Sustaining a cost-efficient energy transition in Europe

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EXECUTIVE SUMMARY

Fighting climate change requires Europe to step up its efforts in decarbonising its energy system by 2050. But investments in clean energy have fallen sharply in Europe from 2011 to 2017, while they have increased world-wide over the same period[1].

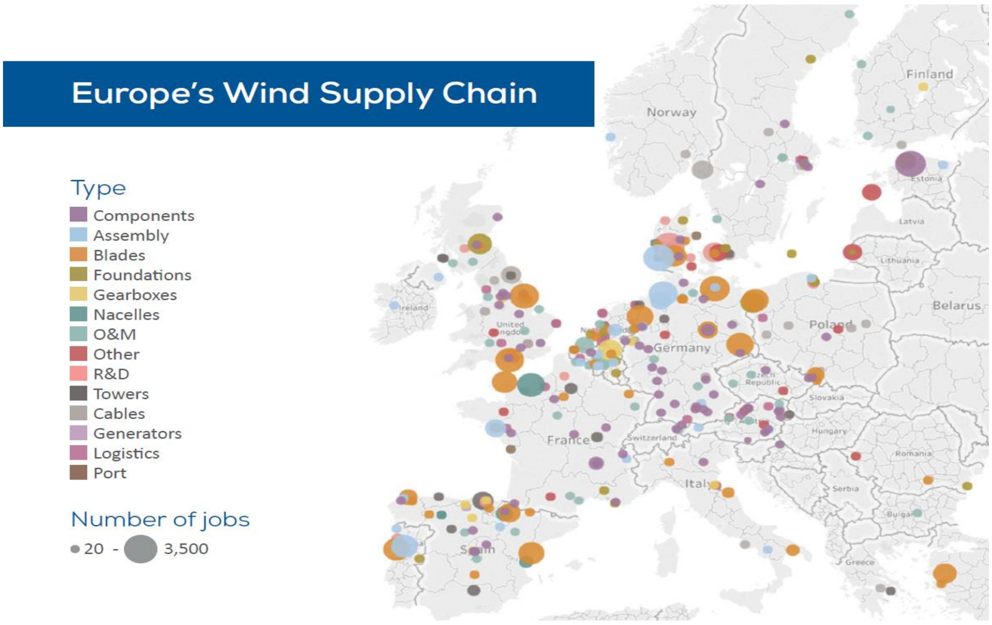
For now, the wind industry remains a major investment opportunity, with €22.3bn raised last year for the construction of new wind farms. However, meeting WindEurope central scenario for 2030 requires €239bn additional investments. So far, most EU countries fail to provide investment predictability beyond 2020. Such uncertainty decreases the funds available and threatens the realisation of climate objectives.

As policymakers debate the Clean Energy Package and prepare their National Energy and Climate Plans (NECPs), it is crucial to put in place the right investment framework to deliver the Paris agreement cost-efficiently. This means market-based revenue stabilisation mechanisms (e.g. contract for differences, sliding premium), allocated via competitive and predictable price discovery schemes (e.g. auction).

Socio-economic benefits and recent developments

Investing in wind energy brings significant benefits for society. It is a leading climate mitigation solution in which Europe has technological excellence**,** offering its citizens and businesses **clean, local and affordable energy**. Contributing €36bn to EU Gross Domestic Product with €8bn exports, it employs 263,000 people across all regions of Europe[2].

Figure 1 Europe's wind supply chain



Source WindEurope (2018)

[1] *Clean Energy Investment Trends*, Bloomberg New Energy Finance (2018). Asia is the largest-investing region since 2015.
[2] *Local Impact, Global Leadership*, WindEurope (2017). All following non-referred figures are extracted from this report.

12% of all the electricity Europe consumes now comes from wind energy, helping to displace emissions from oil, gas and coal power. Between 2011 and 2016, it generated 1,451 TWh, avoiding over 819 million tons of CO2. This is equivalent to 22 million average cars taken off the roads each year.

Wind energy not only saves CO2 but other pollutants too, particularly from large combustion plants, which are responsible for a significant proportion of sulphur dioxide, nitrogen oxides and fine particulate matter pollution. The latter caused 399,000 premature deaths in the EU in 2014[3].

Replacing fossil fuels by domestic renewable electricity for heating, transport and industry processes also strengthens EU energy independence. According to the European Commission, the EU imports 54% of all the energy it consumes. This costs citizens more than €1 billion a day. Between 2011 and 2016, wind energy avoided 171,951 Ktoe fossil fuel imports in the EU, translating to €32bn in cost savings.

Onshore wind is now the most affordable form of new power generation in Europe. The 2020 national renewables targets prove efficient in mandating the volumes required to fully unleash technology costs reduction. This economy of scale effect is further reinforced by the introduction of auctions, which foster competition between developers (although project realisation rates have to be considered carefully).

Offshore wind is not far behind: its costs have fallen 60% in three years. And the latest German and Dutch offshore auctions open the door to the construction of the first wind farms without financial support. Nonetheless, these "zero-subsidy" bids are possible only for some developers in some markets, not least where governments take on and manage a share of the project risk[4].

Investors can also finance more capacity with a lower outlay thanks to an increased competition between financial institutions and the implementation of revenue stabilisation mechanisms. This results in lower policy costs since a 2.4% change in cost of capital leads on average to €1.3bn of savings per year[5].

These cost reductions are good news for electricity consumers[6]. Higher wind penetration put downward pressure on day-ahead prices. On average, a 1% increase of renewables share in EU power mix translates in a decrease of wholesale prices by 0.4 €/MWh[7]. They also provide hedging against fuel prices volatility.

Large energy consumers increasingly appreciate this and have signed 2.6 GW of Power Purchase Agreement (PPAs) in wind energy over the last four years[8]. In exchange for a stable and better price, they offer investors a guaranteed off-take and longer-term security which lowers financing costs.

Challenges

As technology matures, investors are taking on more risks that used to be socialised. From 2020 onwards, the phase-out of priority dispatch and balancing exemptions will expose new installations to higher volume and operational risks. And with the decline of Feed-in Tariffs, 50% of new wind capacity was already partly exposed to market price risk in 2017, via market-based premium or green certificates.

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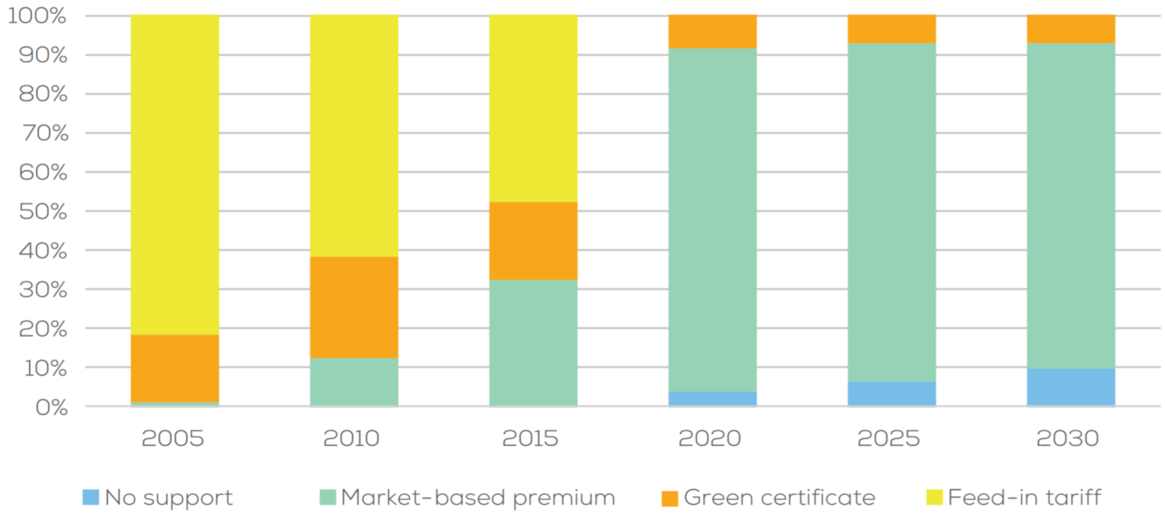
[3] *Air quality in Europe*, European Environmental Agency (2017).
[4] Grid connection costs are socialised in both countries; also, no final investment decision has been made yet.
[5] Diacore project findings (2016). A 10% financing rate vs. 3% increase onshore wind LCOE by approx. 70% (WindEurope, 2017)
[6] The impact of such wholesale price variation on the final price paid by consumers will vary depending on their tariff structure.
[7] *Energy prices and costs in Europe*, European Commission (2016). This merit order effect is 0.6-0.8 €/MWh in other regions
[8] *Financing and investment trends*, WindEurope (2018). 1.3 GW of which in 2017 alone.

Figure 2 Share of new wind capacity per type of support



Source WindEurope (2017)

However, short-term spot market prices on their own do not provide a basis for investment. They are too low and volatile to provide adequate returns, and signals for recovery remain weak and uncertain. In the absence of policies aimed at addressing market failures (see below), there would be no merchant investments in any power generation asset, including conventional technologies.

The bar for investment in wind energy assets is even harder to clear. They are upfront capital-intensive assets, and current hedging options are limited or not perceived as feasible[9]. This leaves these class of assets even more exposed to monetary policy orientation[10]. Full exposure to merchant conditions would raise financing costs by deterring low-risk investors and stall investments into new capacities.

Also, under todays' market design, the market value of wind energy tends to decrease as its penetration rate increases: wind farms capture lower spot market prices than other market players. This revenue attrition of wind energy projects requires to complement, not substitute, their spot market revenues with a long-term revenue stabilisation mechanism until the power system provides a level playing field.

Tackling the following market failures is indispensable before merchant investments in wind energy can represent significant volumes:

- The uncoordinated introduction of Capacity Remuneration Mechanisms, and market exit barriers for existing assets, tend to extend the **overcapacity** of power generation in Europe to the detriment of consumers' bills[11]. Also, some regions experience high levels of **price-inelastic production** that impede higher renewables penetration (see section 1.2).
- Bottlenecks exist due to **inadequate grid infrastructure,** within and across national boundaries. This hampers all the potential cost savings that a common power market could offer, including the smoothing out of variable power production by wind power generation.

[9] Hedging products targeting wind energy exist, but their liquidity has not picked up so far (e.g. EEX Wind Power Futures).
[10] For instance, the quantitative easing by the European Central Bank has allowed to significantly reduce investor's risk.
[11] Where needed and as a last resort option, CRM should be designed to support clean and flexible energy resources, including renewables.

The EU ETS remains the central EU policy to regulate CO2 emissions and deliver effective transition signals. Thanks to a series of reforms, the carbon price has known a recent uptick to 16.03 €/tCO2[12]. This is a step in the right direction but further efforts are needed to make sure the ETS drives out Europe's most polluting assets and also promotes decarbonisation beyond the power sector.

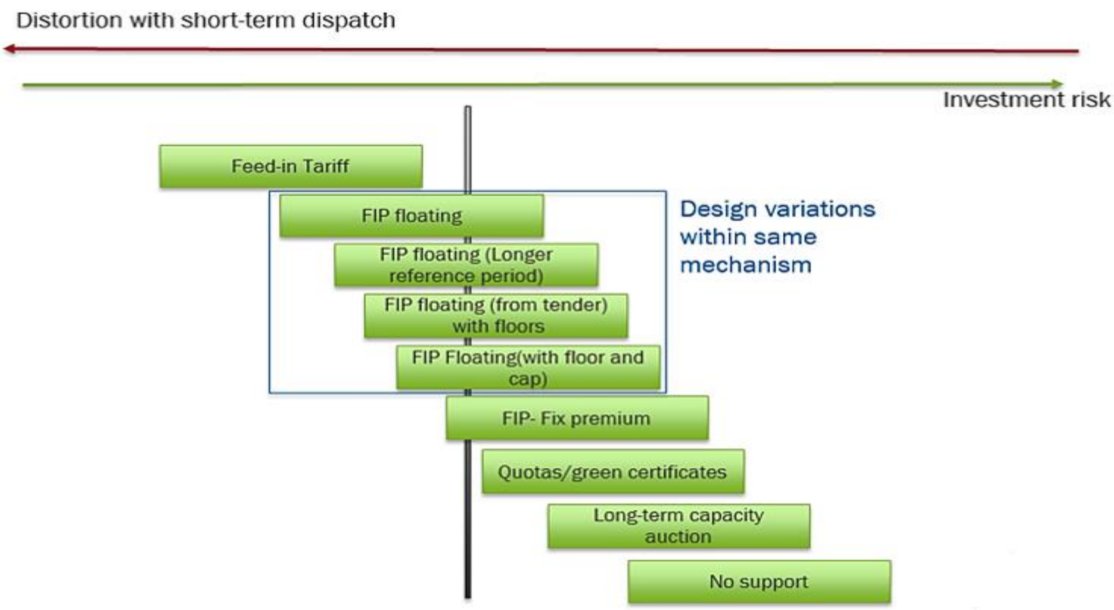
Way forward and policy solutions

Higher ambition on renewables will offer greater macro-economic benefits. By 2030, and with the right policies sustaining the European industry's competitiveness, the sector could employ up to 569,000 people. And this goes together with benefits for related sectors: every €1,000 invested in wind creates €250 value for the wider supply chain e.g. chemicals, steel, construction. Member States have all interest in deploying larger volumes of wind energy as part of their NECPs.

Contracting of wind energy via auctions is critical to maintain a competitive industrial base. Individual projects rely on the available regulatory framework at the time of the investment decision. But decisions to invest in factories, test facilities, logistics, skills development, research and innovation rely on multiple projects moving to construction over several successive years. Regular auctions can best provide the visibility to sustain cost reductions, and ensure fair competition[13].

Revenue stabilisation mechanisms have to strike the right balance between investors' need for certainty and lower costs for society. They are indispensable to lower financing costs, which in turn results in lower prices for consumers. But they should also avoid extraordinary revenues and encourage realistic bidding, either via a two-sided Contract for Difference or a well-designed premium e.g. determined vis-à-vis an electricity price floor and avoiding dispatch distortions during negative prices.

Figure 3 Impact of revenue stabilisation mechanisms on financing costs and spot market



Source Market4RES (2016)

[12] May 25th 2018, EEX (source)
[13] They also allow governments to reach optimal power mix which reap the benefits of complementary technologies

Consumers will also benefit from a diversification of revenue stabilisation mechanisms. Other revenue sources can help reducing further the price of wind energy: corporate PPAs underpinned by Guarantees of Origins (GOs), ancillary services etc. In the Netherlands, corporate PPA revenues can be combined with a Feed-in Premium. The value of the GOs, which is required from the generator by the PPA off-taker, is factored in the developer's bid.

This need for long-term visibility is not exclusive to wind energy. Other sectors with similar cost structure[14] rely on economic instruments that minimise, not eliminate, the investment risk: turnkey construction contracts, concessions, public-private partnerships etc. All pursue the same end goal, i.e. developing or improving infrastructure while reducing the costs for taxpayers that benefit from them.

Wind assets investors and owners are increasingly exposed to merchant risk. Purely merchant investments may already materialise in some Member States by 2020, where market conditions are favourable. This would change both the landscape and investor profiles of wind energy financing. Power exchanges and other hedging products providers may also play a key role in devising tools closer to wind energy assets needs in such context, including for projects whose mechanism's period comes to an end.

[1414] For instance, highways, airports, sewage water treatment etc., which are characterised by heavy investment up-front compared to low running OPEX.

POLICY RECOMMENDATIONS

In the short-term, **adjustments to the design of revenue stabilisation mechanisms and auctions** should be considered as part of the next **state aid guidelines** and **National Energy and Climate Plans**.

Revenue stabilisation mechanisms

- They should minimise risks for investors to attract low cost capital, while striking a right balance with limiting potential dispatch distortions and impact on public finance;
- Extraordinary revenues can be avoided by setting a cap to the incentive received and/or allowing the premium to become negative such as in a two-sided Contract for Difference;
- Imposing operational constraints should be avoided to spur competition between assets (and *in fine* reduce the price paid by consumers);
- The participation of wind farms operators in other markets, such as the balancing market, should be allowed without resulting in a loss of the financial support;
- The treatment of the incentive during negative prices hours should minimise financing costs. In any case, the rule should be the same in the entire EU to avoid price distortions across borders;
- Their design should be flexible enough to address national circumstances.

Auctions

- Member States should provide as part of their National Energy and Climate Plans a schedule of at least 3 years for revenue stabilisation mechanisms to renewable energy.
- Auctions should be tailor-made to renewable energy technologies to optimise the deployment of generation assets at the least cost for society;
- Compulsory permits should be considered best practice for prequalification rounds to secure high realisation rates in a timely manner.

Corporate Power Purchase Agreements

- Renewable power generators should be able to combine revenue from corporate renewable PPAs with policy-drive revenue stabilisation mechanisms;
- Guarantees of origin should be the reference system to ensure the traceability of green power underpinning corporate renewable PPAs. They should be issued by Member States to all renewables producers which should be able to factor them in their bidding strategies.

In parallel, **structural reforms** must be implemented to improve the overall efficiency of the power system over the longer-term:

- Upgrading EU electricity grid and its operational rules to enable high renewables penetration thanks to a market built around renewables and where flexibility is properly incentivised;
- Tackling current overcapacity of power generation by ensuring a cautious and EU-coordinated approach to system adequacy and a last resort use of CRMs;
- Ensuring the ETS can deliver a high and stable enough carbon price to support market-based investments in renewable energy;
- Developing smart electrification and flexibility strategies (e.g. Demand Response, storage) to stabilise the market value of wind.

1. REVENUE STABILISATION MECHANISMS

Because an Energy-Only Market approach is unlikely to deliver long-term investment signals[15], market-friendly revenue stabilisation mechanisms will still be needed by investors to secure their revenues (1.1). But structural reforms may reduce their role in the longer term (1.2).

1.1. MITIGATING THE PRICE RISK

The design of revenue stabilisation mechanisms and their effects will depend on national framework conditions and the pursued objectives: minimising projects' financing costs, promoting effective technology, easing grid integration, optimising system costs etc.

One can distinguish two main approaches: production-based and investment-based mechanisms[16]**.** The former provide operators with an operating premium for the actual output sold on the market, which can be fixed and defined ex-ante (Denmark, onshore), or sliding[17] i.e. evolving as the difference between a strike price and a reference market price. Investment-based scheme provides an investment compensation based on the installed capacity and the expected energy production (Spain)[18].

The former expose more to the volume risk and the latter expose more to the price risk. But both aim at filling the financial gap between the anticipated project costs and its expected or realised market revenues over a given period. The nature and delivery conditions of the mechanisms will have a crucial influence on the risk allocation between investors and consumers, consequently on the price paid for wind energy, as well as on dispatch optimisation.

The trade-off between investor certainty, the effectiveness of the scheme and efficiency lie in features such as:

- **What the premium remunerates for**: all MWh produced (France, Germany) or a certain number of full load hours (Denmark). The former minimises investors' risks while the latter incentivises demand-oriented feed-in and facilitates wind farms participation in markets such as balancing or redispatch (although at a higher risk for investors);
- **Against which benchmark the reference market price is calculated**: the average baseload price (the Netherlands) or the specific price received by wind farms in each specific hour (e.g. Italy).
- **The frequency of the premium is adjusted**: investors' risk is minimised if the premium covers hourly price deviations (UK), while longer period encourages to perform better than the market outcome with sophisticated bidding strategies (month in Germany, year in Spain).

To ensure a greater control of policy costs, some countries are also implementing[19]:

[15] See also *Creating a business case for wind after 2020*, WindEurope (2017)

[16] See *Revisiting support policies for RES-E adulthood,* MIT Energy Initiative (2016). Green certificates are voluntarily excluded from our analysis since their use is restrained to a few countries and they tend to be phased out.

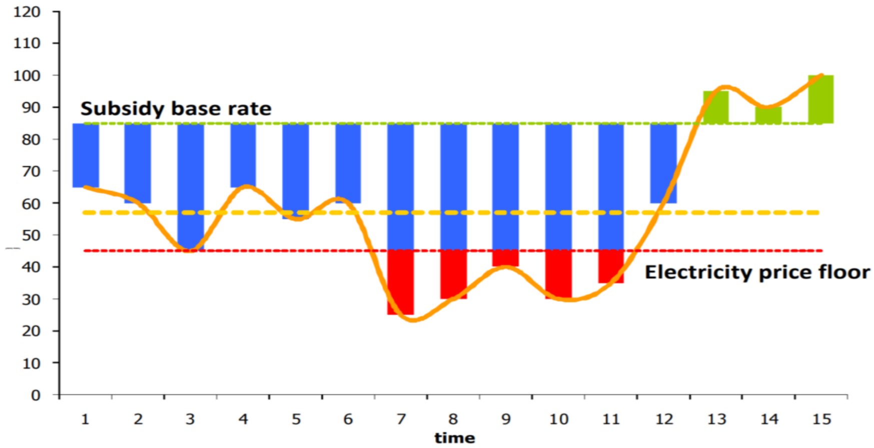
[17] Germany (Market Premium), the Netherlands (SDE+), France ("complément de remuneration"), the UK (CfD) etc.

[18] It may imply significant administrative burden for regulators to develop accurate benchmark for all type of installations.

[19] A so-called "reasonable rate of return" can also be defined e.g. in Spain, where it is reviewed every six years, creating significant uncertainty for investors

A price floor[20] over the whole contract period (the Netherlands), which implies a non-negligible risk to the investor as the electricity price may drop below what is sufficient to provide full coverage of the 'financial gap'; or

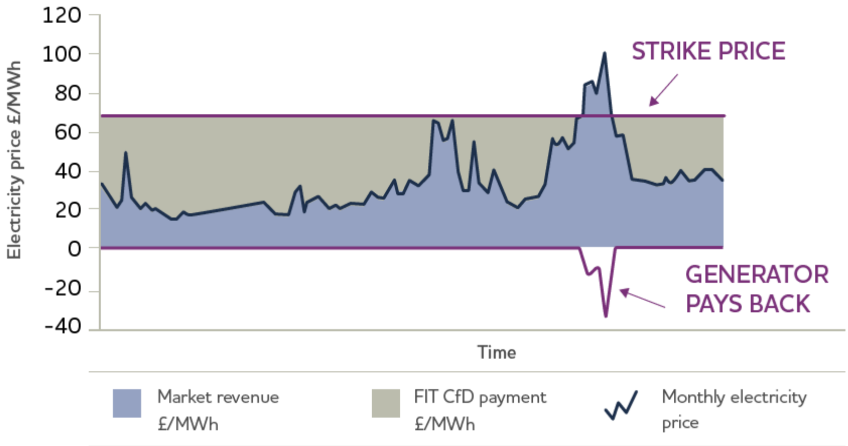
Figure 4 SDE+ scheme



Source Energy Research Centre of the Netherlands (2011)

A two-sided Contract for Difference whereby the premium can become negative, i.e. the operator pays back any excess revenues above the strike price (UK).

Figure 5 Contract for Difference



Source UK government white paper (2011)

Recommendations

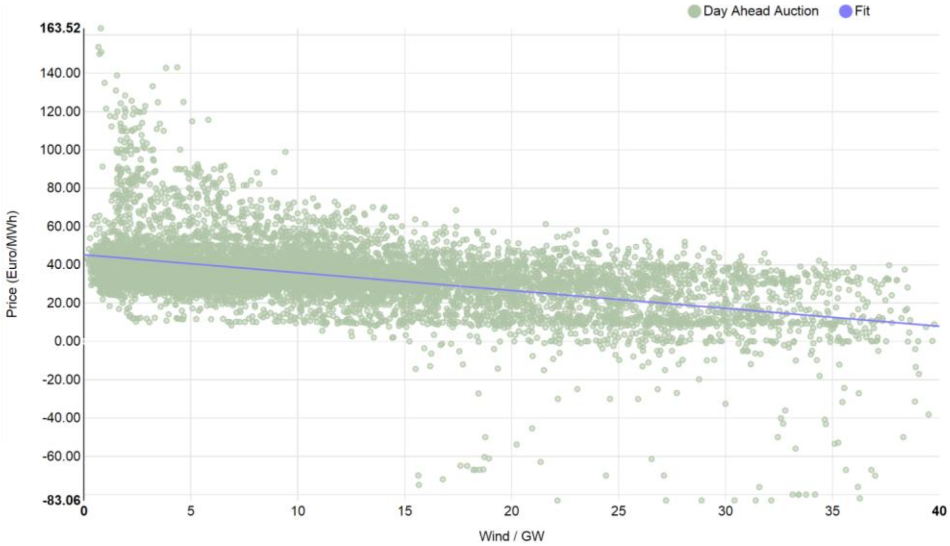
- Revenue stabilisation mechanisms should minimise risks for investors to attract low cost capital, while striking the right balance with limiting potential dispatch distortions and impact on public finance;
- Extraordinary revenues can be avoided by setting a cap to the incentive received and/or allowing the premium to become negative such as in a two-sided Contract for Difference;
- Imposing operational constraints should be avoided to spur competition between assets (and ultimately reduce the price paid by consumers);
- The participation of wind farms operators in other markets, such as the balancing market, should be allowed without resulting in a loss of the financial support;
- Their design should be flexible enough to address national circumstances.

[20] The compensation (blue bars) is determined as the difference between the expected projects costs (green dotted line) and the yearly average electricity price (orange line). A price floor (red dotted line) is determined as 2/3 of the long-term average electricity price (orange dotted line). During years 7 to 11, the compensation is capped and does not suffice to cover expected projects costs (red bars). However, during years 13 to 15, the plant income is larger than expected (green bars).

1.2. RESTORING THE VALUE OF WIND

Several studies have anticipated that the revenues of wind power generators on spot markets, here after called “market value”, would decline with increasing deployment. Market data confirm this value drop, however it is stronger in power markets that are dominated by inflexible baseload power plants, while it remains limited in countries with more flexible generation and higher demand responsiveness. On average, 1 MWh of electricity from wind energy is “worth” 18% more in Sweden than in Germany[21].

Figure 6 Spot prices vs. wind energy in Germany in 2017



Source Energy Charts, Fraunhofer ISE (2018)

The remedial actions to limit such revenues attrition consist first in making the system more fit for variable renewables: an improved assessment of resource adequacy and further cross-border cooperation to limit oversized CRMs, incentives to electrification (esp. in the industry) that allows large-scale demand response, investments in smart grids, interconnections[22], storage capacity and robust carbon pricing. It also helps both market value and the system adequacy to develop a portfolio of renewables technologies e.g. wind and solar PV show a seasonal complementarity of their monthly production values.

But wind energy development should also be more system-friendly. The Danish Feed-in Premium incentivises wind turbines with larger rotors that can tap into lower wind speeds, but smaller generators, to distribute their output more evenly and increase the market value[23]. Carefully designed incentives can also be introduced to favor a geographically diverse distribution or ancillary services capabilities.

The treatment of negative prices events is also critical. In Germany, those occurred 146 hours in 2017, which translates into 1.6% of total time[24]. One root cause of this phenomenon is that baseload conventional power plants continue to feed power into the grid either for technical (to provide ancillary

[21] *The market value of wind power in the Nordic region*, L. Hirth (2016)

[22] Denmark achieved a wind value factor of 80% with 35% penetration, due to the flexible underlying electric system and strong interconnections to hydro-dominated neighbouring countries. Berkeley Lab for IEA (2017)

[23] Advanced turbine design would increase wind market value of 13% in Germany by 2030 vs. business as usual (IEA, 2017)

[24] Agora Energiewende (2018). It’s an increase by 50% vs. 2016. The average negative power price was - 27 €/MWh

services or heat cogeneration) or economic reasons (marginal loss due to high ramping costs and already hedged position on future markets)[25].

The state aid guidelines require that "*measures are put in place to ensure that generators have no incentive to generate electricity under negative prices*". Suspending the incentive during these hours may significantly increase financing costs. Also, system stability issues start arising in Germany because this rule triggers large price-driven swings of wind energy production that cause frequency deviations[26].

To minimise the impact on financing costs, some countries found a compromise with the so-called "6 hours rule" whereby operators keep their premium up to 6 consecutive hours of negative prices (Germany, UK, the Netherlands). But this has significant drawbacks as well: operators are incentivised to produce as long as the premium compensates for the negative price; and negative prices start occurring in neighbouring countries in which wind energy producers will have to reduce their production.

Alternatives exist. In France, operators will receive no premium on top of the market price only for the first 20 hours of negative prices in a year. This provides investors with visibility on this risk. Academics also suggest that TSOs are allowed to curtail a limited proportion of wind energy when prices go negative, and that the cost of this curtailment is socialised within the support received by all generators[27].

Recommendation

- The treatment of the incentive during negative prices hours should minimise financing costs. In any case, the rule should be the same in the entire EU to avoid price distortions across borders.

2. AUCTION DESIGN

Auctions will be a building block to reach the EU's decarbonisation goals. Deployment scale, innovative technologies and upgraded energy infrastructure will be necessary if the EU is to achieve its goal of a fully decarbonized energy system by 2050. Managing successfully the transition period to 2030 will make or break the EU's ability to fulfil its long-term energy system vision.

Reaching the intermediary 2030 climate and energy objectives means that almost 50% of domestic electricity will come from renewables. This requires €254 bn of private investment in the electricity sector alone according to the European Commission. Auctions will have a critical role in attracting private financing and enabling the shift towards a renewable energy system cost-effectively.

An optimised auction design is necessary to secure cost reduction alongside build-out. Since 2014, 8 Member States launched competitive bidding mechanisms for wind energy as prescribed by the EU's State aid guidelines. The transition towards auctions has not been straightforward: many countries have struggled with auction design and have enacted changes in view of accommodating different policy objectives beyond the price-only award criteria. In smaller markets with low liquidity and no homogenous

[25] *Monitoring report*, BNetzA (2017). 23 to 28 GW, with only a very small required for technical network-related reasons
[26] *Man-made wind eclipse: market triggered step response of electric power systems*, Gunnar Kaestle (2017)
[27] This option would increase LCOE by only 5% vs. 17% for the 6h rule, Climate Policy Initiative (2016)

bidding structure tenders might not even be an effective support allocation mechanism. EU Governments and industry are still learning and additional practice will be necessary to make tenders fit national circumstances.

2.1. RECOMMENDATIONS FOR AUCTION DESIGN

In addition to the good practice tender design principles[28] the industry identified back in 2015, the accumulated experience reveals non-regret features of auction design for immediate application by national policy-makers:

a) **Visibility on auction rounds:** forward stability and transparency on auction rounds are key to industrial planning. This allows the wind industry to realise long-term investments in factories, skills development, test facilities, research and innovation. Investments create jobs and deliver revenues to national budgets. But also optimise economies of scale and efficiencies across the supply chain that allow the industry to drive costs down. The quick implementation of a long-term schedule for public support allocation over multiple years, including the timing, capacity and budget for auctions as prescribed in the post-2020 Renewable Energy Directive, should be a top priority for national governments in view of tapping into the economic benefits of wind energy and enabling a cost-effective energy transition.

b) **Clear auction design and rules**: the more complex the auction design is, the more risk a participant must reflect in his bid thus increasing final prices. Transparency, simplicity and clarity of design and support allocation rules instead go a long way in attracting bidders and cutting costs.

   The auction design process should include consultation and open dialogue between governments and investors on design. Through an iterative process, sides should strive to secure simple and straightforward selection criteria (e.g. payment arrangements, price-finding mechanisms) and clear features of the remuneration scheme. Price-only should be the preferred award mechanism. It offers an objective comparison between bids as opposed to qualitative assessment between projects. Quantitative criteria also eliminate the risk of court appeals.

   It remains of utmost importance to investor confidence and auction realisation rates that the remuneration awarded in a tender is not subject to retroactive modifications. Costs achieved in a competitive setting represent the most efficient outcome for renewable sourcing to end-users.

c) **Technology baskets:** Auctions, be they technology-specific or technology-neutral, should take into account the technical characteristic of technologies (e.g. risk profile, project lead times, size, costs) and put into competition comparable technologies. Member States should have the possibility to enact tailor-made technology auctions to enable the deployment of flexible generation at the least cost for society in the medium- to long-term. This will enable the transition towards a power system with a broad mix of technologies with different generation profiles that complement each other on the grid.

[28] *Design options for wind energy tenders*, EWEA (2015)

The post-2020 EU renewables regulatory framework offers an opportunity for Member States to align renewables deployment with infrastructure planning as part of 2030 National Energy and Climate Plans. The post-2020 Renewable Energy Directive should back up the planning principles with clear rules on support mechanism design that provide investor certainty on the stability of future support schemes. As a supporting instrument to the implementation of the Directive, the State aid guidelines for the post-2020 period should be fully aligned with the sectorial legislation.

d) **Compulsory permits as prequalification criteria:** auctions are only successful if contracted volumes get built. This should be guaranteed by pre-obtained permits which ensure that bidders are competing against each other on a level playing field and wind projects will be delivered in a timely manner.

   Mandatory permitting is of particular importance to onshore wind. It compensates for project realisation delays resulting from lengthy approval between different administrative levels. In contrast, governments should apply flexibility on compulsory permitting for offshore wind due to longer lead times, in particular in the project feasibility phase.
   The simplification of administrative and permitting procedures is a prerequisite to investors' ability to bid in auction rounds. Burdensome procedures should be streamlined and include at the very least a one-stop-shop arrangement that coordinates multi-level authorisation process. National authorities should aim to shorten permitting timelines and align them with the national schedules for public support allocation.

e) **Set construction times**: concrete realisation deadlines are a best practice in some EU countries. They guarantee the construction of wind farms under short periods of time to reach specific government objectives.

   Lead times could ensure that there would be no mismatch between the latest technology available on the market and what is installed on the ground. Pending on swifter permitting processes and level playing field between technologies participating in the auction, such timeframes could be, on average, three years for onshore wind and five to seven years for offshore wind under current market conditions.

   The consequences of missing construction deadlines because of unforeseen events (e.g. change in regulatory frameworks, court trials, grid connection delays) should be calibrated and should not result in disproportionate penalties for the developers.

2.2. CONSIDERATIONS FOR FUTURE AUCTION DESIGN

In view of planning a fully decarbonized energy system, future auction design should consider:

a) **Geographically balanced build-out:** the inclusion of locational signals depending on proximity to demand, wind resource availability or grid infrastructure availability could tackle the need for an even distribution of wind energy deployment. Governments should be allowed to introduce mechanisms for geographical distribution that are tailor-made to national circumstances.

b) **Repowering:** a significant portion of the EU installed wind energy fleet will come to the end of its operational lifetime between 2020 and 2030. The decommissioned assets will not count for the delivery of the EU 2030 renewable energy target. Future auctions should ensure that decommissioned volumes are added on top of the yearly national announced auction rounds. And that repowered projects can compete on par with new installations in tenders or other state aid-compatible systems.

c) **Increased grid connection performance requirements:** auction design currently does not reflect the increasing set of requirements imposed by Transmission System Operators through Grid Codes. The lack of clarity regarding future grid connection requirements might undermine the ability of developers to realise their projects at the costs foreseen in their bids today. This mismatch could be addressed in forthcoming auctions by reducing realisation time for winning projects and/or by a reasonable transition period.

d) **Cross-border auctions:** cross-border tendering remains an option for experimentation between Member States in line with the increased emphasis on regional cooperation in the post-2020 European legislation for renewables. The industry considers that voluntary opening of support schemes could serve as a first step for exploring new ways of deploying wind energy in the EU. However, cross-border auctions should tackle the impact of different regulatory regimes on the competitiveness of projects if they are to be viable to attract bidders and ensure balanced deployment across EU Member States.

We should also start exploring how it might be possible in future auction design to attribute value to the non-price benefits.

2.3. INTERPRETING AUCTION RESULTS

Because of the differences in resource potentials, market conditions, regulatory frameworks and tender design, auction results require careful interpretation.

Auction results cannot be directly transferred across-technologies or across-markets. Cost reductions are possible in every European market with the appropriate regulatory framework in place. But their scale will differ as country-specific support mechanism design, permitting procedures, wind resources, cost of capital have huge impact on return-on-investment risk and are incorporated differently into auction bids. Strike prices are also not directly comparable as auction designs provide for distinct project commissioning and delivery times, grid connection rules and inflation indexation regime that affect the economics of projects.

For instance, a zero bid in onshore wind is hardly foreseeable compared to offshore wind given territorial constraints, generation profile or numerous levels of administrative authorization required. Similarly, a zero bid in offshore wind in the UK would not be possible in comparison to Germany or the Netherlands given the developers' responsibility to provide the grid connection and the design of the support scheme itself.

Zero bids are an exception to the rule rather than the new normal. They are only possible in certain markets under specific conditions. These include the high competition in the market, the scalability of offshore wind, the optimization of the value chain and exploited synergies between existing infrastructure and transmission system assets, long lead times and expected decline in technology costs. The pre-development of sites by national authorities, including the grid connection, and a one-stop-shop for administrative procedures (e.g. the Netherlands, Germany) have incentivized winning companies / consortiums to offer offshore wind build-out with zero public support.

Merchant projects are an option for the future. The emergence, or not, of merchant projects will depend on the ability of governments to counterbalance the risk transfer from the state towards developers with adequate revenue stabilisation mechanisms. Merchant projects reflect the readiness of the industry to fulfil governments' aspiration for procuring wind energy supply at zero price when the enabling market or simplified project realisation conditions are enacted (e.g. high carbon price, improved market design). In a transition period, it is up to Member States to implement a regulatory framework that can deliver a portion of the wind energy capacity at market price.

3. FINANCING IMPLICATIONS AND PPAS

Until recently, support mechanisms for renewable energy took away most of the market risk from power generating assets. However, with the roll-out of auctions allocating market based support across Europe, more than 65% of the installed capacity will be partially exposed to power markets and more than 25% fully exposed to power markets.

While auctions can partially limit a project's exposure to price risk, uncertainty on the volume of sales remains entirely with the asset owners. As a result, merchant risk exposure – or the uncertainty on both price and volume – is likely to arise in the future. Without a long-term mechanism in place that addresses the volatility of revenues, the project runs the risk of not generating enough cash to cover all its obligations, including the servicing of debt and the dividends to shareholders. This underscores the importance of financing solutions that factor in the nature of merchant risk and stabilise the revenue flows in these projects.

3.1. AVAILABILITY AND COST OF CAPITAL

A merchant environment for wind energy financing will test both the availability and cost of capital. Financing costs make up a considerable portion of the overall cost of a project. Therefore it is critical for policy makers to have an understanding about the availability of capital and the implications in the cost of capital of merchant financing.

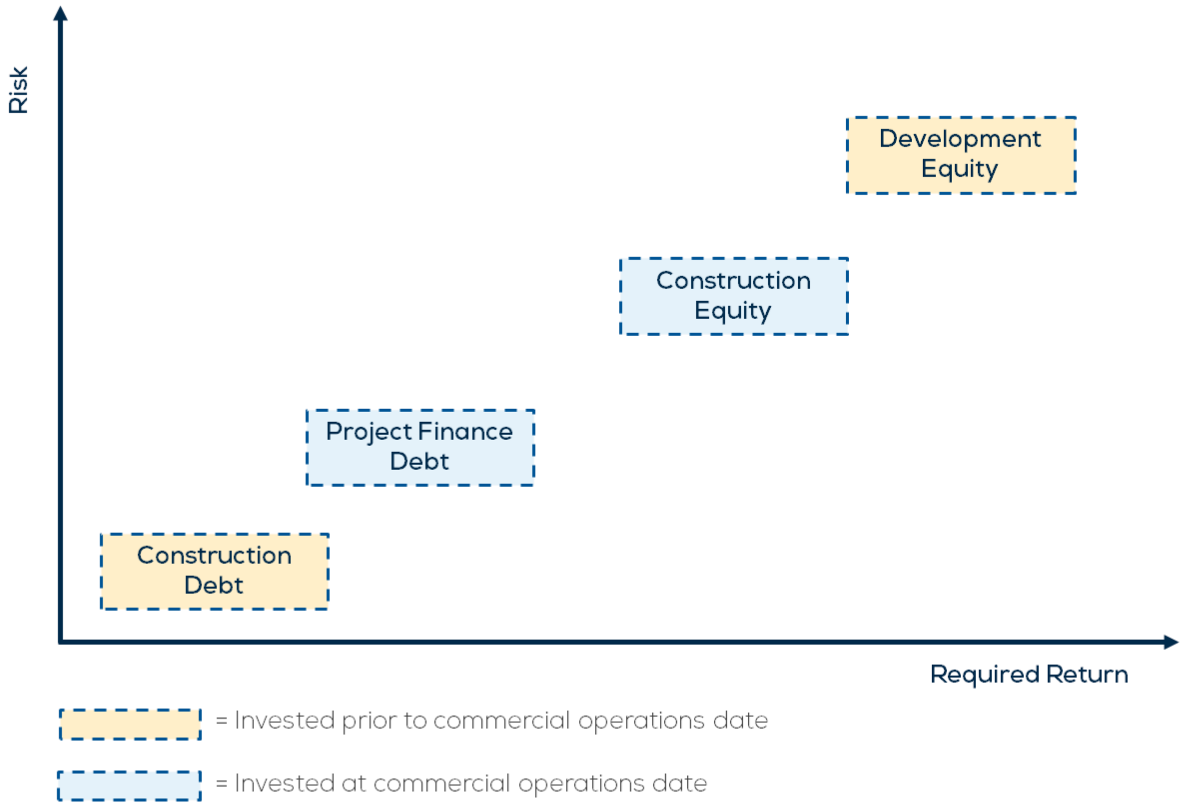
The two main sources of capital in wind energy finance in Europe have been sponsor equity and debt. The proportion of each, as well as the way in which they are used, will determine the capital structure of the project. The majority of the installed wind capacity in Europe has been financed on a non-recourse basis, typically referred to as project finance. In the last five years, project finance has leveraged on average

75% of Capex requirements for onshore wind and 30% of the Capex requirements for offshore wind projects[29].

In a project finance structure, the investment is turned into a separate business entity capable of fundraising on its own. Any bank debt will rely on the project's own capacity to generate cash, with no recourse to the other assets of the project's equity sponsors. Lenders have some collateral coverage as a financial protection in case the project is unable to meet the debt repayment schedule. If the project defaults, the lenders are the first party to be liquidated, before equity type investors. As such, debt is generally considered a lower-risk investment and therefore comes with lower-cost financing compared to equity.

Debt-to-equity ratios in such transactions may vary considerably depending on the project specifics, availability of capital and risk profile of the project owners. For wind projects they range between 70% - 80% debt and 30% - 20% equity.

Figure 2 Comparison of the relative risks and returns for typical wind energy financing sources[30]



Source Adapted from NREL (2017)

A merchant environment might introduce limitations on the availability of debt. Lenders are used to some elements of merchant financing, predominantly in the certificate based support scheme countries such as the Nordic markets or the UK's ROC regime. However, full merchant exposure might tighten the requirements for raising project debt, introduce higher cover ratios and financial covenants that a project

[29] Financing and investments trends : The European wind industry in 2017
[30] Adapted from NREL 2017

might not be able to fulfil. Sponsor equity will then have to fill in the financial voids created by less debt capacity. In a world where debt costs less than equity, this would translate into a higher cost of capital for the project.

A merchant environment will also introduce limitations on the equity side by making it harder for developers and power producers to exit projects post construction and recycle capital. The equity mix in the last years has brought in more financial investors. In 2017 institutional investors, infrastructure funds and asset managers purchased 5.5 GW of wind assets throughout construction and operation phase. That is equivalent to 60% of the total project capacity that was traded in 2017[31]. While these investors are becoming more comfortable with the technology, they remain risk averse to full merchant exposure. Unlike large energy producers, financial investors cannot benefit from hedging merchant risk within their portfolios. Given that their primary business is not energy production, the size of their portfolios as well as the geographical spread of their wind fleet is limited to a select few countries.

3.2. CORPORATE PPAs AS AN ADDITIONAL REVENUE STREAM

Elements of merchant financing that are starting to emerge in the wind sector will require some form of additional revenue stabilisation complementary to support mechanisms. Corporate renewable PPAs come with certain benefits for generators to hedge the volatility of their revenues. Price visibility over a long period of time and a guaranteed off-take are important to lower the cost of debt financing. Lenders would typically need protection for a downside in project revenues to ensure debt repayment obligations are met. As such, lenders tend to prefer lower revenues over a long period of time rather than higher but uncertain revenues.

Corporate renewable PPAs to date is still a niche market and not to the scale necessary to replace other policy driven revenue stabilisation mechanisms. Such contracts are still limited to a handful of countries. The Nordic region, followed by the UK and the Netherlands are the biggest market for such deals. These markets share a good track record in renewable energy development, coupled electricity markets, sufficient demand for green electricity from corporates and, most importantly, a lack of explicit regulatory barriers to sign corporate renewable PPAs.

Another major incentive for corporate renewable PPAs is the underlying support mechanisms in the country. Until recently, priority dispatch and administratively set tariffs have crowded out the role of such contracts. In Feed-in Tariff jurisdictions it is not relevant for the developer to lock in a long term power hedge with a corporate off-taker. Conversely, green certificate based support regimes such as in the Nordic region or the UK ROC scheme usually call for a long term power hedge for price certainty. This explains the significant uptake of corporate renewable PPAs in these countries in the last years.

Market-based mechanisms that combine a variable market price and an awarded premium are increasingly being used in many Member States. However, these mechanisms too can have their limitations as to the uncertainty they can reduce in the long term.

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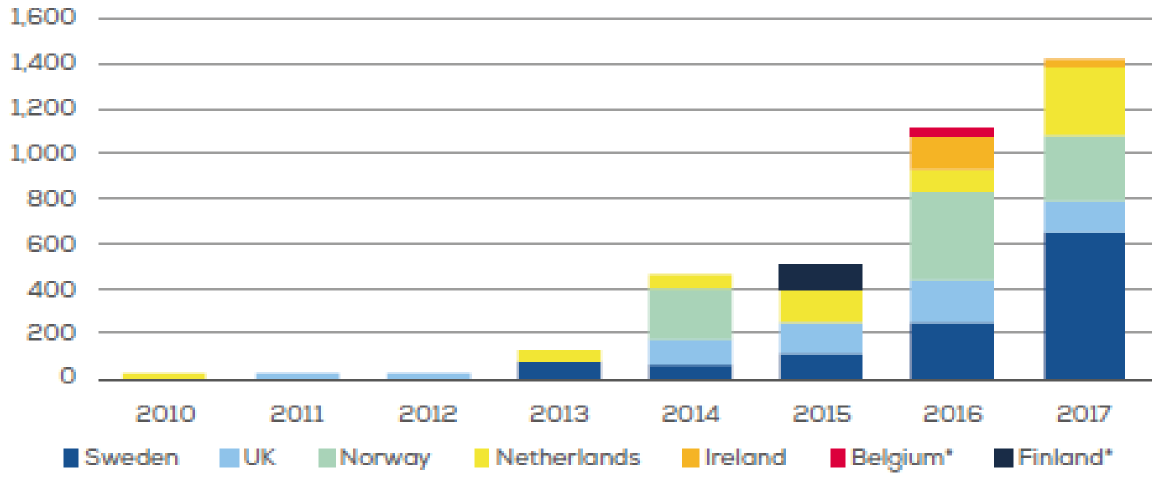
[31] Financing and investment trends in the wind energy industry in 2017

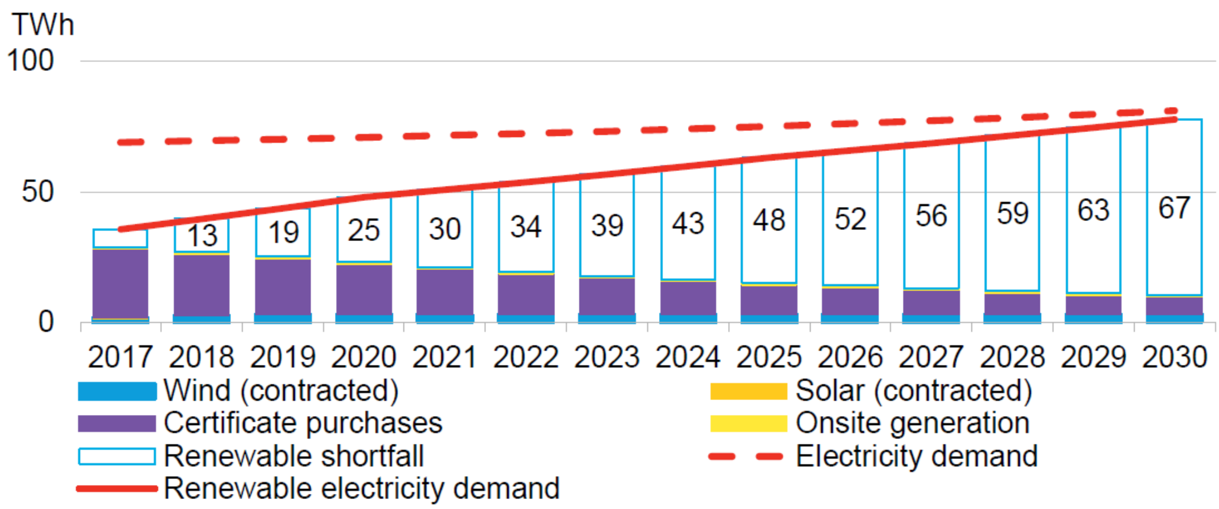
Figure 3 Renewable energy corporate sourcing through power purchase agreements (in MW)[32]



Source WindEurope (2018)

The commitment of significant global corporations to renewable energy is set to increase in the coming years. Demand for renewable electricity generation Europe-based companies involved in the RE-100 initiative could be comparable to the electricity consumption of Belgium according to Bloomberg New Energy Finance[33]. Given the importance that these corporates bring to supporting renewable energy government targets, policies that nurture the growth of this market should be put into place.

Figure 4 Market potential of renewable energy corporate sourcing[34]



Source Bloomberg New Energy Finance, Bloomberg Terminal, the Climate Group (2018)

[32] Financing and investments trends in the wind energy industry in 2017

[33] Electricity consumption in Belgium is reported at around 70 TWh annually. Available at https://economie.fgov.be

[34] Certificates includes utility contracts and unbundled guarantees of origin. Certificates assumed to step down 10% each year, while contracted solar, wind and onsite generation remain steady through 2030.

A key is to ensure that future revenue stabilisation mechanisms allows for the revenue from a corporate renewable PPA to stand in conjunction with any form of government support. For instance, the SDE+ scheme in the Netherlands includes a floor price to support. Corporate PPAs have been used in the country to mitigate the risk for a project of power prices falling below the floor price.

To ensure there is no double compensation when placing the bids, project owners factor in both the expected revenue of the PPA and the Guarantees of Origin (GO). Guarantees of origin are a critical tracing mechanism for corporates with internal sustainability targets. These off-takers will tend to buy bundled products: both the electricity produced as well as the GO that verifies the source of electricity.

Therefore, a normal PPA in the Netherlands will offer the following:

Price per MWh = Yearly average spot price – balancing cost + GO price.

Where the GOs have a value, the level of needed support is reduced by the equivalent revenue from the GOs through the PPA. The SDE+ scheme provides only the extra funds needed to reach the LCOE.

Where market based support comes with certain limitations, corporate off-takers can provide the revenue stability a project needs to raise the much needed financing. A project should be allowed to sell part of their energy production to a corporate buyer, with the remaining production to be sold with some form of government support. This combination, where a government off-taker sits next to a corporate off-taker also come with the benefit of reduced government expenses for renewable energy support.

Recommendations:

- Renewable power generators should be able to combine revenue from corporate renewable PPAs with policy-driven revenue stabilisation mechanisms;
- Guarantees of origin should be the reference system to ensure the traceability of green power underpinning corporate renewable PPAs. They should be issued by Member States to all renewables producers which should be able to factor them in their bidding strategies.