-5)	Seller Implications	Buyer Implications	Suggested Initiatives
Managing Energy Costs and Risks with Energy Traders	4	Selling the electricity forward to an energy trader is less complex than entering a CPPA. However, most contracts with traders are typically only 2-3 years and rarely more than 5 years, leaving the generator with significant price risk exposure.	Large corporate buyers can lock in prices with electricity suppliers and energy traders. The downside, compared to the CPPA, however, is the low additionality as the RE aspect of these contracts is either missing or based on GoOs.	N/A
Slow Corporate Decision Process	2	When developing a RE project – time is money. Every delay in the process of reaching financial close is critical. Consequently, the prospects of spending weeks negotiating a CPPA not resulting in a contract is discouraging.	While this barrier is mainly a problem for the seller, the problem is typically based on the buyer's the lack of experience and competence in negotiating this type of contracts.	This is a learning curve issue for the buyers, which will probably diminish as CPPAs become familiar to the market.
Renewable Energy Capacity	4	Attractiveness of other neighbouring markets in terms of onshore sites may decrease developers' interest in Denmark	Limited Danish onshore capacity has hindered large industrials from securing CPPAs of larger volumes involving just one wind farm. Nevertheless, new offshore capacity has been awarded with very low subsidies making them eligible for CPPAs.	The strong offshore wind pipeline will likely reduce the impact of this barrier over time.
Less Energy Intensive Market (A Small Energy Market and the Characteristics of Danish Companies)	5	These two barriers strongly affect corporate demand for CPPAs and contribute to the low demand compared to Norway and Sweden. Hence, Danish power generators would look for foreign offtakers instead.	The small number of large energy intensive manufacturers in Denmark decrease the number of obvious candidates for CPPAs. Nonetheless, data centres are likely to change that in the future.	N/A
Lack of Standardized CPPA Contracts	3	In many cases, the power generator will come up with a first draft, as they are typically the more experienced party. The draft will be taking account of previous experiences and any financing requirements and will naturally be favour the generator.	The complexity of the negations depends on the degree of detail in the contract. The inexperienced (or foreign) offtaker may feel insecure about the terms of the contract, demanding a high degree of detail leading to higher legal costs.	A neutral market standard would simplify and speed up the CPPA process, reducing the legal and commercial costs.
Credit Risk of Corporate Offtaker	4	If the credit rating of the offtaker is not satisfactory (to banks) it will reduce the bankability of the CPPA and thus defeat the purpose.	A low credit rating will prevent many smaller companies from entering CPPAs.	A guarantee system like the Norwegian – see section 8.1.4

9.1 Drivers

Various drivers, previously identified, have helped to advance the use of CPPAs around the world. This section discusses in greater details key drivers for the growth of CPPAs in Denmark, i.e. a Zero subsidy market, Corporate green energy transition, CPPA syndications and consortia and Facilitation of guarantee mechanisms.

9.1.1 Zero-subsidy Market

Government subsidies in more mature markets are gradually removed, justified by the lower capital costs and RE pricing reaching the levelized cost of energy (LCOE) requiring new RE generation capacity to enter electricity offtake agreements on market competitive terms. As an example, in April 2017, the German Network Agency had its first round of offshore wind auction, and three out of four projects will be built subsidy-free, meaning that it had a bid price of zero cent/kWh.

This merchant pricing system for RE, e.g. CPPAs across many jurisdictions between the RE production plants and the immediate offtakers, such as electricity suppliers and traders, or the ultimate consumers, is making the RE market comparable to the broader energy markets and, not surprisingly, major traditional oil and gas groups are consolidating the RE market, e.g. Shell (wind), BP (solar) and Total (solar).

Our mapping of the global CPPA market has shown a link between subsidy schemes and CPPA activity; countries with no direct subsidies on revenues or with subsidies associated with capital costs (e.g. Norway, Sweden and the U.S. are far ahead of other markets, with direct revenue subsidies, like FiT-schemes.

A new Danish subsidy scheme is likely to increase the use of PPAs in general. Whether it will be CPPAs or the utility PPAs, concluded between a generator and an energy trader or electricity supplier, or both will depend on other factors discussed in section 10.

Throughout the years, Denmark's policies regarding subsidies for RE has been characterized by frequent changes and the lack of a stable long-term framework. Up until now, the subsidy system has been made up of approximately 35 different types of subsidies differentiating between RE technologies, with FIT being the underlying basis for the schemes.[63] The combination of the FIT system and the general insecurity resulting from the changing subsidy systems appear to have worked as a barrier to the usage of CPPAs. The FIT schemes have left generators with little incentive to pursue PPA contracts, be it Utility PPAs or CPPAs, or other types of merchant pricing, as the generators have automatically had access to attractive prices through government support.

However, with the new energy agreement of 2018 Denmark follows the recommendations of the EU Energy Commission to replicate neighbouring countries; the commission states that "marketization of measures is central to achieving a cost-effective transition to a low-emissions society in which technological opportunities are fully exploited".[64] The new energy agreement means harmonization and simplification of RE subsidies with equal treatment for different technologies, thereby ensuring that the most efficient RE technologies are promoted and prioritised, targeting the lowest possible price of RE. The Danish government intend to reduce the RE subsidies from 35 to 4-6 schemes. The first technology neutral tender took place in November 2018, and a similar tender will be conducted in 2019 followed by tenders in 2020-2024 totalling DKK 4.2 billion.[65] This system with subsidies awarded based on auctions has recently been implemented in Germany, where there has been bids of zero cent/KWh and CPPA activity is expected to grow rapidly in the coming years. Also, in Finland the government has recently proposed a similar system, which is expected to result in increased PPA activity.

[63] (The Danish Government, 2018)
[64] (State of Green, 2017)
[65] (Energi-, Forsynings- og Klimaministeriet, 2018)

With the new system and severely reduced levels of subsidies, Danish RE generators are likely to seek market-based arrangements, such as PPAs with energy traders, electricity suppliers or CPPAs to secure long-term offtake arrangements, particularly if they are to become bankable and qualify for project finance.

9.1.2 Green Energy Transition of Private and Public Sector Corporate Consumers

Businesses are not only using CPPAs for economic reasons – an increasing number of multinational corporations use CPPAs as a way of improving their green image towards customers and in general as corporate responsibility initiative. "The Paris Agreement was a bold step towards a cleaner, brighter future, and must be protected. IKEA will continue to work together with other businesses and policymakers to build a low-carbon economy, because we know that together, we can build a better future" said Lars Petersson, president of IKEA USA.

IKEA and other multinational companies' green policies have led to the creation of several proactive climate-friendly initiatives such as the RE100 and Low-Carbon USA. While these initiatives are working towards a greener world by committing to reduce carbon-emission and by interfering in policy debates, they are also creating publicity and branding for the companies involved.

Currently, there are three Danish headquartered members of RE100; Bestseller, Carlsberg and Novo Nordisk. In an interview following Climate Week NYC, Dorthe Nielsen, Senior Director of Corporate Environmental Strategy at Novo Nordisk was asked why Novo Nordisk joined RE100. "Here at Novo Nordisk, we believe that reducing our environmental impact is both our corporate responsibility and a way to mitigate long-term risk; as such, RE solutions are something that makes business sense". Novo Nordisk began their transition towards 100% RE in 2007 by buying Certificates of Origin from Ørsted's wind farm in the North Sea. In Asia, Novo Nordisk are acquiring EACs for their manufacturing plants, using Gold Power (a global organization assisting companies in their RE transition) as their provider of EACs. However, in the future Novo Nordisk will no longer rely on Certificates of Origin for their facilities in Europe, as they have recently concluded a 10-year CPPA with Vattenfall for the Kriegers Flak wind farm which will be operational from 2020. The last step for Novo Nordisk to reach their goal of 100% RE is securing RE for their US facilities, which could likely come from a CPPA seeing as Novo Nordisk is always striving for additionality.[66]

Carlsberg is also relying on Certificates of Origin for processing facilities in Western Europe. However, they have also embarked on the production of RE, having installed on-site solar panels in Dali, China, covering 20% of their electricity needs for the local brewery. Carlsberg believes their ambitious RE program will provide them with a competitive advantage and help them in becoming the preferred beer for key customers and consumers.

In the IRENA report on Corporate Sourcing of Renewables a number of surveys on RE drivers has been analysed and grouped into categories and in RE100's recent progress reports the same categories were identified. CSR and Reputation is ranked as the number 2 driver. This category relates to "mitigating reputational risks, including answering to customers and shareholders who seek more sustainable operations from companies or, in the case of shareholders, more favourable public opinion".[67]

Consumer behaviour is adding to company's drive towards using RE. According to a Nielsen (Research) survey, from the consumers' point of view 42% of Danes are willing to pay more for products and services from companies with a responsible environmental policy. Age matters as well, as millennials is the group with the highest willingness to pay more for sustainable products. In fact, 75% say they would be willing to pay extra for a product if it is produced sustainably. "Brands that establish a reputation for environmental stewardship among today's youngest consumers have an opportunity to not only grow market share but build loyalty among the power-spending Millennials of tomorrow, too" says Grace Farraj, SVP for Public Development & Sustainability, Nielsen (global market research firm).[68]

While the members of RE100 are very committed to the green transition and are fully aware of the RE sourcing options and the concept of additionality, this is most likely not the case for all companies.

[66] (RE100, 2018)
[67] (IRENA, 2018).
[68] (Nielsen, 2015)

In Denmark, there are several ways corporates can source renewable electricity. One way of sourcing RE is of course through a CPPA, on-site generation might be an option for some facilities with the right features, however most electricity suppliers also offer some kind of "green deal" whereby corporates can buy RE.

As described in section 7.2 on certificates of origin, the green deals offered by electricity traders/suppliers will often involve Certificates of Origin with a low additionality. The problem, however, is that companies and consumers have a hard time seeing through this complex certificate system. The current branding of the certificates might be considered misleading. In order to further facilitate the green transition, a new labelling system as discussed in section 7.2 could be a tool to increase transparency and make it easier for the smaller companies to choose the right sourcing option on a well-informed basis. The same goes for the end-consumers who would also benefit from this label that could be used as a simple indicator of the companies' green efforts.

9.1.3 Corporate Landscape Benefiting from Syndications and Consortia

The sophistication of the CPPA market is growing with syndication structures or consortia of corporate electricity buyers formed to enter CPPAs for larger capacity assets in the Netherlands, the U.S. and Australia, leading to greater financing and financial risk management options.

Syndication structures and consortia have the potential to be major drivers in the future growth of CPPAs as they address two important barriers to CPPA usage for small and medium-sized enterprises (SMEs), 1) reaching critical volume of CPPA contracts to make them economically viable to the sellers and 2) cost of CPPA process.

SMEs have up until now been less represented in the CPPA market as they have struggled with meeting the capacities necessary for a CPPA to pay off and the expenses of contracting. However, by forming a consortium with other corporate buyers SMEs can share risks, expenses and experience and open the possibility for buying smaller capacity sizes, while they achieve the collective goal of "Greenification".

In Europe, the most well described consortium CPPA is the "Dutch Wind Consortium" formed by Google, AkzoNobel, DSM, and Philips. The Consortium have signed long-term CPPAs of two wind plants that totalled 140 MW in capacity, enough to power approximately 140,000 households.

In Australia, Coca-Cola, ANZ, Monash University, Melbourne University and Telstra combined their needs for RE in the consortium Telstra Club 1. The group reportedly locked in a record-low price for a CPPA, for a combined contracted output of almost 1,000 GWh per year from RES Australia and Macquarie Capital's Murra Warra I Wind Farm, near Horsham in Victoria. [69]

Although both of the above consortium examples are based on large corporate buyers, a report by Energetics, an Australian consultancy firm, and Norton Rose Fulbright, the law firm, estimates that in general an energy buyer with an electricity load less than 15 GWh per year may benefit from joining a buyer's consortium as energy buyer groups are more likely to have the scale needed to reduce their individual transaction costs.

The consortium model offers a range of benefits, such as economies of scale, saving and sharing costs, portfolio diversification and risk management. The very first transaction concluded by a consortium will likely have high transaction costs, as the consortium structure adds complexity in terms of internal alignment and communication between the parties. Nevertheless, the following transactions will benefit from the experiences and standards setup for the first transaction – there is a steep learning curve. In the second transaction, the costs of, for example, legal and accounting are overhead costs that can now be shared by more players.

Furthermore, the increased bargaining power resulting from the consortium structure has allowed consortiums to reach significantly lower power prices per MWh.

[69] (Energetics & Norton Rose Fulbright, 2018)

The Business Renewables Center has done a case study on the aforementioned "Dutch Wind Consortium". Building the consortium was a long process and took almost 2 years – much longer than anticipated. For the first transaction, the development of the CPPA took 6 months, while commercial negotiations and executing the CPPA took 3 and 9 months, respectively. However, for the second CPPA deal, no time was spent building the consortium or developing the CPPA, while commercial negotiations and execution took 3 and 4 months, respectively. This example serves as proof for the steep learning curve and the transaction costs reductions that can be achieved over time.[70]

This model of using consortia or buying groups for CPPA purposes will most likely be well-suited for the Danish market. According to the IRENA report on corporate sourcing of renewables, SMEs are increasingly turning to renewables to run their operations. Hence, if Danish companies' follow the global trends of SMEs, this consortia model will be suited for the Danish market seeing as Denmark has many SMEs, for which the loads are too small for a CPPA to be feasible on individual level.

The Danish market consists mainly of smaller companies, while the number of large companies with 250+ employees is limited to approximately 800 companies.[71] Although that may sound like a lot, only a smaller part of them are within energy intensive industries where the incentive for hedging the energy price is significant. Hence, to make smaller companies interested in CPPAs, there is a need to overcome the barriers of internal resource allocation and large transaction costs (see 5.2 Barriers below).

Syndications and consortia can be part of that solution, but even though the consortium can decrease risks and capital spending, there will be several other challenges associated, not with the CPPAs, but with the consortium itself. Finding the right partner(s) that may have to share your values in terms of sustainability as well as agreeing on joint term can lead to a complex and time-consuming process. Furthermore, the consortium structure itself can be very complex and require specialized legal advice. In the case of the Dutch Wind Consortium, the partners opted for a simple unincorporated structure (unique to Holland). Once established, the consortium will need ongoing management both between consortium partners and within each firm.[72]

As with the CPPA contract, having a standardised contract or at least some standard procedures for setting up a buying group/consortium with the purpose of entering CPPAs would ease the process, making renewable energy more easily accessible to a larger part of the Danish firms, not least the SME segment, however there has been no real examples of consortia in Denmark yet and it has yet to be investigated if the Consortium model will find itself into the Danish PPA market. Perhaps one example is the collaboration between the two Novo Holdings companies, Novo Nordisk and Novozymes, that collaborated on the beforementioned CPPA for Kriegers Flak wind farm; while associated and sharing environmental values, both companies are listed and governed independently.

9.1.4 Potential for Financing Mechanisms

CPPAs, and PPAs in general, are becoming popular methods of "locking in" longer term revenues in the absence of FiT and other subsidy schemes, as an otherwise merchant pricing revenue base for RE prevents the traditional lenders from providing debt financing to RE projects, i.e. not "bankable". The revenue profile of a RE asset drives not only gross income profitability of the asset, but also the risk profile, hence impacting the costs of financing i.e. the weighted average cost of capital (WACC) and with that the levelized cost of energy (LCOE) relative to other energy sources.

In 2016, the EU under the "Intelligent Energy – Europe programme" released a report on the impact of risks in renewable energy investments and the role of smart policies. The report finds that across all EU member states, the risks induced by policy designs (subsidies) is perceived as most pressing. WACC estimations show large differences between the EU Member states; Germany has the lowest WACC of 3.5-4.5% for onshore wind projects, while Greece and Croatia show WACCs of above 11%.

[70] (Business Renewables Center, 2018)
[71] (Danmarks Statistik, 2017)
[72] (Business Renewables Center, 2018)

While there are many factors, other than support schemes, affecting the WACC of an investment in any jurisdiction, it can be difficult to prove an obvious link between the two factors, however comparing countries with a similar level of country specific risk (Denmark, Sweden and Finland), the report finds that Sweden has a significantly higher WACC. Through interviews, Swedish investors has attributed the higher investment risk (and thereby WACC) to the shortcomings of the support scheme which does not offset existing price risks.[73] As Sweden is also one of the leading countries for the use of CPPAs, there could be an indirect correlation between WACC and the use of CPPAs, as the lack of revenue-based subsidies is linked to both higher WACC and greater use of CPPAs.

Thus, if one were to estimate the effect of a CPPA on the WACC, one could argue that the CPPA in itself may not increase the WACC if the electricity price was similar to a FiT price. However, the support system leading to the use of the CPPA and/or the common CPPA risks associated with counterparty credit risks (lower credit ratings than sovereign ratings) and shorter tenors would increase the WACC.

Comparing a case where the power producer would be fully exposed to market price, with the case where a CPPA contract exists, the CPPA would lower the risk and thereby reducing the WACC relative to 100% merchant procing.. However, comparing the case of a CPPA contract to the case of a FiT, the case of the FiT would have the lower risk and thereby a lower WACC.

There are no studies addressing the direct effects of a CPPA/PPA on the costs of financing, however following the above reasoning, concluding a CPPA would, relatively speaking, mitigate the exposure to merchant pricing risks. Nonetheless, the WACC very much depends on the specific terms of the CPPA, pricing regime and duration, if the CPPA offers lower WACC than merchant pricing; e.g, the longer the duration and of the CPPA would lead to a lower WACC

While it is difficult to envisage lower counterparty risk than sovereign risk, its is nevertheless conceivable that WACC with the use of CPPA will trend lower over time as the demand for CPPAs grow and the terms and hedging mechanisms evolve and improve.

From the seller's point of view (i.e. owner and its finance providers), there will always be credit risk associated with the buyer's ability to fulfil the contract and make good on the agreed future payments. These credit and contract risks increase with the duration of the contracts. Hence, the CPPAs concluded to-date, have primarily had large corporations of high credit ratings as offtakers, while not eliminating the risk. Examples like Enron, Worldcom and Lehman Brothers bankruptcies serve as a reminder that even large companies fails.

In the electricity industry, FirstEnergy, part of the Ohio Electric Utility, has recently filed for bankruptcy. FirstEnergy is the offtaker in several PPAs with independent power producers and states that they are currently losing $58 million a year on these contracts due to falling energy prices and a decrease in electricity demand. Filing for bankruptcy gives FirstEnergy the ability to reject contracts leaving the IPPs in a very unfortunate situation.[74] The industry is currently evaluating similar potential fall outs from the Chapter 11 filing of California's and one of the U.S.'s largest electric utilities, PG&E.

[73] (Ecofys, Eclareon, Frauenhofer ISI, EPU-NTUA, LEI, TU Wien for the EU, 2016)
[74] (Norton Rose Fulbright, 2018).

In addition to recent cases, Baker & McKenzie has recently conducted a survey on CPPAs where they asked power generators to rate risks associated with synthetic/virtual CPPAs based on significance.
The results are illustrated below:

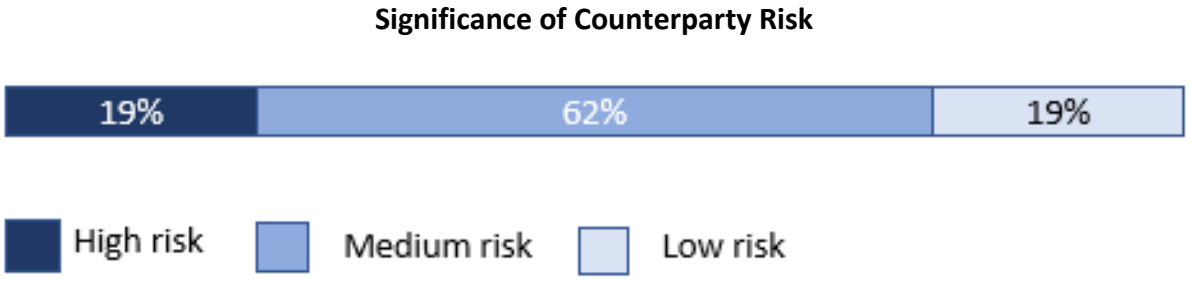

Figure 26: Significance of counterparty risk according to generators based on survey, 2018
Source: Baker & McKenzie, 2018

To further mitigate the risk related to the CPPA, government-owned and supranational financing providers, like Export Credit Agencies and the United Nations' MIGA, can act as providers of risk mitigation (MIGA for developing countries only).

In Norway, the Norwegian Guarantee Institute for Export Credits (GIEK) has led the way and been involved in several guarantee provisions that have contributed to the growth of CPPA usage. In these situations, GIEK provide guarantees to the seller of electricity protecting against the buyer's non-fulfilment of the power contract.

In October 2017, Alcoa Norway, the aluminium producer, entered a CPPA to buy energy from the wind power plants at Raudfjell and Kvitfjell consisting of 67 WTGs with a capacity of 281.4 MW. For this contract, GIEK has provided guarantees to power sellers to meet Alcoa Norway's obligations under the power agreements for an amount of EUR 55.8 million.

"Giek's power purchase guarantee scheme has enabled us to enter into a long-term power purchase contract with the highest level of security. The predictability provided by GIEK is crucial for realizing projects such as the Nordlicht project and helps us to gain access to renewable power in Norway at nearly globally competitive prices" said Kai Rune Heggland, CEO of Alcoa Norway. It is evident from this quote that such guarantees will increase the bankability projects while at the same time promoting longer durations and lowering the project WACC.

"In the future, GIEK power purchase guarantees can help create a more efficient market for long-term power contracts because more power buyers and sellers may be eligible as counterparties", said Karl Magnus Maribu, adviser to DNB Markets which has assisted Prime Capital with the establishment of the power agreements.

So far, no other country has provided a safety net like the Norwegian, while the Dutch consortia options discussed above have the additional advantage of spreading the credit risk between more than one offtaker and thereby effectively reducing the credit risk from the power generators and finance providers' perspective. With this multi-buyer approach, the power generator is not relying solely on the credit ratings of one power offtaker, but rather on a group of firms and hence, the probability of default is reduced. [75]

Based on the evidence of other markets' use of guarantee support, and considering the success of the Danish export credit agency, EKF, the development finance institution, IFO, and Danish Ship Finance in supporting Danish industries at home and abroad, it should be considered to establish a Danish guarantee mechanism for the support of the expansion of corporate use of RE, in turn supporting an important Danish job creator like the Danish wind industry. Such initiative could be a significant driver of CPPAs and qualify the SME companies with weaker creditworthiness to enter CPPAs.

[75] (BNEF, 2018)

9.2 Barriers

As with the Drivers, highlighted various barriers to the use of CPPAs for renewable energy were previously highlighted. In this section follows an elaborated discussion of the barriers that could negatively affect the growth of CPPAs in the advancement of RE in Denmark, including Existing energy trading, Corporate decision process, Limitations for capacity expansion, Small energy market, Company size barriers and Lack of standardized contracts.

9.2.1 Tradition for Managing Energy Costs and Risk with Energy Traders

Companies with large electricity consumption and correspondingly high electricity costs, have for a long time been able to manage their electricity price exposure via hedging on exchanges like Nord Pool and Nasdaq or with energy traders, like NEAS, Danske Commodities and others.

These trading companies and most of their utility-scale peers are actively involved in the PPA market for RE, which allows companies to arrange for RE as well as price hedging through their usual energy trading counterparties.

While corporates will make use of CPPAs for the various reasons previously listed (see section 9.1), it is equally likely that many companies will find it less complex, less costly and less time consuming, to continue buying electricity and hedging electricity purchases from energy traders to manage their electricity price risks and meet renewable energy goals.

9.2.2 Slow Corporate Decision Process

For a larger number of developers and generators, the project budget is very restricted and, as evidenced in interviews with independent developers, the efforts of accessing the decision process of many corporate offtakers can be extremely time consuming with a low probability of success. Once discussions have been initiated with a prospective offtaker and interest established, the negotiations will begin without necessarily having a clear timeline. Some developers have stated their preference for participating in public auctions, appreciating the equal low chance of success but preferring a process with publicly available framework and application process.

However, it should be noted that this slow decision process is likely to decrease as the corporates becomes familiar with CPPA structures and contracts. As experience increases, corporates will move further up the learning curve, and the same is likely to apply to legal advisers.

9.2.3 Limited Potential for Additional Renewable Energy Capacity

A main driver for the growth in CPPA usage in Norway, Finland and Sweden has been the vast amount of land available for additional onshore wind capacity. Most European CPPAs are based on onshore wind projects, as onshore wind is still regarded as a cheaper and less risky option compared to offshore wind. In the U.S. and Australia, C&I solar is the dominant source of CPPAs.

Other Nordic countries are benefitting from huge uninhabited areas well-suited for the construction of large onshore wind farms and hence appealing to large industrial corporations interested in CPPAs.

In contrast, Denmark's opportunity for increasing onshore wind capacity is naturally restricted by the relatively small land masses and the population density and thus the restricted local RE capacity has acted as a barrier to CPPAs in Denmark for the past decade.

The current Danish onshore wind capacity is characterized by older wind turbines primarily constructed throughout the late nineties and the beginning of the new century. Consequently, many of them are of smaller capacities and nearing their decommissioning date. Furthermore, they are often not part of a larger wind park, but rather single or small groups

of turbines, sometimes erected on private lands and thus not appealing to e.g. data centres which require much more electricity than the amount available from these smaller groups of turbines.[76]

Currently, the Danish onshore energy capacity amounts to 4,229 MW as of 2018.[77] In the Power and Gas Sector Outlook for Infrastructure Planning (2018) prepared by the DEA covering their 2040 projections, this amount is expected to stay on the approximate same level for the next 20 years. This is ratified by the Energy Agreement concluded in June 2018, indicating that the government will rely primarily on offshore wind based on the expectation that procurement of offshore wind without subsidies will be possible within the foreseeable future. Specifically, the agreement states that the parties have agreed to reduce the number of onshore wind turbines by more than half. This represents a reduction of onshore wind turbines from the current level of approximately 4,300 to a maximum of 1,850 in 2030.[78] However, as the new onshore wind turbines are based on newer technology each new turbine will on average have a capacity that is more than doubled compared to the older turbines, thereby keeping the overall onshore wind capacity stable throughout this reduction.

However, as observed with the example of Kriegers Flak, the attitude towards offshore wind is changing. The levelized cost of energy (LCOE) for offshore wind is decreasing and furthermore, the experience and expertise within the offshore wind industry is constantly growing and thus implicitly lowering the risk on offshore wind. With this noted, it is reasonable to expect that a larger share of the future CPPAs will be based on electricity from offshore wind parks. Especially seeing as the offshore wind parks are more likely to have the scale required for e.g. data centres and other large industrial offtakers, who would prefer entering one CPPA for the entire amount demanded rather than several due to the inevitable transaction costs associated with CPPAs.

Global Average Levelized Cost of Electricity from CSP, Solar PV, Onshore and Offshore Wind

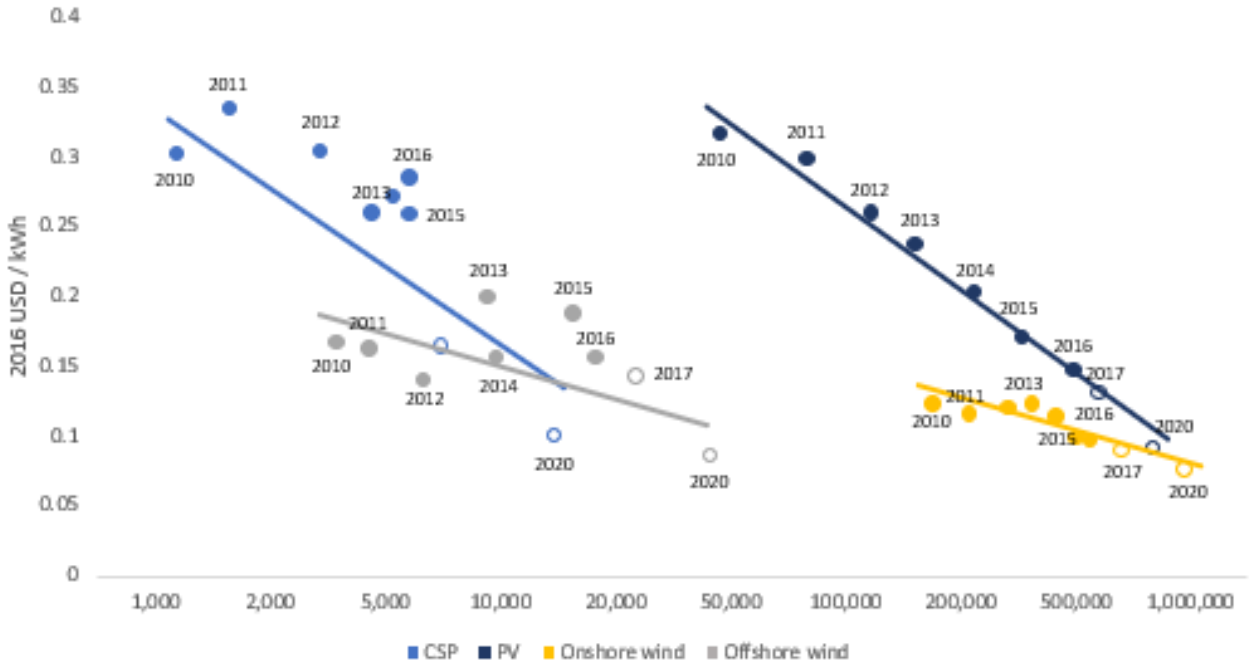

Figure 27: Learning curves for the global weighted average levelized cost of electricity from CSP, solar PV, onshore and offshore wind based on cumulative deployment, 2010-2020
Source: IRENA, 2018

As of 2018, the Danish offshore wind capacity amounts to 1,142MW. This capacity is to increase significantly within the next 20 years. According to the DEA's Power and Gas Sector Outlook for Infrastructure Planning (2018), the Danish

[76] (Danmarks Vindmølleforening, 2018)
[77] (Danish Energy Agency, 2018)
[78] (Energi-, Forsynings- og Klimaministeriet, 2018)

offshore wind capacity will have increased to 7,507 MW by 2040. These expectations are aligned with the commitments of the Energy Agreement, 2018 where the parties express a commitment to continue Denmark's strong position as a leading offshore wind nation.

The pipeline agreed to be the parties hold a new offshore wind farm with a capacity of approximately 800 MW with a planned grid connection in 2024-2027. Moreover, the parties will establish to additional offshore wind farms by 2030 of at least 800MW each and if feasible, technologically and economically, even larger. To meet these assurances, the parties agree on the launch of a large-scale screening of Danish waters in the North Sea and Baltic Sea. The screening will identify locations for up to 10 GW of offshore wind capacity, establishing an extensive selection of attractive offshore wind farm sites.

9.2.4 A Small Energy Market

In the CPPA context, the market size is defined as the market for corporate electricity consumption. The size of this market is affected by both the number of corporate consumers, the sizes of these corporations and their energy intensity, often a factor of the industry in which they operate, be it manufacturing, transportation, ICT, retail or other services.

As such, it makes sense that the more large-energy-intensive firms in the market, the larger electricity consumption in the market, and the larger the pool of potential corporate offtakers that could take interest in hedging their energy need with a CPPA. This reasoning seems to hold true for the majority of the markets that has shown CPPA activity and it is also the case for Denmark's neighbours in Norway and Sweden.

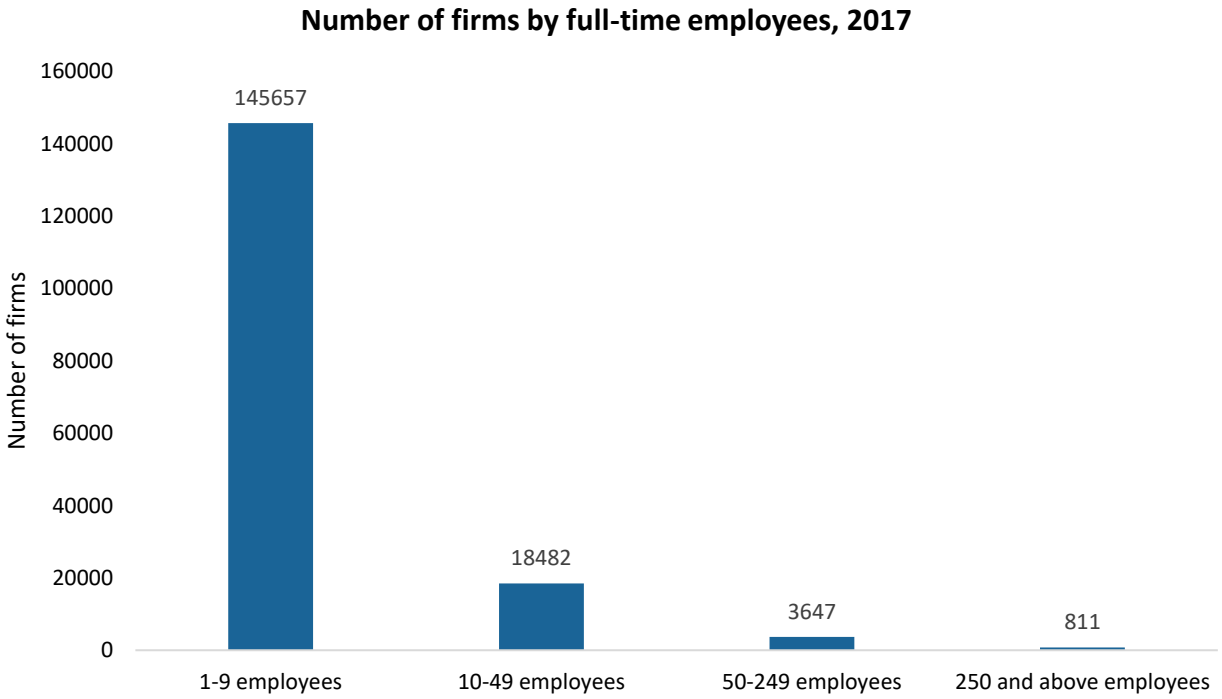

Figure 28: Number of firms in Denmark by full-time employees, 2017
Source: Statistics Denmark, 2019

The Danish market is characterized by a high number of small and medium sized firms, as shown by the figure above. For the majority of companies, the daily electricity consumption is not seen as a major environmental concern or cost factor, and thus the incentive to hedge against the energy price is limited.

For the large corporations with more than 250 employees, there could be some reasoning in hedging against the energy price and establishing a green image by securing a CPPA. However, studies have shown (not surprisingly) that the energy

intensity (measured here as the electricity share of operational expenditures) has a substantial impact on the RE sourcing, see 5.2.5 below.

9.2.5 Danish Companies are Relatively Small and Less Energy Intensive

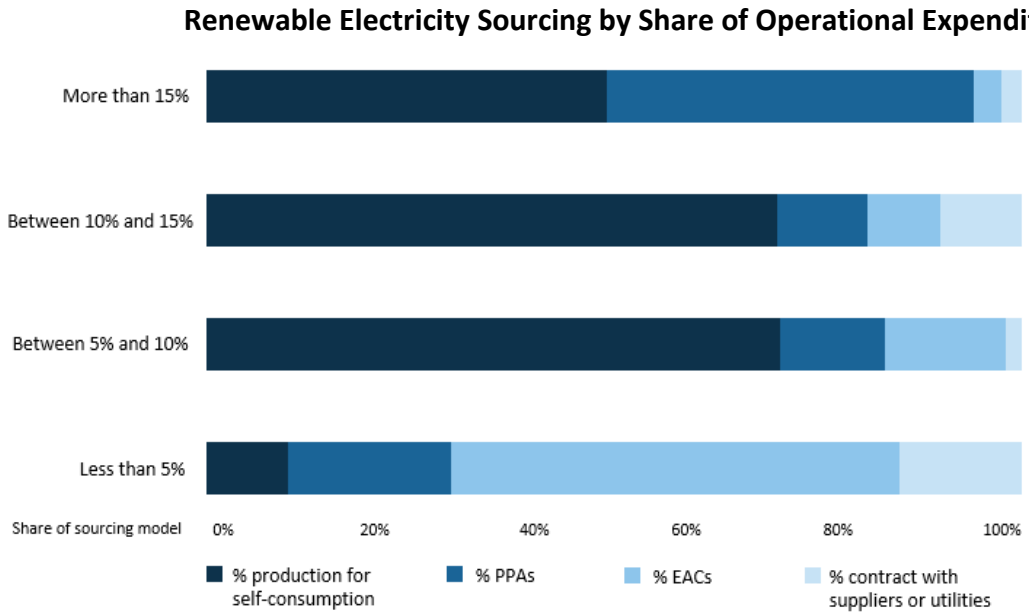

Figure 29: Renewable Electricity Sourcing by Share of Operational Expenditure
Source: IRENA, 2018

In the IRENA report on corporate sourcing of renewables it is shown that corporations with higher energy intensity are more ambitious in terms of RE sourcing and use methods with higher additionality such as e.g. self-generation and PPAs. In fact, PPAs (including CPPAs) is one of the preferred methods for RE sourcing (with almost 50%) by the most energy intensive firms involved in renewables sourcing.

Based on the above and the fact that the industrial sector uses more energy than any other sector in the world, consuming approximately 54% of the world's total delivered energy, [79] it is worthwhile considering the Danish corporate make-up in terms of industries.

Overall, comparing the energy consumption of the Danish industrial sector with the consumption of the industrial sector worldwide (average), the Danish industrial and services sector is considerably smaller with a share of 33%[80] of the total Danish consumption compared to 54% worldwide. The explanation for this difference could be found be looking deeper into the subsectors, as Danish corporations are not heavily involved in some of the most energy intensive subsectors such as iron and steel, mining, pulp and paper or other industrials e.g. car manufacturing.

In a Nordic context, it is worth noting that the growth of CPPA's in Norway and Sweden has been driven by energy intensive sectors such as mining and paper manufacturing.

In conclusion, the characteristics of Danish industry do not suggest a quick adoption of RE. The Danish industrial sector is simply smaller and hold less energy intensive firms compared to e.g. the Nordic neighbours. However, the growth of large data centres may change the energy intensity of industry in the future as data centres will account for 85% of the increase in electricity consumption. [81]

[79] (U.S. Energy Information Administration, 2016)
[80] (Danish Energy Agency, 2018)
[81] (Danish Energy Agency, 2018)

9.2.6 Lack of Standardized Corporate PPA Contracts

The contractual complexity influenced by bilateral agreements, and lack of contract standardization remain major barriers for CPPAs. Contracting and draft preparation is both costly and time consuming. The process of preparing a CPPA from scratch requires a high level of expertise that are most often not available for developers, generators or offtakers internally.

In a recent survey concluded by Baker & McKenzie corporates where asked: To what extent do you agree that most corporates lack the necessary skills in-house to negotiate renewable energy PPAs? Of the responses, 15% strongly agrees and 54% agrees.

The actual timeline and price for drafting and negotiating a contract varies. However, through interviews the following key issues have been identified:

- Internal policies: Each company will have internal differences in terms of e.g. procurement policies that will affect their requirements for and interpretation of the contract. Large corporations may have very strict procurement policies that would require many adjustments to the contract.

- Purpose of the CPPA: The corporate offtakers have different purposes for entering a CPPA. Some are more concerned with the environment and the need for "Greenification", while others are more interested in securing a reasonable price of electricity while hedging against future increases in the price.

- Differences in legal system: Various jurisdictions have different legal traditions of contract drafting. The nationality of the offtaker will thus have a large impact on the contract. In the USA and the UK, the legal contracts are generally very long and detailed leaving nothing to chance. A CPPA contract with a US offtaker could easily take up 100 pages. In other legal systems, such as the Danish, it is considered natural to build the contract on some basic presumptions that will not have to be explicitly expressed in the contract and thereby trusting the court with these issues. In that case a CPPA contract could take up 15-25 pages.

- Experience: As CPPAs are quite new in the market, there will likely be a quite steep learning curve in the preparation of these contracts and thus having just one employee with experience within CPPAs could make quite a big difference.

Depending on the points outlined above, the drafting and negotiation of the CPPA contract could vary within 2-12 months, a relatively large time range variation. According to lawyers involved in these processes, experience shows that one is to expect a timeline of 2-4 months in a market like the Danish.

The process of entering a CPPA is mostly initiated by developers or generators, notwithstanding the growing number of CPPA tenders by larger corporates. A CPPA drafted from the generators point of view will likely take account of previous experiences and any financing requirements, albeit also seek to achieve the objectives of the developer. Similarly, one offtaker may not have same objectives as others, and hence a contract will require much modification and negotiation like other bilateral agreements.

Consequently, a more neutral market standard or a framework for CPPAs would help to simplify and speed up the process of entering more CPPAs, in turn reduce the internal and external legal and commercial costs involved.

A continuous development in standardisation would from an industry perspective be welcomed by investors, with similar standardisations seen in the past in the British PFI market, the current market for Energy Performance Contracts and, in the broader financial markets, financial instrument trading agreements. A market standard of some kind would encourage smaller corporate offtakers to take part in the market, and one could imagine the power sales of a wind asset being broken into smaller CPPAs. This is from a Danish perspective potentially an important focus area supporting increased usage of CPPAs.

10 The Role of Corporate PPAs in Energy Trading and Risk Management

The options and alternatives for CPPAs and other forms of sourcing, trading and hedging RE as part of a corporate buyer's green electricity strategy are illustrated in the figure below:

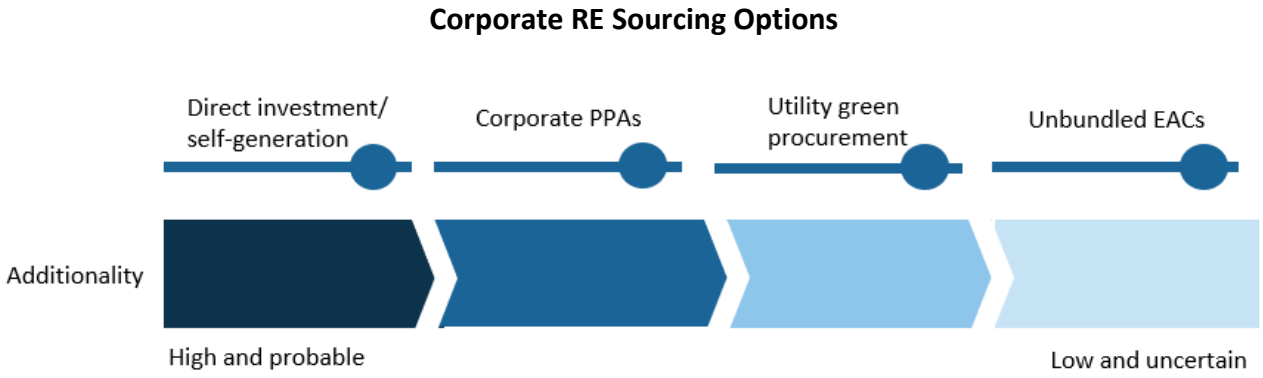

Figure 30: Corporate renewable energy sourcing options ranked by additionality
Source: IRENA, 2018

Generally, no single sourcing method dominates the corporate procurement of RE. The above four options are available in most countries subject to regulation, and companies choose their strategy based on internal policies, risk profiles and financial constraints.[82] Each strategy comes with various levels of ownership, financial exposure and additionality, for many companies making the decision process rather complex.

The higher the additionality, the higher the probability that the sourcing method is contributing to the society green transition by facilitating the installation of new RE capacity. Hence, the strongest corporate statement of supporting carbon emission reductions would appear to be the direct investment/self-generation option.

However, for most companies, energy supplies are an essential resource, while not core to their business and rather than investing in RE, they seek to procure RE with the use of PPAs, be it CPPAs or Utility PPAs (Utility Green Procurement), effectively achieving Additionality through contractual "proof".

The main corporate transition into Direct Investments and Self-Generation has been seen from the major Oil and Gas companies in recent years, as they have made the strategic shift away from oil and natural gas to include a bigger share of RE in the "upstream" end of their value chain. Large mining companies have increasingly entered the Self-Generation market by having RE production facilities co-locating (off-grid) with their remote mining sites as a way of addressing green transition and providing another source of energy security. Among other industries, automotive manufacturers have in the past couple of years embarked on the establishment of RE production as part of ensuring a clean emission value chain for their production and charging of electric vehicles. Also, major industrial conglomerates in Japan and elsewhere are adding RE production subsidiaries to their diversified industrial portfolios.

Notwithstanding these trends, a vast majority of companies see the greater use of RE procurement in the form of:

1) Energy trading with utilities and independent electricity traders (Utility PPAs), which is a large, known and liquid market suitable for financial risk management, and

2) CPPAs, which generally offers more additionality while also more discretion than energy trading with regards to financial terms, both alternatives offering energy price hedging and long-term predictability.

The energy trading with utilities and independent electricity traders, referred to here as Utility PPAs, is growing rapidly even if electricity is predominantly traded on Exchanges. Typically, this solution is a way of securing a fixed or semi-fixed

[82] (IRENA, 2018)

(fluctuation within a range) price in a longer period of years for the power generator, but at a lower cost of contracting compared to the CPPA. The tenor will typically be shorter than the CPPA (5-15 years).

The purchasing of unbundled EACs are different from the utility procurement option as they are not sold together with the specific purchase of physical electricity. They are usually purchased from a third-party supplier or broker. This is a popular form of corporate sourcing as it is available in most markets and is a very flexible options that does not require any long-term commitment and is available at rather low volumes. Furthermore, it is typically not associated with any significant costs. Disadvantages of this method is the low additionality, which is partly contributed to the price level, which is sometimes too low for them to have any significant impact on the income and financing opportunities of the power generator.

From the perspective of the power generator, the advantages of a CPPA includes a predictable, guaranteed long-term source of income that adds bankability even in the absence of any significant subsidies. The drawbacks are similar to those discussed in Section 9.2 for corporate buyers, i.e. complexity and costs, leading to the view that only at a certain level of volume are CPPAs viable.

In Denmark, all the above-mentioned sourcing options are available both for the corporate buyers and the power generators. In terms of corporate sourcing, the most popular methods of sourcing seem to be utility trading and PPAs, including the purchasing of Certificates of Origin. For most Danish companies with a modest energy usage, energy pricing is not a significant concern and hence there is little incentive for e.g. fixing the price through a Utility PPA or CPPA, as mentioned in Section 9.2.

Thus, when making the transition to green energy most companies tend to opt for the most flexible and economical solution, namely the Certificates of Origin. However, with the recent energy agreement and the changes in the Danish subsidy system, the Utility PPA market between power generators and energy traders/suppliers has taken off in the past couple of years. As an example, Danske Commodities signed a 15-year PPA with Beatrice for 50% of the power their 588MW wind farm on the Scottish coast.[83] According to their website Danske Commodities offer PPAs on both standard fixed or floating prices and individually structured settlements with a tenor from 1-15 years.

According to Vindenergi Danmark, they have assisted in some minor cases by setting up PPAs between their members and their trading partners (e.g. NEAS/Centrica, Axpo and Danske Commodities) with tenors of 5-10 years. While limited impact to-date, it is nonetheless a step in the right direction.
The use of CPPAs are likely to trail that of Utility PPAs in the immediate future. However, as the PPA market in Denmark matures, and with Danish multinationals like Bestseller, Carlsberg, Lego and Novo Nordisk.

Price Hedging Alternatives	Description
Financial trading on NASDAQ OMX Commodities	The market players enter financial products that fix the future price of electricity for a set number of months and years (often no more than 2 years) in advance through NASDAQ. The contracts trading electricity in days or weeks are so-called futures and are traded and settled between NASDAQ and a buyer or seller in the market. Longer contracts of months and years are called forwards and are settled between the buyer and the seller directly Furthermore, put and call options are traded on base load forwards contracts. With a put option the owner is secured a future minimum electricity price, while still having upside potential (with a call option the owner is secured a future maximum price, still having downside potential)

[83] (Danske Commodities, 2018)

Price Hedging Alternatives	Description
Utility PPAs (bilateral agreements)	Both large corporates and power generators can lock-in electricity price and volume with an electricity supplier/trader. Although there are examples of utility PPAs with a duration of up to 15 years, the most common deals have had a duration of 2-3 years, trending towards 5 years.
Corporate PPAs	With CPPAs, the buyer and seller are also fixing electricity price and volume as with a utility PPA, however there have been deals with a duration as long as 25 years.

The above table shows the different methods for price hedging to provide a simple overview of the alternatives available to corporates for buying electricity and managing the price and supply risks.

Green sourcing alternatives	Comments
Direct investment/ self-generation	While this option secures a high additionality and thereby also high branding value, it is a complex sourcing strategy exposing the owner to a number of additional risks. Depending on the exact structure of the arrangement, there will be high capital costs and indeed the owner will be exposed to technical site-specific risks.
Corporate PPA	The CPPA also ensures high additionality by contributing to the bankability of new projects, however the branding signal is not quite as strong as with self-generation. In a CPPA the offtaker is to some extent still exposed to price risks as the offtaker is missing out on potential decreases in future prices (below CPPA fixed price), which gives the offtaker a relative disadvantage compared to competition; however the opposite case is also true. Moreover, the offtaker is exposed to volume risk as future electricity demand could decrease to a level below the contracted volume.
Utility Green Procurement	Utility green procurement is not only one defined sourcing method but varies with the specific country and utility. Sometimes it will be a utility PPA securing the offtaker a fixed price and volume, and in other cases it will include EACs or the cancellation of CO_2 quotas. The additionality varies depending on the specific method, but it generally lower than the above alternatives.
Unbundled EACs (Certificates of Origin)	This sourcing method has low additionality, as they are only providing the power generator with minor cash flows with an unfixed and sometimes very low price. However, the use of certificates in branding can sometimes be misleading to the consumer implying a falsely high additionality.

The above table provides a brief summary of advantages and disadvantages of the various green sourcing methods.

11 Projected Growth of Corporate PPAs in Denmark 2020-2040

As uncovered in the analysis of drivers (section 9), the potential for CPPAs in Denmark is evident. There is an overall trend among corporations globally, including Danish companies to make the "green" transition and make use of sustainable and clean energy sources. The fact that the trend is accelerating despite reduced subsidies for RE production, indicates that the trend is increasingly rooted in corporate governance, strategy and visions and, thus, long-term towards zero carbon emission.

While various barriers have been highlighted in Section 9.2, the main barrier in the long-run for CPPA growth, may not be an obstacle for the advancement of RE. Barriers that apply particularly to an advanced RE nation like Denmark, such as limited landmass, well-established energy trading market and a SME-dominated corporate landscape, do not prevent companies from participating in the advancement of RE, while CPPAs may find their role to play with certain industry segments and/or in the use of cross-border CPPA, as part of Greenification of international activities.

In this section, two growth scenarios for CPPAs in Denmark have been analysed based on the current projections for renewable energy consumption from 2018-2040 published by the DEA. The latter has been defined as the "minimal growth" scenario and established an aggressive, "maximal growth" scenario as well as a best guess, "realistic growth" scenario.

11.1 Scenario Assumptions

In terms of data, the scenarios are based primarily on data from the DEA's 2018 Power and Gas Sector Outlook for Infrastructure Planning. This is an extensive set of data that outlines most aspects of the Danish energy system and its development until 2040. The data also serves as basis for Energinet's analyses, business cases, reports, planning, and international collaborations.

The Power and Gas Sector Outlook for Infrastructure Planning (2018) is not based on "frozen policy", but a "best guess" on a long-term development until 2040 within key areas in the electricity and gas system.
In addition to the Power and Gas Sector Outlook for Infrastructure Planning, which is publicly available, the DEA has provided supplementary data on the projected corporate electricity consumption broken down by sectors. Furthermore, the DEA has provided historical data on the subsectors of the industry (manufacturing) sector showing consumption up until 2016. Lastly, the DEA has provided data on the consumption of electricity intensive companies 2015-2019.[84] The definition of "electricity intensive" is based on the legal requirements a company must fulfil to qualify for a discount on the PSO-tariff. Data centres are, given their nature, also assumed to be electricity intensive.

The different subsectors of corporate consumption have been broken down and evaluated based on electricity intensity as part of the analysis leading to projections on the share of electricity production that will be based in CPPAs until 2040. Be aware that non-corporate electricity consumption has been disregarded in the analysis due to the nature of CPPAs. The rationale behind the breakdown of corporate consumption by electricity intensity, assumes that electricity intensive companies are likely to engage in CPPAs even in the scenarios where barriers dominate, and drivers are only realized to a limited extent. Furthermore, it is assumed that the corporate consumption of electricity has the same share of electricity from renewable energy sources as the overall total consumption.

In the following sections, 11.2 and 11.3 below, two different scenarios have been developed to illustrate the potential for growing CPPA usage's contribution to RE growth. They are presented in tables emphasizing the share of CPPAs in the overall electricity consumption in Denmark, as well as its projected growth. The breakdown of the scenarios is based on electricity consumption and divided into two main groups: "Energy Intensive Consumption" and "Non-Energy Intensive Consumption".
The "Energy Intensive Consumption" category consists of two groups: 1) The consumption by energy intensive manufacturing companies (EIMC), defined above as the consumption by companies that qualify for a PSO-tariff discount

[84] Please note that the figures provided does only contain the share of electricity consumption that is eligible for the discount, thus if the corporates have any own production that is not included.

– this data was specifically provided by the DEA and 2) The consumption by large data centres predicted in the Power and Gas Sector Outlook for Infrastructure Planning (2018).

"Non-Energy Intensive Consumption" category consists of three groups: 1) The consumption by the other manufacturing companies (OMC), defined as the total electricity consumption by the manufacturing subsector minus the electricity consumption by EIMC and 2) Agriculture consumption and 3) Services consumption.

Looking at the subsectors of corporate consumption, the manufacturing subsector currently takes up the largest share of the total corporate electricity consumption. As mentioned, the DEA has furthermore been able to provide information on the consumption of electricity intensive companies, as they are providing a discount on the PSO-tariff to electricity intensives companies that fulfil specific requirements. Most companies receiving the discount belong to the manufacturing industry, and they are thus treated as such in the scenarios. Hence, the category "Other manufacturing companies" is simply the derived by subtracting the consumption of the electricity intensive manufacturing companies, from the total consumption by manufacturing companies. As the DEA has only been able to provide historical data on the consumption of electricity intensive companies, it is assumed that the consumption will grow at the same rate as the manufacturing subsector.

In addition to the electricity intensive manufacturing companies, the data centres expected to emerge in Denmark within the coming years will also be electricity intensive. Based on a separate analysis on hyper scale data centres prepared by COWI for the DEA, it is assumed that, by 2030, there will be approximately six large data centres with an average electricity output for of 150 MW each. The number of average-size data centres is expected to increase to nine by 2040, if the linear growth in data volumes continues. In this scenario, total electricity demand from data centres will grow to approximately 7 TWh in 2030 and to more than 11 TWh in 2040, corresponding to a share of total electricity demand in 2030 and 2040 of about 16% and 22%, respectively.[85] In the scenarios, data centres account for a considerable share of the total CPPA usage. Google, Facebook and other large internet companies have been very active in the CPPA market in foreign countries and are assumed to follow suit in Denmark.

Besides the two heavy categories elaborated above, the scenarios also account for the CPPA usage in less electricity intensive sectors. In the realistic scenario the CPPA use of these companies is assumed to be zero, however in the maximal scenario they make up a smaller part of the final CPPA usage.

It is important to emphasize that the projections extrapolating CPPA usage more than 20 years into the future are obviously associated with a large degree of uncertainty. Thus, in other contexts, the projections provided in this report should be used with caution.

11.1.1 Input Assumptions

As with any estimation, the scenarios are based largely on a subjective view on how the individual drivers specific to the Danish market previously mentioned (see section 9.1), contribute to the future growth of CPPAs and how individual barriers contribute to holding back the growth.
In addition to expertise knowledge on the abovementioned drivers and barriers, several interviews with leading players in the Danish renewable energy market were conducted to derive the assumptions used in the scenarios.

Based on the significance rating of drivers and barriers in the table in section 9, the drivers' impact on the projected CPPA usage have been weighted against each other. Furthermore, the development of their impact over time has been assessed, as well as the impact of barriers that may become less significant in the long-term.

The zero-subsidy market has a high significance rating and accordingly a strong weight in terms of the input. It is evident from neighbouring countries that this driver has been the kick starter of the entire CPPA movement. The evolution of this driver with time accounts for the additions of new offshore wind. As more auction-based offshore capacity is added, the supply of RE project looking for CPPAs will increase, leading to attractive electricity prices for corporate offtakers. Consequently, more CPPAs will be entered as the new projects seek bankability.

[85] (Danish Energy Agency, 2018)

The green energy transition of private and public corporations is likely to increase in the coming years. Additionality is a key aspect emphasized by several interviewees, and if the Certificates of Origin system is reconsidered to increase transparency that would further increase the impact of this driver with time. Going beyond 2030, the reliability of the predictions is naturally diminished, and the arguments for respectively increasing or decreasing the effect of this driver are ambiguous. One could argue that the climate focus would increase as a result of augmented awareness among politicians and institutions as well as the general public. Conversely, the RE share of total consumption in 2030 in Denmark is above 90%, thus weakening the rationale behind the additionality argument.

The driver relating to syndications and consortium has followed an upwards trend in other countries in recent years. In the specific countries that have seen a breakthrough in the use of consortia, the Netherlands and Australia, they seem to become increasingly popular. If a similar breakthrough takes place in Denmark, one must assume that the impact will increase over time as it is seen abroad. Still, the argument raised above regarding the additionality going beyond 2030 also applies in this case.

If a financing mechanism is initiated to guarantee the offtakers fulfilment of the contract (to a certain degree) the impact of this driver would take off. Meanwhile, the extent of the agreement would have decisive impact on the weight of this driver. Considering the extent of the agreement, one would refer to the length of the guarantees provided, the amount of money allocated to the guarantee scheme, the offtaker criteria and so on. It is almost impossible to predict how such an agreement would take shape, due to the constantly changing political landscape and hence, these input assumptions are particularly sensitive.

The barriers have not been assigned negative weights, however they have been considered when assigning weights to the drivers. While the impact of some barriers is likely to stay rather constant during the coming 20 years, the impact of other barriers might also fade due to learning curves and emerging business customs.

The slow corporate decision process currently experienced by developers will fade as corporates become familiar with the CPPA process. Likewise, if a standardised CPPA contract is published this barrier would fade. A standard contract would benefit both parties of the CPPA and would put CPPAs in a strong position to compete against the offerings of energy traders.

The input assumptions elaborated above are mainly concerned the country-wide drivers that apply to the Danish market, however further assumptions have been considered to estimate how each subsector will make use of CPPAs.
As mentioned in section 11.1, the electricity intensity has been assessed, as it is assumed that the incentives for electricity intensive firms to enter CPPAs are somewhat different from those of non-electricity intensive companies.

Electricity intensive companies will not only consider the CSR aspects of a CPPA, they will use it as a hedging instrument as well. For these companies, electricity is a vital resource in the production and accounts for a large share of total costs. Thus, electricity risk management becomes critical. They are dependent on a cheap and stable source of electricity at a known cost, and a CPPA can provide that. One can argue that for these specific firms, the drivers are generally a bit different and for the large firms the advantages will likely outweigh the costs. Consequently, the share of large firms within each subsector has also been considered when assessing the most accurate input assumption.
Furthermore, these Co_2 intensive companies usually receive more public awareness requiring CSR actions.

The estimations further account for the fact that if a company concludes a CPPA it will presumably not cover the entire electricity demand of the offtaker in order to minimize risk exposure associated with relying solely on one source of electricity.

11.2 Realistic Scenario

Driver inputs REALISTIC	EIMC	OMC	Data Centres	Agriculture	Services
Zero-subsidy market	36%	0%	93%	0%	0%
Greenification of Corporates	25%	0%	90%	0%	0%
Syndications and Consortia	15%	0%	85%	0%	0%
Financing Mechanisms	0%	0%	0%	0%	0%
Drivers impact (Average)	**19,0%**	**0,0%**	**67,0%**	**0,0%**	**0,0%**
Driver evolution REALISTIC					
	2020	**2025**	**2030**	**2035**	**2040**
EIMC	19%	20%	21%	22%	22%
Data centres	67%	70%	74%	78%	78%
OMC	0%	0%	0%	0%	0%
Agriculture	0%	0%	0%	0%	0%
Services	0%	0%	0%	0%	0%

Figure 31: Driver inputs for the Realistic scenario

The table above illustrates the quantifiable inputs forming the basis of the CPPA predictions in the realistic scenario. As each subsector has its own set of characteristics in terms of electricity needs and CPPA motivation, the drivers outlined in section 9 are valued differently for each of the subsectors analysed.

The top section of the table depicts the value of each driver for each subsector and the average impact of those. However, as mentioned in the section above on scenario inputs, it is important to note that the drivers are indeed not the only inputs considered in the predictions, nonetheless they are rather quantifiable compared to e.g. interviews.

This scenario assumes that electricity intensive companies are likely to engage in CPPAs even if barriers dominate, and drivers are only realized to a limited extent. Hence, the subsectors that are deemed non-electricity intensive (OMC, Agriculture and Services) are all zeroed in this scenario.

The bottom section uses the average impact of each subsector as a starting point, and then shows the evolution of the impact with time. In the realistic scenario, the impact of each driver grows with a factor of 5% for every five years, expect for the last prediction from 2035-2040 where the growth is assumed to be zero.

The rationale behind these growth predictions follows from the discussions presented in section 11.1.1 on scenario inputs. The impact of the zero-subsidy market driver will increase with time due to the new auctions on offshore wind. Other drivers contain a learning curve aspect that will grow over the years, however in 2035 RE makes up more than 100% of the electricity consumption in Denmark, which will diminish the impact accordingly, thus the growth aspect has not been considered for this last period.

Realistic Scenario (GWh)	2020	2025	2030	2035	2040
Total consumption covered by CPPA (%)	3.3%	9.9%	13.4%	16.4%	17.9%
Total Consumption covered by CPPA (GWh)	**1,031**	**3,833**	**5,732**	**7,735**	**9,468**
Total Consumption	**31,486**	**38,627**	**42,821**	**47,093**	**52,832**
Total CORPORATE Consumption	**19,814**	**24,796**	**27,378**	**29,760**	**32,639**
Total RE Consumption	**19,277**	**25,662**	**38,921**	**47,093**	**52,832**
Total consumption from RE (%)	61.2%	66.4%	90.9%	105.7%	113.7%
ENERGY INTENSIVE Consumption					
Energy Intensive Manufacturing Companies (EIMC)	**2,325**	**2,545**	**2,558**	**2,608**	**2,734**
Predicted GWh covered by CPPA	442	508	536	574	601
Large Data Centres Consumption	**879**	**4,727**	**7,035**	**9,233**	**11,432**
Predicted GWh covered by CPPA	589	3,325	5,196	7,161	8,867
NON-ENERGY INTENSIVE Consumption					
Other Manufacturing Companies (OMC)	**5,714**	**6,255**	**6,287**	**6,409**	**6,720**
Predicted GWh covered by CPPA	0	0	0	0	0
Agriculture Consumption	**1,519**	**1,614**	**1,684**	**1,751**	**1,845**
Predicted GWh covered by CPPA	0	0	0	0	0
Services Consumption	**9,376**	**9,656**	**9,814**	**9,758**	**9,908**
Predicted GWh covered by CPPA	0	0	0	0	0

Figure 32: Realistic Scenario

The realistic scenario illustrates moderate growth of CPPAs in the next five years.

Greenification of corporates is still a major driver of CPPA growth, and it is expected that the impact of this driver will continue to grow in the next few years led by major players in the manufacturing industry and the data centres. The CPPA usage by smaller participants is being held back by a number of barriers e.g. the established corporate behaviour of using utilities and energy traders for RE procurement and risk management.

It is likely that the repowering of aging wind turbines could see some use of CPPAs over other ways of securing the offtake for extended operations, not excluding that PPAs with utilities and/or traders already in place for same assets could be deemed easier to prolong. It should be noted that repowering is already included in the base case 2040 RE projections by the DEA.

In this scenario, financing mechanisms, which require some government support, are not considered as little action has been seen towards it and, hence, without any official proposals, let alone policy indications, it has been deemed premature to consider any contribution from financing mechanisms.

Data centres are expected to kick off the CPPA market in Denmark, with the newly auctioned offshore parks being an obvious opportunity for the data centres. The basis for this prediction lies not only with the electricity intensive nature of the data centres, but also acknowledge the experience from other countries.

As previously mentioned, lack of contractual transparency is a barrier for the players not considered in this scenario as the current framework hinders their participation due to high costs, and the demand of legal and contractual expertise for such executions.

As a “best guess” for the projected share of CPPAs, the table below estimates that CPPAs will cover roughly 17.9% of the total consumption, and approximately 29% of total corporate consumption by 2040.

11.3 Maximal Scenario

Driver inputs MAXIMAL	EIMC	OMC	Data Centres	Agriculture	Services
Zero-subsidy market	47%	7%	90%	6%	7%
Greenification	30%	6%	85%	4%	5%
Syndications and Consortia	15%	4%	70%	3%	4%
Financing Mechanisms	15%	3%	55%	3%	4%
Drivers impact (Average)	**27,0%**	**5,0%**	**75,0%**	**4,0%**	**5,0%**
Driver evolution EXTENSIVE					
	2020	**2025**	**2030**	**2035**	**2040**
EIMC	27%	29%	31%	33%	35%
Data centres	75%	79%	83%	83%	83%
OMC	5%	5%	6%	6%	7%
Agriculture	4%	4%	5%	5%	5%
Services	5%	5%	6%	6%	7%

Figure 33: Driver inputs for the Maximal scenario

The table above illustrates the quantifiable inputs forming the basis of the CPPA predictions in the maximal scenario. As each subsector has its own set of characteristics in terms of electricity needs and CPPA motivation, the drivers outlined in section 9 are valued differently for each of the subsectors analysed.

The top section of the table depicts the value of each driver for each subsector and the average impact of those. However, as mentioned in the section above on scenario inputs, it is important to note that the drivers are indeed not the only inputs considered in the predictions, nonetheless they are rather quantifiable compared to e.g. interviews.

This scenario assumes that both electricity intensive companies and non-electricity intensive companies will engage in CPPAs, however not to the same extent. It is assumed that all drivers will be active and thus motivate SMEs to enter CPPAs either individually or in consortia. The standardized contracts will further simplify the process and decrease the costs of CPPAs although they are still substantive.

The bottom section uses the average impact of each subsector as a starting point, and then shows the evolution of the impact with time. In the maximal scenario, the impact of each driver grows with a factor of 7% for every five years, expect for the data centres, which are already highly engaged in CPPAs as a starting point. Data centres contribution will grow at a rate of 5% in the first two periods, after which the impact will stay constant at 83%. This assumption is based on the fact that a single offtaker is not likely to rely solely on power from a CPPA seeing as the power production from a RE asset is volatile and can never fully match the corporate demand. Thus, a buffer is needed.

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Maximal Scenario (GWh)	2020	2025	2030	2035	2040
Total consumption covered by CPPA (%)	6,7%	13,9%	17,8%	20,3%	22,0%
Total Consumption covered by CPPA (GWh)	**2.102**	**5.378**	**7.606**	**9.573**	**11.607**
Total Consumption	**31.486**	**38.627**	**42.821**	**47.093**	**52.832**
Total CORPORATE Consumption	**19.814**	**24.796**	**27.378**	**29.760**	**32.639**
Total RE Consumption	**19.277**	**25.662**	**38.921**	**47.093**	**52.832**
Total consumption from RE (%)	61,2%	66,4%	90,9%	105,7%	113,7%
ENERGY INTENSIVE Consumption					
Energy Intensive Manufacturing Companies (EIMC)	**2.325**	**2.545**	**2.558**	**2.608**	**2.734**
Predicted GWh covered by CPPA	628	735	791	862	968
Large Data Centres Consumption	**879**	**4.727**	**7.035**	**9.233**	**11.432**
Predicted GWh covered by CPPA	660	3.722	5.817	7.635	9.453
NON-ENERGY INTENSIVE Consumption					
Other Manufacturing Companies (OMC)	**5.714**	**6.255**	**6.287**	**6.409**	**6.720**
Predicted GWh covered by CPPA	286	335	360	393	440
Agriculture Consumption	**1.519**	**1.614**	**1.684**	**1.751**	**1.845**
Predicted GWh covered by CPPA	61	69	77	86	97
Services Consumption	**9.376**	**9.656**	**9.814**	**9.758**	**9.908**
Predicted GWh covered by CPPA	469	517	562	598	649

Figure 34: Maximal Scenario

The maximal scenario assumes that the future CPPA market will have relatively simpler frameworks that reduce costs and needs of expertise for execution of such contracts, thus allowing smaller companies and players from non-energy intensive sectors such as agriculture and services, to participate in the CPPA market.

As in the realistic scenario, zero-subsidy markets will have a considerable impact in this scenario as auction competition will push investors towards CPPAs as a tool for bankability.

In the maximal scenario, the Certificates of Origin system is updated to increase transparency and push buyers towards solutions that have a higher degree of additionality. Following the increased transparency, there will be an increased demand from the public towards corporate greenification, which will accelerate in coming years.

The growing use by larger offtakers of CPPAs will see emerging contract standards introducing pricing and volume frameworks, which will bring down the costs and time for CPPA execution and lead to the SME segment increasingly choosing CPPAs as a way of documenting additionality.

The SMEs' adoption of CPPAs will accelerate with the maturity of syndication and consortia structures, as these structures are gradually being accepted by lenders in the financing of RE, not least the financing of portfolios of smaller C&I solar installations. Furthermore, this scenario assumes a near-term introduction of a financial support mechanism akin to the Norwegian guarantee system introduced by GIEK.

It is K2 Management's belief that the emerging sustainable mobility trends will see significant penetration of electric vehicles in the coming 20 years combined with continued digitalization of society that will drive the growth in data centre capacity and attract new corporate consumers to the country.

Based on these assumptions and the blended growth drivers, the maximal growth scenario estimates that, by 2040, CPPAs will respond to 22% of all renewable energy consumption and 35,5% of all corporate electricity consumption

12 Conclusions

12.1 Corporate PPA Trends in the Global Energy Market

With government subsidy programs being abolished and the renewable energy sector discussing ways of growing generation capacity in a zero-subsidy environment, CPPAs are increasingly seen as the way for developers as well as corporate and financial investors as the way, alongside CfD contracts and utility PPAs, to secure bankable projects.

A further driver for CPPA usage is the ambitions of large global corporations that are embracing ESG policies across their operations. B2C companies in food & drinks retailing sees renewable energy as part of their green branding / CSR, e.g. Carlsberg, Starbucks, Lego, Ikea, and others taking part in RE100, while electricity intensive companies like Google, Amazon and Facebook, finds the renewable energy sources suitable to power their growing need for powering data storage facilities. Other energy intensive industries like mining, paper manufacturers, automotive companies, oil majors and chemical groups are using CPPAs for price hedging purposes.

While syndications and consortia allowing smaller corporations to participate in CPPAS alongside their bigger peers have been observed mainly in Australia, the U.S. and the Netherlands, the global CPPA market is still to some extent constrained by various barriers.

Corporate decision processes are seen by many developers and independent power producers as slow, while contractual requirements, in the lack of a standardized CPPA contract, are equally time consuming as well as costly, holding back the uptake of CPPAs for smaller players. Creditworthiness of corporate offtakers is increasingly important as durations increase, thus hampering the CPPA potential for smaller offtakers in the absence of government-backed guarantee schemes.

Lastly, CPPAs are competing with the offerings of utilities and energy traders supplying price hedges of up to 5 years for the power generators, while providing less demanding green solutions to offtakers with a low relative importance of electricity costs.

12.2 The Danish Energy Market is Fundamentally Suitable for CPPAs

The Danish electricity market is characterised by a large proportion of electricity generated by RE sources, particularly on- and offshore wind energy. The market has been a front-runner in the introduction of wind energy and other RE sources, while solar energy has only seen large-scale installations for the past 4-5 years, leading to the vast majority of renewable electricity coming from wind energy sources. This has largely influenced Denmark's global leadership as R&D hub and equipment manufacturer of wind turbine technology over the past 25-30 years, led by MHI Vestas, Siemens and an "under forest" of equipment suppliers, installation firms and services providers to the wider wind energy industry.

Like with RE generation, the suppliers of electricity are advanced buyers of RE from Danish and other Northern European sources, many of them known for being active energy traders selling RE to corporates in Denmark and abroad, arranging for Certificates of Origin and brokering EACs. Two recent acquisitions of Danish energy traders by leading, global energy groups, Centrica's acquisition of NEAS and Equinor's acquisition of Danske Commodities, are testament to the RE market trading expertise of Danish participants.

Notwithstanding the overall suitability of the market and the size of the RE contribution in Denmark, the overall energy market remains relatively small, but the relatively stable Danish economy, the rise of large data centres, and the environmental policy leadership will likely create a balanced market place for use of CPPAs in the future growth of RE.

12.3 Drivers and Barriers of CPPA usage in a Danish context

12.3.1 Drivers

1) Denmark is among the leading countries for corporate green energy transition and environmental awareness, the origin of environmental corporate reporting and host to leading RE100 companies, like Novo Nordisk, Carlsberg, Bestseller and Lego. The growth of CPPA globally is partly driven by RE100 members and large Danish corporations as well as data centres are expected to take the lead in the CPPA growth in Denmark

2) Disappearing or reduced subsidy schemes for RE in Denmark, like in other countries, will require developers and energy traders to diversify their offtake models to include not only utility PPAs but also CPPAs

3) Given a corporate landscape of many SME corporate electricity consumers, the market for Syndication and Consortia CPPAs is considered very suitable to the Danish market, in turn allowing smaller companies with a green vision to acquire Certificate of Origins through the contractual CPPA relationship

4) The introduction of financial support mechanisms similar to GIEK in Norway, and albeit not proposed by any public institution, could see financing risks mitigated through instruments that would guarantee the longer tenors of CPPAs, i.e. guarantee the offtake obligations beyond year 5 of a CPPA.

12.3.2 Barriers

1) The existing availability of energy trading and utility PPAs and the active relationship between utilities, traders and corporate buyers, could limit the up-take of CPPAs in the near-term. While in the longer-term energy traders are likely to embrace CPPAs as a business opportunity that creates greater additionality than their current trading products, which are dominated by Certificates of Origin. This transaction could be advanced by updating the Certificates of Origin scheme to increase transparency.

2) Another near-term barrier is the slow decisions process of most companies with regards to CPPA negotiations as experienced and mentioned by RE developers

3) While confirming the suitability of the Danish electricity market, the relatively build-out RE market, except for ground-mounted and C&I solar, is seen as limiting factor for large-scale CPPAs e.g. Google and other for data centre offtake

4) Similarly, the high proportion of small and less-energy intensive companies when compared to other countries like Norway and Sweden may limit the demand for CPPAs

5) The contractual framework for CPPAs is Denmark is in its infancy and learnings will have to be made from PPA experiences in other countries, be it utility PPAs or CPPAs. Until a level of standardisation or framework has been established, it is likely that many smaller companies and/or less proactive energy procurement managers will favour CPPAs over traditional energy hedging via traders or exchanges

12.4 Other Key Conclusions

1) The potential driver of facilitating more renewable energy via CPPAs by introducing government supported financing mechanisms has received support by many interviewees whether developers, energy traders and the financing community. It is a learning from Norway and Sweden that it took a guarantee mechanism by GIEK in Norway or, as a contrast, almost a decade before the Swedish CPPA market moved beyond 5 years.

2) Given the current level of RE in Denmark and the projected growth over the next 20 years, the scenario analysis suggests that even less- or non-energy intensive players can have some influence on the growth of

CPPAs as the maximal scenario yields a 22% CPPA share of consumption. In the realistic scenario this share is limited to 18%. More analysis can be done to refine scenarios in terms of solar energy versus wind growth, slower growth in earlier years and potential for accelerated growth in later years as well as cross-border CPPA activity related to Danish RE production and procurement

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14 Appendices

Appendix A

In the process of conducting this report, K2 Management has interviewed a number of specialists within their respective fields of expertise. This appendix lists the companies of the specialists interviewed.

Company Name	Description
AIP Management A/S	Danish investment manager advising institutional clients on direct investments in energy and infrastructure
Armstrong Asset Management Ltd	Asian independent clean energy asset manager
Bird & Bird	International law firm
Better Energy A/S	Danish-based solar developer
Energetics Ltd	Australian-based consultancy firm
Energinet Danmark I/S	Denmark's transmission system operator
Equis LTd	Asian infrastructure and real asset investment management company
European Energy A/S	Danish wind and solar energy developer and operator
Euro Wind Energy A/S	
Google Inc.	American multinational technology company
Kromann Reumert	Danish law firm
Macquarie Capital Ltd.	Australian multinational investment bank and financial services company with expertise in infrastructure
NEAS Energy A/S	International energy trading company owned by Centrica
REG Power Management Ltd.	UK-based developer, owner and operator of renewable energy projects
Smartest Energy Ltd.	UK-based commercial electricity supplier
Vindenergi Danmark	Co-operative for Danish wind turbine owners
Vindmølleindustrien	Danish industry association within wind energy
Watson Farley & Williams	International law firm
Wind Farm Developments Ltd.	Australian-based wind developer

Appendix B

The following document shows an anonymized expression of interest for a CPPA between a solar farm operator and a major mining group. It touches upon the main issues of a CPPA contract and serves as a real-life example of the industry terms and expressions used as well as the proposed agreement structures.

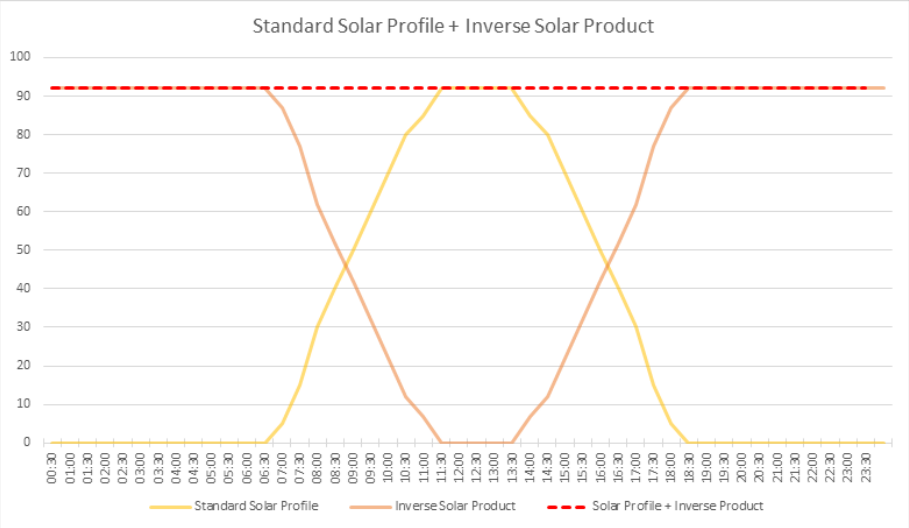
1. PART A

Item	Details	
General Supplier Information	The [redacted] Fund will own and operate the [redacted] Solar Farm. The [redacted] Fund will be managed by [redacted] Management Pty Ltd which has extensive experience in the renewable energy and finance sectors.	
Project Summary	**Name**	[redacted]
	Location	Australia
	Technology Type	Solar
	Nameplate Capacity	300 MW
Project Technical Details	**Site Details**	▪ 6,000-acre site is traversed by [redacted] transmission lines. ▪ Ample relatively flat, open land ▪ High irradiance and climatic conditions ▪ **Capacity factor (AC):** 29% ▪ **Global Horizontal Irradiance (GHI)** 2,000 kWh/m2 ▪ **Marginal Loss Factor (MLF)** 0.96 ▪ Direct access to available grid capacity and favourable network location providing robust MLF and reduced network congestion potential ▪ Good site access via road and access to highway, rail and port transport services for construction ▪ No environmental, heritage or ecological constraints within the development area
	Key Equipment Specifications	▪ **Single Axis Tracking:** Tier 1 ▪ **Panels:** Tier 1 ▪ **Inverters:** Tier 1
	Capacity DC	300 MWp
	Capacity AC	250 MW
	Available Supply to [redacted] offtaker	92 MW[86]
	Connection Point	▪ **Transmission level connection** – [redacted] ▪ **Connection Voltage:** 275 kV ▪ **Distance from Grid Connection:** 0 kilometres

[86] The 92MW represent the quantity of power covered by this CPPA

	Grid Connection/System Strength Assessments	Details can be provided upon request
	Generator Performance Standards	Details can be provided upon request
	Annual Generation	**P50:** 626,138 MWh
	Availability (%)	99%
	Generation Profile (Daily)[87]	
	Generation Profile (Annual)[88]	
Proposed MWh offered to [redacted] offtaker (Annual)	803,200MWh	
Proposed Types of Sales Agreements	Three separate types of PPA agreements are being proposed to [redacted] the offtaker 1. **Run of Plant** – A non-firm PPA where [redacted] purchases a proportion of [redacted] Solar Farm's generation in order to supply its electricity needs. In circumstances where [redacted] demand is not met by [redacted] Solar Farm's generation, [redacted] will purchase the remaining MWh from of the spot market. The price per MWh of a run of plant agreement is generally at a discount relative to the spot price. (Price risk is absorbed by [redacted] + add detail on exports. 2. **Fixed Volume Swap** – A firm PPA that guarantees [redacted] a specific volume of MWh across the contracted period. In circumstances where [redacted] Solar Farm's generation is unable to fulfil the Fixed Volume Swap, the solar project is obligated to purchase the remaining MWh from the spot market. (Price risk is absorbed by [redacted] Solar Farm) 3. **Fixed Volume Swap + Inverse Solar Shape** – This is a blend of the abovementioned Fixed Volume Swap and an Inverse Solar Shape product. The Fixed Volume Swap when blended with an inverse solar shape product guarantees [redacted] a specific volume of MWh over the contracted period. During periods where the solar farm is not generating energy, the Inverse Solar Shape product firms a standard solar profile to a flat swap.	

[87] Deleted to maintain anonymity
[88] Deleted to maintain anonymity



Further discussion between the two parties is required to determine the exact terms of these sales agreements.

Contract Term

3, 5, 7 or 10 years

Indicative Price(s) in 2019 ($/MWh), Contract Periods and Confidence Interval (±% per each contract)

Run of Plant	
3 years	$70.00/MWh
5 years	$65.00/MWh
7 years	$60.00/MWh
10 years	$55.00/MWh
Fixed Volume Swap	
3 years	$80.50/MWh
5 years	$74.50/MWh
7 years	$69.00/MWh
10 years	$63.25/MWh
Fixed Volume Swap + Inverse Solar Shape (blend price)	
3 years	$86.10/MWh
5 years	$83.50/MWh
7 years	$81.20/MWh
10 years	$78.90/MWh

Indicative Price Escalation per year for each of the contract terms offered

Run of plant – 50% escalation

Fixed Volume Swap – 50% CPI escalation

Fixed Volume Swap + Inverse Solar Shape – 50% CPI escalation

Availability of Green Rights, Indicative Price

3 years	$30.00/MWh (no escalation)
5 years	$25.00/MWh (no escalation)

in 2019, Confidence Interval (±% per each contract)	7 years	$20.00/MWh (no escalation)
	10 years	$15.00/MWh (no escalation)