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Utility-scale

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Executive Summary

1 Executive Summary

This Study is part of the Grid Parity Monitor Series, which currently includes more than 11 publications, and is the first one to be exclusively focused on the wind market. This report analyzes wind energy competitiveness in wholesale energy markets and provides an outline of the electricity regulation in different countries: Brazil, France, Germany, India, Mexico, Spain, and the US (Texas).

The previous GPM reports were centered on the different market segments (residential, commercial, and utility-scale) within the PV sector. The present report analyzes wind energy generation of multi-MW wind power parks (WPP) and assesses its cost-competitiveness against alternative generation sources.

The approach of this GPM issue differs considerably from the residential and commercial GPM's methodologies: while for these two the LCOE is calculated to analyse the so-called *grid parity* proximity, the analysis of this issue focuses on *generation parity,* as does the PV utility scale report. In doing so, the report determines a theoretical tariff which fulfils profitability requirements for wind investors. This *required tariff* is compared to local wholesale prices in order to determine if *generation parity* exists in the country.

In conducting the analysis, the following important considerations were taken:

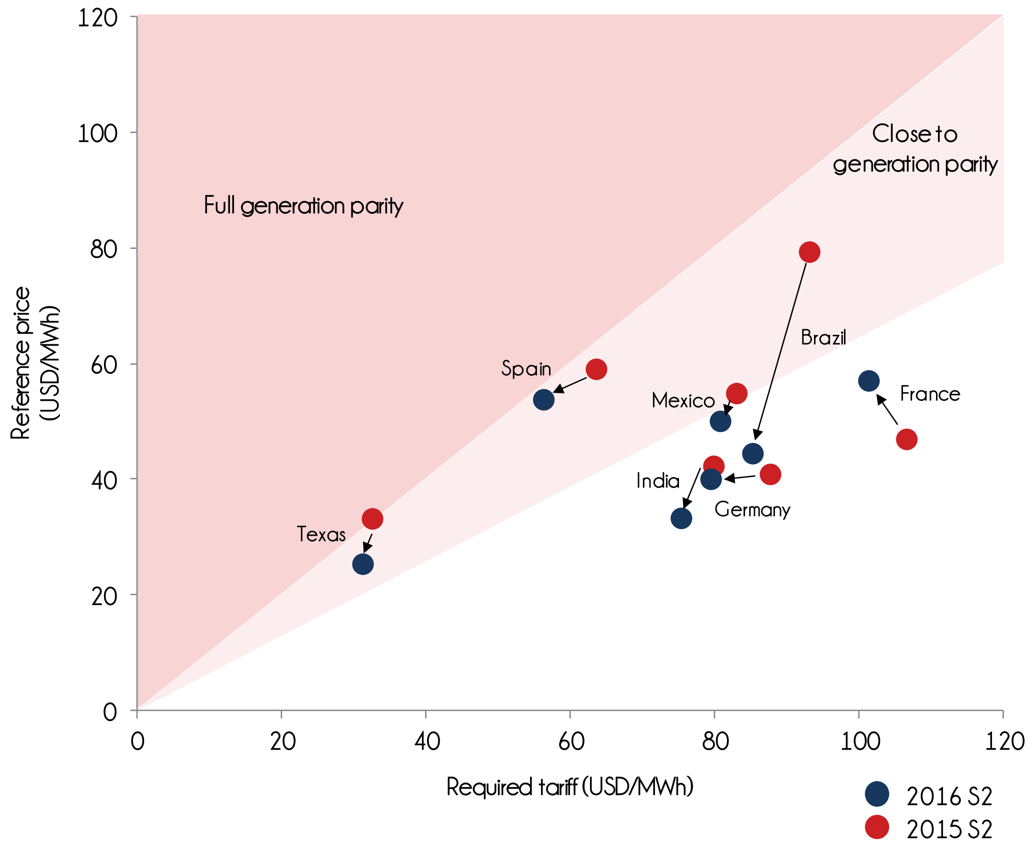
- The required tariff is calculated based on the economics of the WPP under a project finance scheme, currently the most common form of financing. Other financing possibilities that could significantly improve generation parity results have not been analyzed in this report[1].
- The analysis is for utility-scale wind projects located onshore only, as the offshore segment is in a nascent stage particularly outside Europe (future issues of the GPM Series may address this segment, as commercial viability increases).
- All data are expressed in local monetary units and in nominal terms.

[1] That is the case of bond-financed plants, commonly used by utilities and which could lower *required tariffs* by 30% to 40%.

The results of the GPM analysis (summarized in the Figure below) show that currently only certain WPP in Spain have achieved a full *generation parity* situation . The US has partly achived generation parity, even though its wind installations are being pushed out of parity as a result of the massive decrease in the reference price.

The required tariff has decreased compared to that of the past year in all analyzed markets.

Figure 1: Generation parity proximity in the countries analyzed



Source: CREARA analysis

The following conclusions on the wind utility-scale segment (30 MW plants) can be drawn from the analysis:

- The evolution of the exchange rate coupled with the decrease in the reference price, has hindered the required tariff for wind investors, preventing Brazil to reach generation parity.

- Although the required tariff in France has decreased, wind utility-scale generation is currently not competitive in the spot market since the required tariff for a wind investor is still higher than the reference price. The increase in electricity prices foreseen for 2017 should boost the attractiveness of this country for utility-scale wind generation.

- Although the required tariff for a wind investor in Germany has decreased, the low wholesale prices and capacity factors, compared with the rest of the locations considered throughout the report, still prevent generation parity in the country. However, it is expected that the introduction of the auction system for wind installations will drive the market in the short-term.

- In India, the sharp decrease in pool market prices coupled with high capital costs (both for equity and debt) and the strong position of the dollar have resulted in the country moving further away from generation parity in the last semesters, despite the decline in the required tariff.

- The liberalization of the energy sector in Mexico has led to more stable reference prices, which are however below required tariff levels.Generation parity proximity in the country should be improved if the Mexican Peso appreciates relative to the US Dollar.

- The decrease in the price of wind turbines has been an important driver of generation parity in Spain in the last semesters, although to a different extent within the country. The auctions that will be held later this year will incentivize the installation of new WPP, fostering the development of the technology in the country.

- Although Texas shows the lowest required tariff of this GPM analysis, the drop in wholesale prices still prevents generation parity from happening in the country. The expected volatility of prices within this market advises to monitor Texas recurrently.

Wind investment costs (quoted in US Dollars, USD) have decreased in the last semesters across all countries. However, a stronger USD with respect to some of the local currencies considered in this report has hindered wind competitiveness.

It should be noted that the fact that generation parity has not been reached in a country does not imply that wind investments are not profitable. Other reasons may trigger such an investment, for example:

- Governmental incentives such are PTC (Production Tax Credit) or FiT in place.
- A convenient Power Purchase Agreement (PPA) scheme granted to the investor.
- A RPS (Renewable Portfolio Standard) system in place.
- The perspective of increasing electricity prices over the medium and long-term.

2

Introduction

2 Introduction

The Grid Parity Monitor (GPM) series was conceived to analyze the competitiveness of renewable energy generation (mainly through PV and wind technologies) in order to increase awareness of clean electricity generation possibilities. The previous GPM issues were oriented to PV energy consumers (residential, commercial, and utility-scale), while this new edition undertakes the perspective of wind power projects selling energy to wholesale markets.

This document presents the first edition of the wind GPM utility-scale series and covers onshore wind power parks (WPP) with a capacity of 30 MW. The WPPs considered reflect the characteristics (e.g. Wind Turbine Generator (WTG) technology) present in each market.

Wind investors already consider wind turbine generators as a credible technology to compete in the wholesale market in certain spots. Currently, revenues from wind projects are usually based on PPA revenues plus subsidies, which tend to be market-based (e.g. a premium over a market price). However, the characteristics of recent wind energy auctions and PPA being closed worldwide show that in some cases wind is already cost-competitive against traditional energy sources. However, given the volatility wholesale markets may present and the decline of wind prices, wind utility-scale competitiveness is a phenomenon that should be monitored overtime.

To assess the competitiveness of large-scale WPP, this study estimates the so-called *generation parity* proximity. Generation parity is achieved when profitability requirements of investors are completely fulfilled with wholesale electricity prices[2].

[2] Without considering any specific financial or fiscal incentives on wind production, such as PTC or FiT

Methodology for the generation parity analysis

- In order to evaluate generation parity proximity, the economics (P&L and cash flows) of a utility-scale WPP have been analyzed, always from an investors' perspective. For that purpose, a project finance structure has been modelled, taking into account all relevant economic considerations.
- A theoretical tariff has been calculated based on investors' requirements for this type of projects. This *required tariff* is such that the IPP would achieve at least the minimum profitability sought in order to build the WPP [3].
- As in most PPA contracts, in this analysis it has been considered that the theoretical tariff increases over time. An annual rate of 2% has been taken into account.
- This investor's *required tariff* has been compared to market prices (in order of priority: marginal prices, PPA prices, or regulated prices for large consumers) in order to determine the generation parity proximity within the analyzed locations.

This report analyzes the economics of a WPP financed under a project finance scheme. This option was chosen because it is currently the most abundant case. However, it is important to bear in mind that WPP are also sometimes financed (mainly by utilities) by corporate debt, which is significantly cheaper[4]. The values of the *required tariff* under this assumption can well be 30% to 40% lower than the ones shown in this report.

In order to get full understanding of wind generation parity proximity, an outline of the electricity market is also needed. This enables identifying which electricity prices must be chosen to evaluate wind generation parity and which are the main difficulties a WPP will face in the

[3] Please note that this approach is considerably different from past GPM's methodologies addressing the residential, commercial and utility-scale segments within PV technology (downloadable at http://www.leonardo-energy.org/photovoltaic-grid-parity-monitor)

[4] The cost of corporate bonds from large utilities can be in the range of 2-3%

considered market. This GPM report provides an abstract of the market situation of each country assessed.

It is important to remark that this GPM issue does not intend to serve as a detailed investment guide for utility-scale wind projects. The expected outcome of this report is a realistic overview of wind energy competitiveness but within a theoretical framework (i.e. without accounting for local regulations that may significantly affect the business case).

A note on Reference prices

Given the goal of this study, it is necessary to determine a *reference price* that will serve as a benchmark of the potential income that a wind IPP could obtain from the market. This *reference price* does not include specific economic incentives for renewable energy generation (such as PTC or FiT) so as to reflect actual competitiveness (without subsidies) of the technology in each market.

In order to determine if the analyzed market presents generation parity, the following market *reference prices* can be considered as a good reference:

- Marginal prices of the day-ahead market in a power exchange: uniform or locational prices, depending on the dispatch model.
- Price of PPA contracts that are negotiated freely in a liberalized market (granted by large consumers or electric utilities).

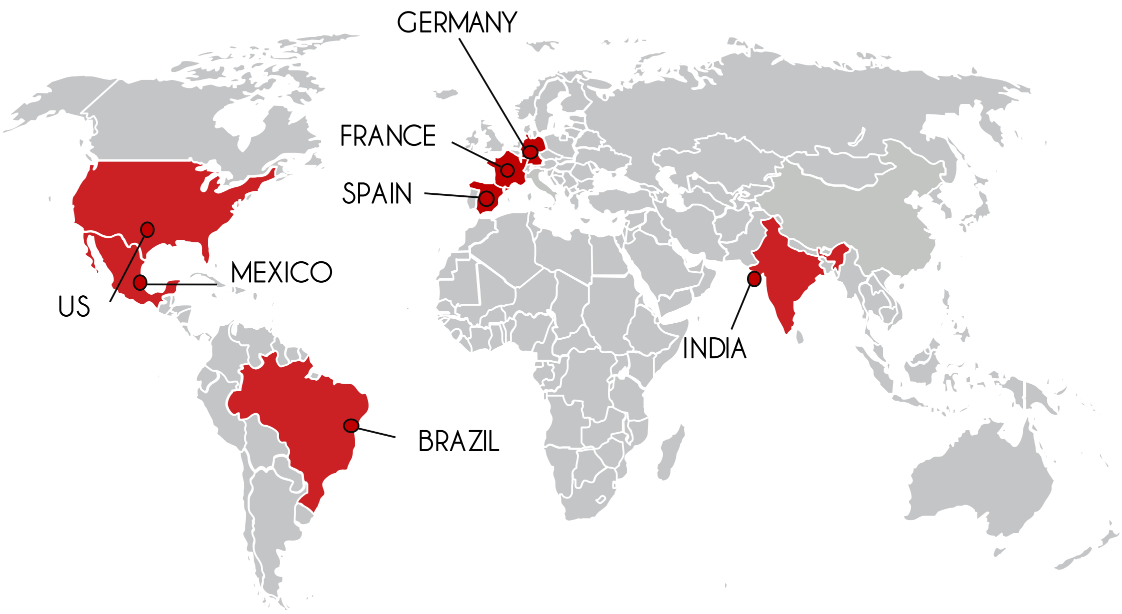
PPA prices are not always easy to obtain, as many of these contracts are private agreements and no public information is available. Therefore, as a practical simplification, the GPM report selects between these two alternatives in order of priority:

- A marginal price, where possible.
- A regulated tariff for large consumers: in countries where no spot market exists, the national utility rate for large consumers has been selected as a theoretical upper boundary of a PPA contract as a working hypothesis.

It should be remarked that fast declining wind energy costs and changing electricity prices advise to monitor cost-competitiveness overtime.

In order to assess the magnitude of utility-scale competitiveness, the current issue of the GPM analyzes some of the main current and potential markets for large WPP. The study considers only one location per country, considering a theoretical WPP in a zone with relatively high wind resource.

Figure 2: Countries included in this issue



The report is structured in two main sections:

- Results Section, where *required tariffs* are quantified for each of the locations under study and wind generation parity proximity is analyzed.
- Methodology Section, which includes a thorough explanation of main assumptions and inputs considered in the analysis.

3

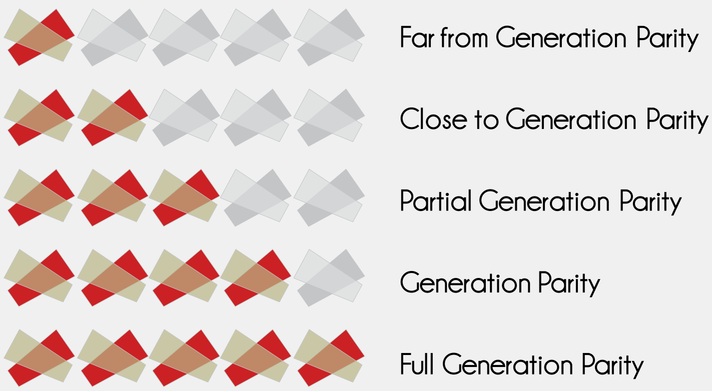
Wind GPM results

3 Wind Grid Parity Monitor Utility-scale Results

In this section, the GPM Utility-scale compares the *required tariff* for a wind investor with electricity prices in order to assess Wind Generation Parity proximity in each country.

Criteria used to assess Wind Generation Parity proximity

Figure 3: Qualitative scale for the assessment of Generation Parity proximity



Where:

- Far from Generation Parity: The *required tariff* is 50% above the *reference price*.
- Close to Generation Parity: The *required tariff* is equal or up to 50% above the *reference price*.
- Partial Generation Parity: The *required tariff* has been lower than the *reference price* in the last 2 years, but it is currently above that value.
- Generation Parity: The *required tariff* is currently lower than the *reference price*, but in the last 2 years generation parity was not clearly achieved.
- Full Generation Parity: All reference wholesale prices are above the *required tariff*.

3.1 Brazil

3.1.1 Wholesale market and reference price in Brazil

The Government, after implementing different reforms, transformed the market from monopoly to competitive in 1996. There are three markets where energy producers can trade their energy in Brazil:

- The regulated market called Ambiente de Contratação Regulada (ACR)
- The open market called Ambiente de Contratação Livre (ACL)
- The short-term market

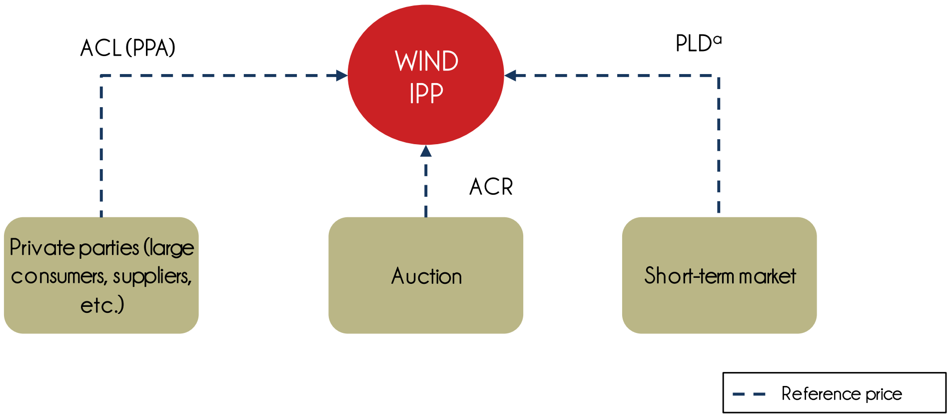
In the ACR market the trade of electricity is formalized through regulated bilateral contracts called CCEAR (Contracts for Commercialization of Electric Energy in a Regulated Environment) selected through auctions. The CCEARs are signed between the winning generators in the auctions and the distributors who have declared their need to purchase the energy contracted in the auction.

On the other hand, in the ACL market, there is a free negotiation between the counterparties who agree contract terms and conditions bilaterally on their own terms.

Finally, the energy bids resulting from the gap between the contracted energy in the first two markets and the real produced and consumed energy is offered in the short-term market. The price reached in this market is called Settlement Price of Differences (*Preço de Liquidação das Diferenças - PLD*) and is counted weekly. The PLD has a specific value depending on the area of analysis (North, North-East, South and South-East).

The specific trading options for a wind IPP are shown in the figure below.

Figure 4: Trading channels for a wind Producer in Brazil



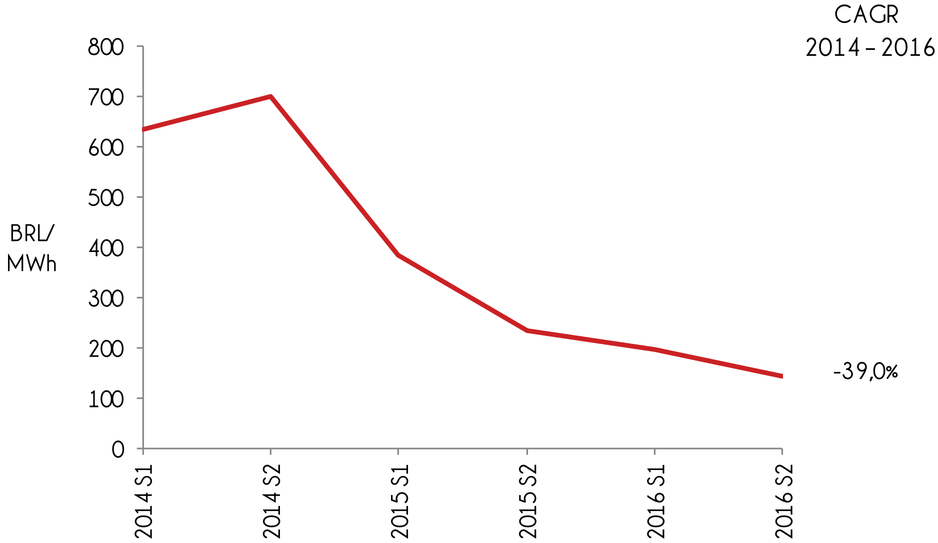
Note: ᵃ Preço de Liquidação das Diferenças
Source: CREARA Analysis

At present, a series of regulatory and economic schemes are in place to boost the penetration of renewable energy. One of the most important ones is the Program for the Renewable Energy Sources (Programa de Incentivo às Fontes Alternativas de Energia – PROINFA) and the Preferential financing for renewable energy projects provided by the Brazilian National Development Bank (BNDES), which provides low-interest financing for renewable energy projects that meet local content requirements.

The chosen sales channel for the wind IPP of the case study is the short-term market, as it is considered to be the spot market in Brazil.Therefore the reference price is the PLD price. The selected zone to assess the reference price corresponds to the North-East region (Bahía).

The next chart shows the evolution of this price for the North-East region since 2014. It shows that power prices have high volatility; this is mainly because 70% of Brazilian's electric generation is covered by hydroelectric plants and thus the price depends on the rainfalls.

Figure 5: Evolution of the PLD prices in North-East Brazil



Source: CCEE; CREARA Analysis

3.1.2 Generation parity proximity

Wind Parity in Brazil is calculated for the region of Bahia, considering a merchant plant selling to the short-term market.

Figure 6: Comparison of PLD market prices and the required tariff for a wind investor in Brazil under a project finance structure (Bahia)

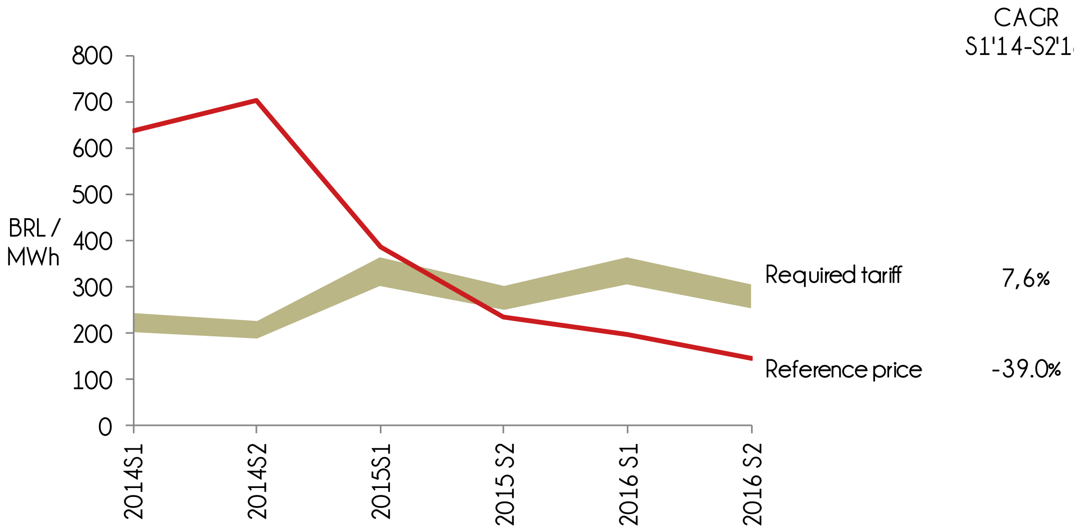


Figure 7: Brazil's Generation Parity Proximity

- The great dependence of the Brazilian's electricity market on rainfalls has negatively affected reference prices, which are currently below the r*equired tariff* for a wind investor, preventing the country from maintaining the generation parity attained in previous years.

- There are some factors which could set Brazil back into generation parity in the short-term:

  - An anticipated procurement of an energy supply contract at predictable and stable prices, i.e. an ACR or an ACL contract for the system's lifetime, instead of the PLD market of this analysis.

  - A further reduction in the cost of wind turbines, which in fact in the last semesters has favoured generation parity in Brazil.

  - The appreciation of the Brazilian Real against the USD, as in the last semesters its depreciation has hindered generation parity..

  - The extraordinary capacity factors in Brazil, specially in Bahia, which contribute to achieving one of the lowest reference prices in all markets.

3.2 France

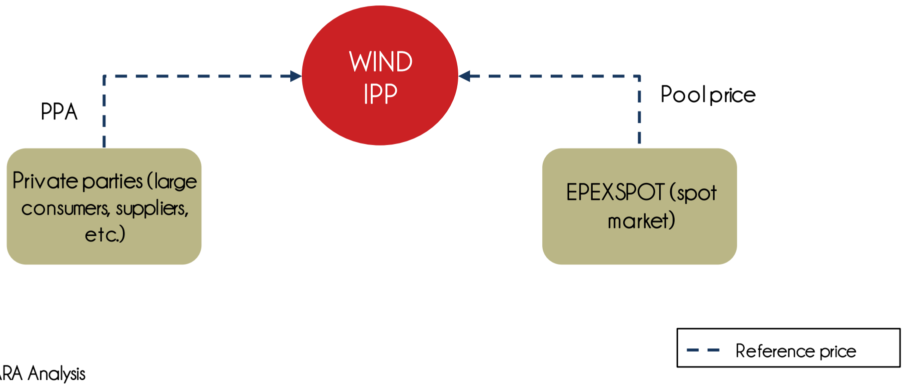
3.2.1 Wholesale market and reference price in France

The recent publication of the Act on Energy Transition (October, 2016) has transformed the French electricity market into a more flexible one, permitting PPA contracts. Renewable energy generators are no longer obliged to sell their electricity production to the national electricity suppliers (although they still are obliged to sell it on the wholesale electricity market). The first accreditation that allows a company to operate with PPAs has been limited to 75 purchase contracts for a maximum installed capacity of 100 MW and entered into force in January2017.

In this sense, wholesale electricity sales may be carried out through two different channels: the spot electricity market (EPEX SPOT) and the bilateral market, where contracts are freely negotiated among agents (generators, suppliers, consumers, etc.)

The specific trading options for a wind IPP are shown in the figure below.

Figure 8: Trading channels for a wind Producer in France



Source: CREARA Analysis

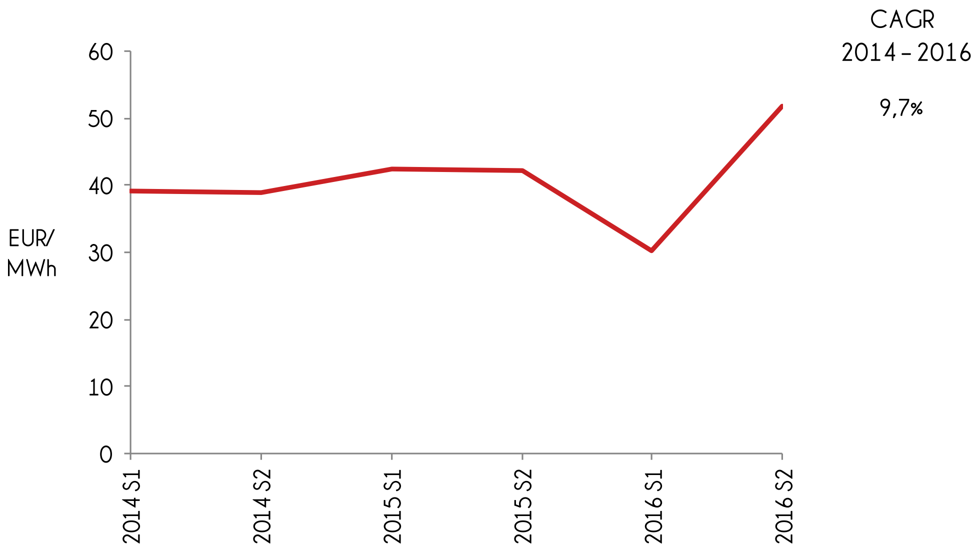
At present, a series of regulatory and economic schemes are in place to boost the penetration of renewable energy. One of the most important ones is the Feed-in-Premium or "compensation mechanism" (in French, "mécanisme de compensation"), introduced by the Act on Energy Transition developed in October, 2016. However, as of June 2017 the tariff order regulating the tariff conditions for onshore energy plants is still pending.

Apart from the Feed-in-Premium, the FiT mechanisms have been maintained for certain installations. Concretely, those wind energy plants situated in particularly cyclonic risky areas and equipped with a device for forecasting and smoothing electricity production may benefit from 0,023 EUR/kWh during the first 10 years and then between 0,05 and 0,023 EUR/kWh for the next five years, depending on the overall time of operation per year.

The *reference price* chosen for this analysis is the one corresponding to the remuneration received by a generator in the spot market, i.e. the hourly marginal price of the day-ahead market. One should bear in mind that this is deemed as reference price to perform the assessment of Wind generation parity, without considering specific economic incentives. In reality, a wind investor would intend to participate from the FiT scheme that is above spot prices of the day-ahead market.

The next figure shows the evolution of marginal prices in the EPEXSPOT (European Power Exchange SE). In the recent months, there has been a sharp increase in the price because of the closure of 21 nuclear reactors. However, since January 2017 the priceremains atstable levels.

Figure 9: Evolution of pool prices in France 2014 - 2016



Source: EPEXSPOT; CREARA Analysis

3.2.2 Generation parity proximity

Wind Parity in France is calculated for the region of Auvergne-Rhône-Alpes, considering a merchant plant selling to the spot market.

Figure 10: Comparison of hourly day-ahead market prices and the required tariff for a wind investor in France under a project finance structure (Auvergne-Rhône-Alpes)

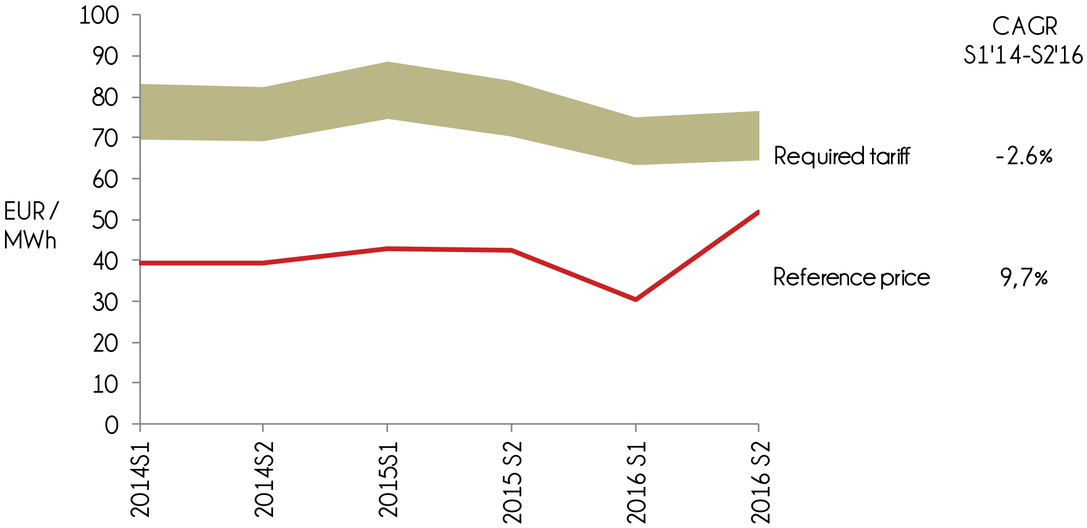


Figure 11: France's Generation Parity Proximity

- In France, wind utility-scale generation is not currently competitive in the spot market since the *required tariff* for a wind investor is still higher than the *reference price*.
  - Spot prices have increased on average 9.7% annually over the past 2 years. The required tariff is experiencing a decreasing trend at lower rates. Even though wind investment costs are declining on average 9% annually since 2014, generation parity has not been reached yet. Further decreases in wind prices and increases in electricity prices could improve the generation parity situation in France in the coming months.
  - The tariff order regulating the tariff conditions for onshore energy plants (still pending) and the high cost of equity are still barriers to reaching generation parity.

3.3 Germany

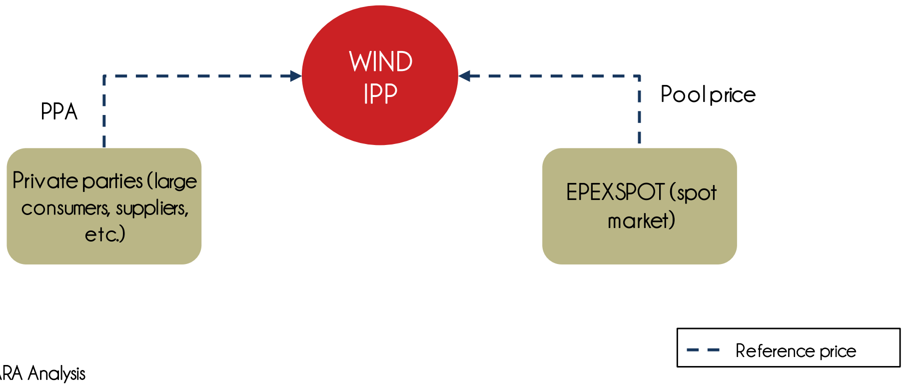
3.3.1 Power system and reference price in Germany

The German power market is fully liberalized. Wholesale electricity sales are carried out through two different channels: the spot electricity market (EPEX SPOT) and the bilateral market, where contracts are freely negotiated among agents (generators, suppliers, consumers, etc.).

The EPEX SPOT is the exchange for the power spot markets in Europe. It covers Germany, France, United Kingdom, the Netherlands, Belgium, Austria, Switzerland and Luxembourg; markets representing 50% of European electricity consumption.

The specific trading options for a wind IPP are shown in the figure below.

Figure 12: Trading channels for a wind Producer in Germany



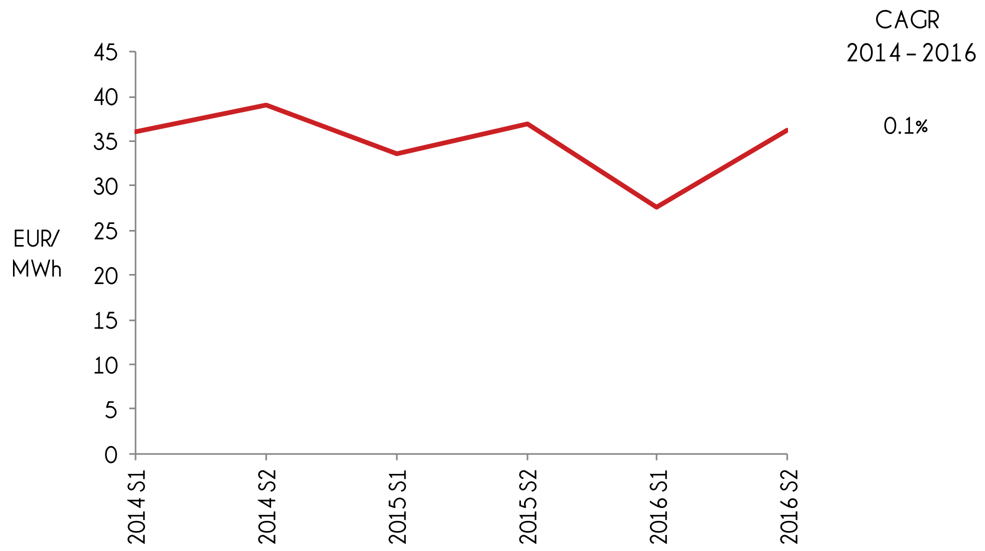
Source: CREARA Analysis

The introduction of the last Renewable Energy Sources Act (EEG) amendment implies a shift from fixed Feed-in-Tariffs to prices set by competitive auctions. Until 2017, the price was fixed by the government following a Feed-in-Tariff scheme, which is still maintained only for small plants up to 100 kW. From 2017 onwards, prices are set by public and competitive auctions for renewables installations over 750 kW (in the case of biomass, 150 kW). The annual capacity volume for onshore wind installations (3 or 4 wind auctions per year) will be set at 2.8 GW per year in 2017-2019 and at 2.9 GW after 2020. The first auction was held on June 2017 and developers have until August 1st to submit their bids; therefore, there is no reference auction price yet for onshore wind.

The *reference price* chosen for this analysis is the remuneration received by a generator in the spot market, i.e. the hourly marginal price of the day-ahead market.

The next figure shows the evolution of marginal prices in the EPEXSPOT (European Power Exchange SE). Spot prices have been decreasing significantly since 2014. However, the price of the first quarter of 2017 is higher than that of previous quarters. Thus, if this trend continues, a rise of the average annual pool price can be expected for the following months.

Figure 13: Evolution of pool prices in Germany 2014 - 2016



Source: EPEXSPOT; CREARA Analysis

It should be considered that the integration of renewable energy is being facilitated by system rules, including:

- Priority dispatch for electricity from renewable energy sources unless other generation units need to remain connected to the grid for reasons of system security and reliability.

3.3.2 Generation parity proximity

Wind Parity in Germany is calculated considering a merchant plant selling to the spot market:

Figure 14: Comparison of hourly day-ahead market prices and the required tariff for a wind investor in Germany under a project finance structure

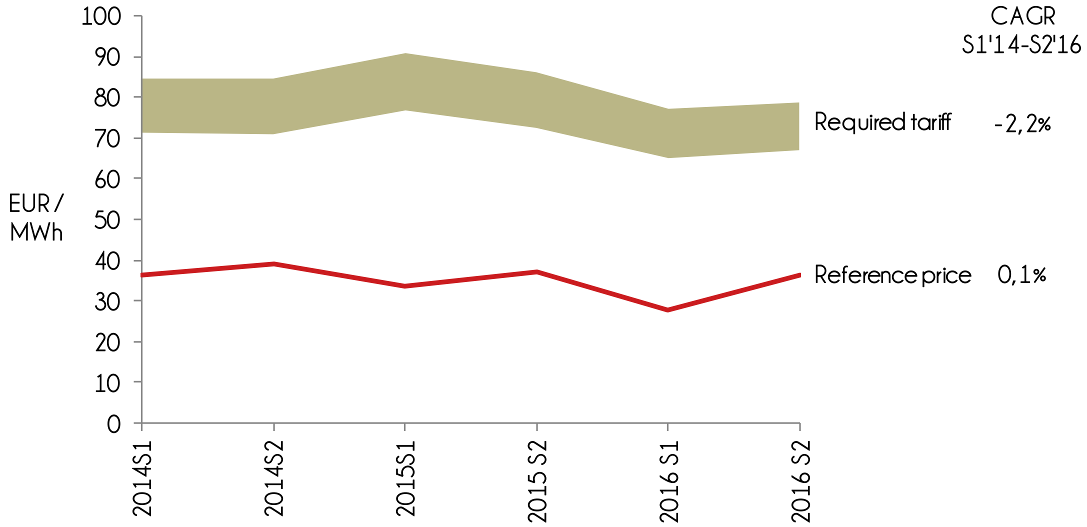


Figure 15: Germany's Generation Parity Proximity

- Generation parity has not been reached in Germany, even though the required tariff for a wind investor in the country has decreased in the last semesters, mainly driven by the decline in wind investment costs.
  - Reference prices have remained stable, with a mild increase of 0.1% per year on average in the last years.
  - Capacity factors in Germany are relatively low in comparison to the rest of the locations considered throughout the report.
- Even though wind utility-scale geeneration is not competitive in the spot market, it is believed that the introduction of the auction system for wind installations will drive the market in the short-term, leading to a significant number of wind installations in the country throughout the next semesters.

3.4 India

3.4.1 Wholesale market and reference price in India

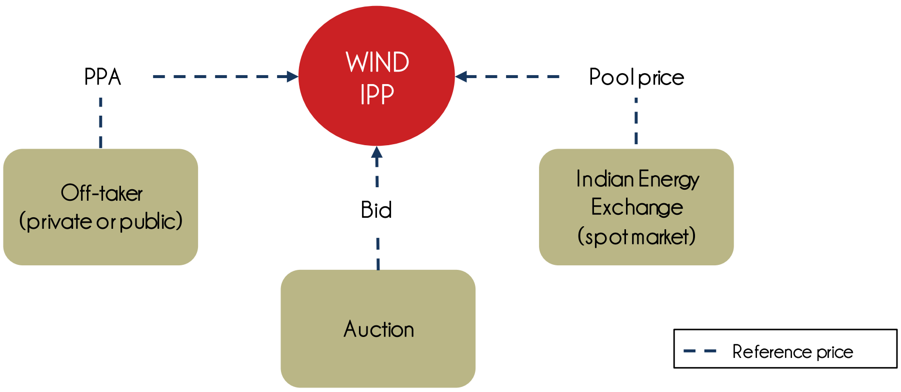
The Indian power system has specific characteristics depending on the area of analysis. For this study, the West region will be evaluated, specifically the area corresponding to Gujarat.

The Indian market is liberalized so that private actors can trade energy freely through bilateral contracts, both through regulated auctions and the spot market (Indian Energy Exchange (IEX)).

- The Indian Energy Exchange is India's premier power trading platform. The exchange is divided in 13 areas for 5 different regions.
- PPAs have been very popular in the country; between 2011 and July 2015, the State Utility had signed PPAs for around 1 GW.
- In Februray 2017, the first auction for wind power was held wherein a wind power tariff of 3.46 INR/kWh was set.

The specific trading options for a wind IPP are shown in the figure below.

Figure 16: Trading channels for a wind Producer in India



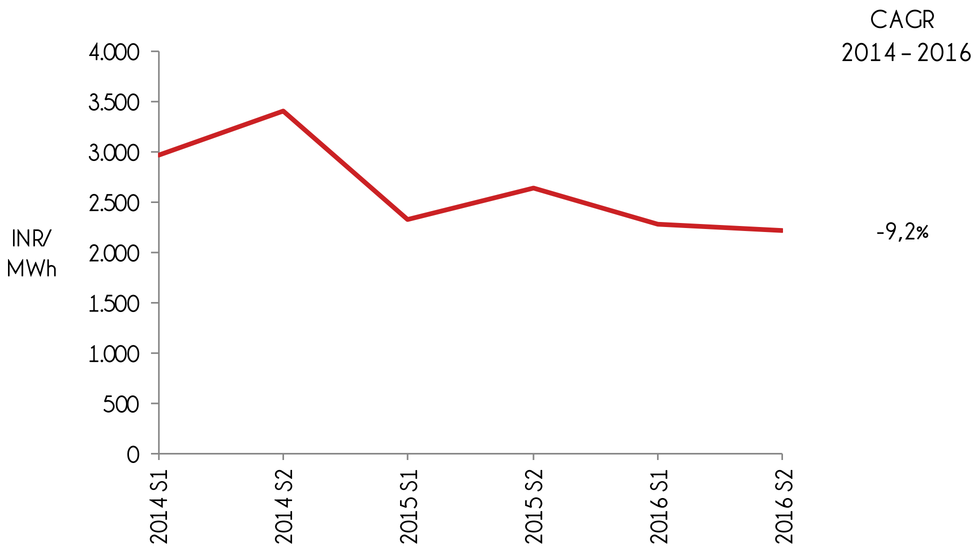
Source: CREARA Analysis

There are renewable-energy-specific incentives that promote the adoption of clean technologies in the energy mix. One of the main schemes is the Feed-in-Tariff, which is available in 7 states (Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Tamil Nadu), with tariffs between 3.82 and 6.04 INR/kWh.

The chosen sales channel for the wind IPP of the case study is the spot market. As previously mentioned, the selected zone to assess the *reference price* corresponds to the Western region, therefore the *reference price* is the day-ahead market price that is aggregated for the Western region.

The next chart shows the evolution of these prices for the Western region since 2014.

Figure 17: Evolution of pool prices in India 2014 - 2016



Source: Indian Energy Exchange; CREARA Analysis

3.4.2 Generation parity proximity

Wind Parity in India is calculated for the region of Gujarat, considering a merchant plant selling to the spot market.

Figure 18: Comparison of day-ahead market prices and the required tariff for a wind investor in India under a project finance structure (Gujarat)

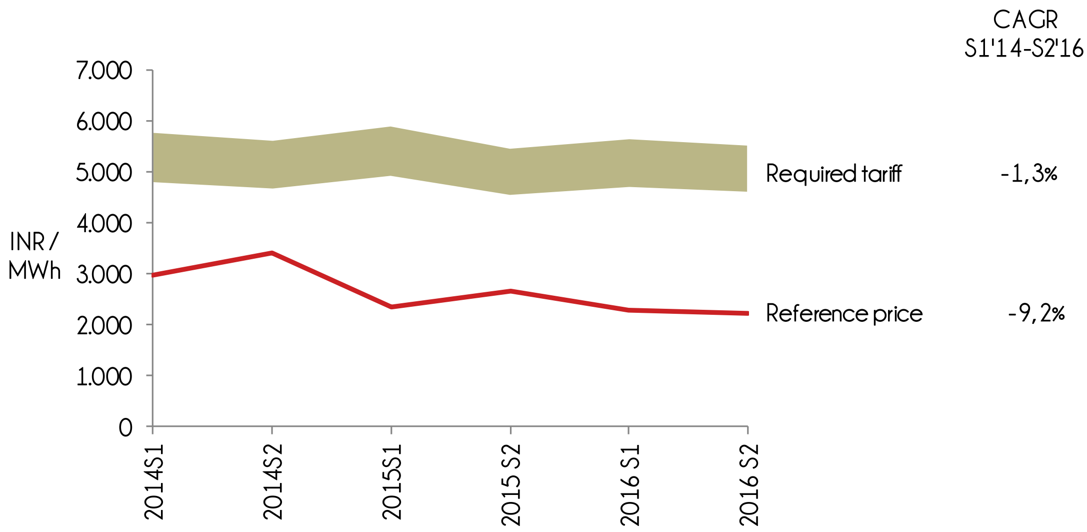


Figure 19: India's Generation Parity Proximity

- In India, wind technology is far from being competitive in the utility scale segment:
    - A high discount rate, which reflects the high return required by equity holders, is one of the main barriers to reach wind generation parity.
    - Despite of the significant decrease in wind investment prices, the required tariff is still significantly higher than the selected reference price.
    - Reference prices are decreasing by 9% per year on average, which has a negative impact on generation parity proximity in the country.
- Initial investment costs (quoted in USD) in India have decreased significantly in the last semesters. However, the appreciation of the USD relative to the Rupee has hindered generation parity proximity.

3.5 Mexico

3.5.1 Wholesale market and reference price in Mexico

Mexico's new Energy Reform liberalized generation activities and opened the retail and wholesale markets to competition in 2014.

This reform included the creation of the MEM (*Mercado Eléctrico Mayorista,* Spanish acronym) a spot market where generators and consumers with a demand greater than 2 MW in 2016 and 1 MW in 2017 can operate on a daily basis directly or through a qualified-service supplier.

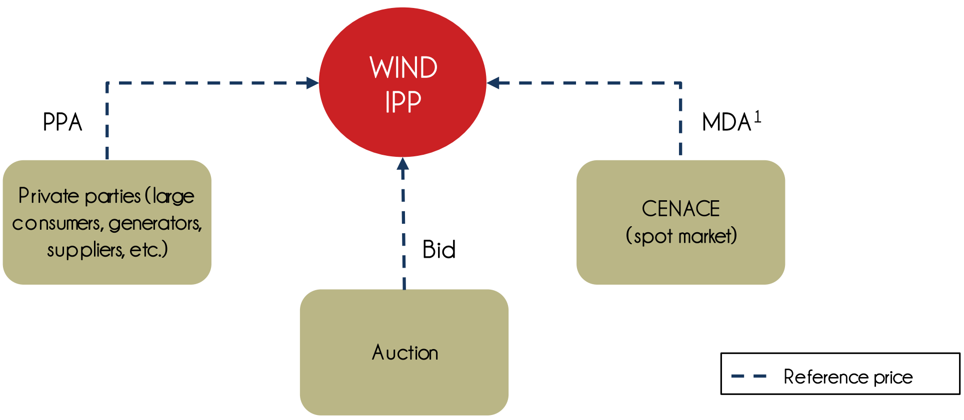
The spot market is regulated by CENACE (*Centro Nacional de Control de Energía,* Spanish acronym), an independent body in charge of controlling the national electricity system.

The new market structure allows bilateral agreements between agents to be signed through the new *Contratos de Cobertura Eléctrica,* where both electricity and new products, such as the clean energy certificates to be introduced in 2018, can be freely negotiated.

Energy from renewable sources can also be sold through auctions, where generators offer a bid for a desired income. In case of winning, the bidder will get the applied price during the term of the contract (15 or 20 years).

The next figure depicts the current trading alternatives of a wind IPP in Mexico.

Figure 20: Trading channels for a Wind Producer in Mexico



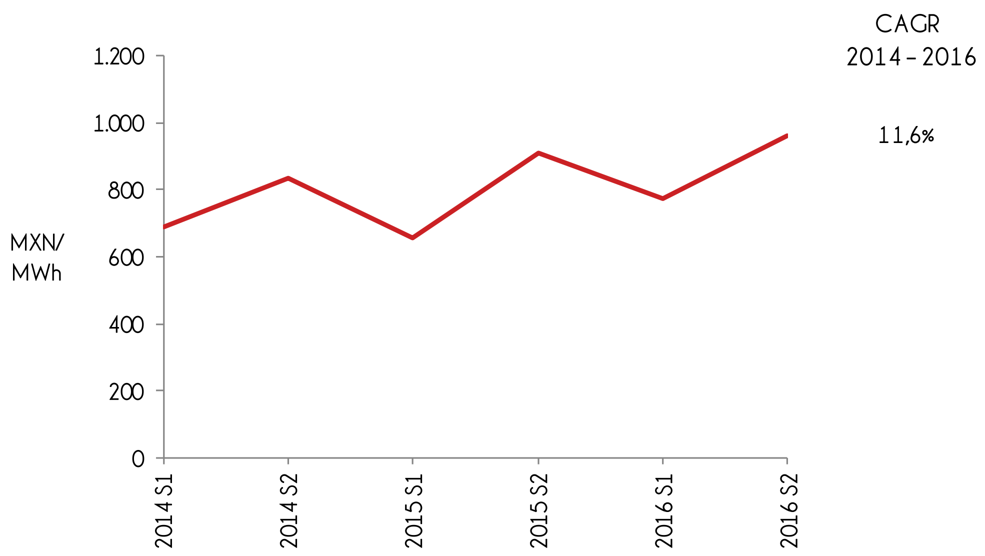
Note: [1] Marginal Local Price of the day-ahead market
Source: CREARA Analysis

Prior to the Energy Reform, IPPs could supply energy to the CFE (Comisión Federal de Electricidad) by signing PPAs that were established either through regulated tenders (*Productor Independiente*) or through the SPP generation scheme (Small Power Producer or *Pequeño*

Productor in Spanish). The latter was accessible for private parties with renewable installations <30 MW. The SPP would sign a PPA with a price that was equivalent (in the case of renewable generation) to 98% of the nodal cost at the connection point. This nodal cost was referred to as the CTCP (Short-term Total Cost or *Costo Total de Corto Plazo* in Spanish) that resulted from the dispatch of the power system. Thus, the *reference price* prior to the start of operation of the spot market in January 2016 was set on the basis of the remuneration for a SPP[5], which represented the costs of the system's dispatch.

From January 2016 onwards the *reference price* considered in the analysis corresponds to the hourly nodal price of the day-ahead market in the node of Oaxaca. This price is calculated on the basis of three components: energy, congestion and losses. The next chart shows the evolution of electricity prices in the node of Oaxaca since 2014.

Figure 21: Evolution of average short-term nodal costs in the node of Oaxaca



Source: CENACE; CREARA Analysis

3.5.2 Generation parity proximity

Wind Parity in Mexico is calculated for the regions of Oaxaca, considering a merchant plant selling to the spot market:

5 In any case, one should bear in mind that this was a theoretical reference as, under the previous framework, an installation of 30 MW (as the one under study) could not apply for the SPP scheme

Figure 22: Comparison of day-ahead market prices and the required tariff for a wind investor in Mexico under a project finance structure (Oaxaca)

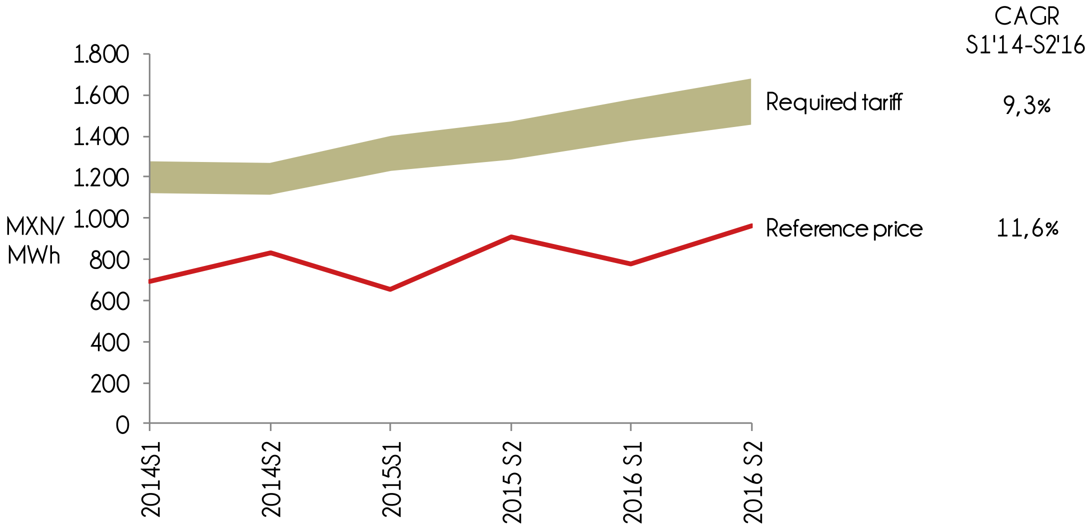


Figure 23: Mexico's Generation Parity Proximity

- Despite high capacity factor levels and a favorable asset depreciation scheme (1st year 40% of investment) the *required tariff* if far from the level that would enable *generation parity* in Mexico, mainly due to the unfavourable evolution of the currency exchange rate.
  - Reference prices, however, are increasing by approximately 11% per year on average, which could drive generation parity proximity in the country.
- As in the other analyzed countries, wind investment costs have decreased in Mexico in the last semesters, but the adverse evolution of the exchange rate has resulted in an increase of the *required tariff* since 2014. Nonetheless, if electricity market prices continue their increasing trend, *generation parity* proximity should improve in coming years.

3.6 Spain

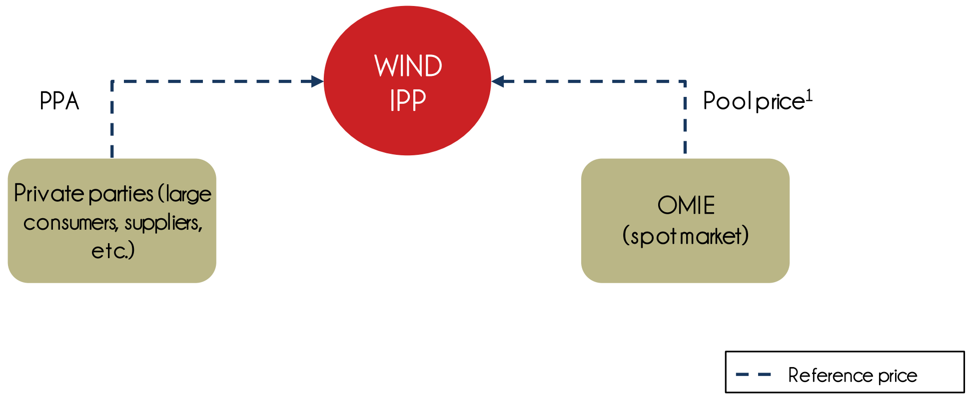
3.6.1 Wholesale market and reference price in Spain

Energy production in Spain is very competitive since the liberalization of the market in 1997. Nowadays there are several power generators all over the country. The total number of companies registered is over 300, most of them small local enterprises with less than 100.000 customers.

Wholesale electricity sales may be carried out through two different channels: the spot electricity market (OMIE) and the bilateral market, where contracts are freely negotiated among agents (generators, suppliers, consumers, etc.). PPAs are legally permited in the country although not many PPAs are being signed nowadays.

The specific trading options for a wind IPP are shown in the figure below.

Figure 24: Trading channels for a wind Producer in Spain



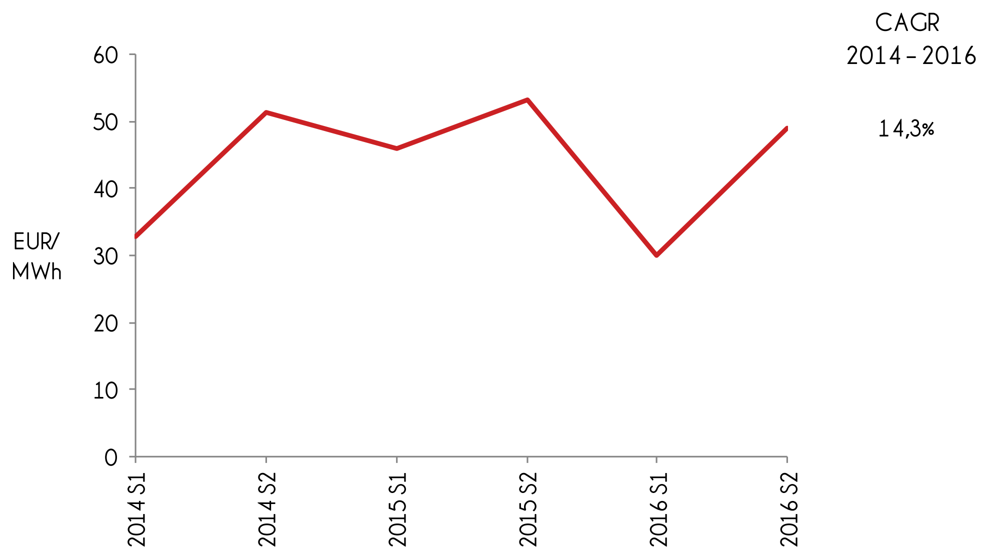
Note: [1] The spot market is the trading channel for the Wind IPPs that go through the auction scheme
Source: CREARA Analysis

At present, the only economic scheme in place to boost the penetration of renewable energy is an auction system, which provides a return on the investment. It should be mentioned that the last auction, which was held in May 2017, was a technologically neutral 3.000 MW auction, where every renewable source of generation competed in the same terms and negative bids were allowed. The resultant price of the auction was cero.

The reference price chosen for this analysis is the one corresponding to the remuneration received by a generator in the spot market, i.e. the hourly marginal price of the day-ahead market. One should bear in mind that this is deemed as reference price to perform the assessment of Wind generation parity, without considering specific economic incentives. In reality, a wind investor would intend to participate in the auction scheme.

The next figure shows the evolution of marginal prices in the OMIE. In recent months (end of 2016 and beginning of 2017), the spot price has increased mainly due to the electricity imports from France (as shown in Figure 30 French electricity prices have increased in the recent months).

Figure 25: Evolution of pool prices in Spain 2014 - 2016



Source: OMIE; CREARA Analysis

3.6.2 Generation parity proximity

Wind Parity in Spain is calculated considering a merchant plant selling to the spot market:

Figure 26: Comparison of day-ahead market prices and the required tariff for a wind investor in Spain under a project finance structure

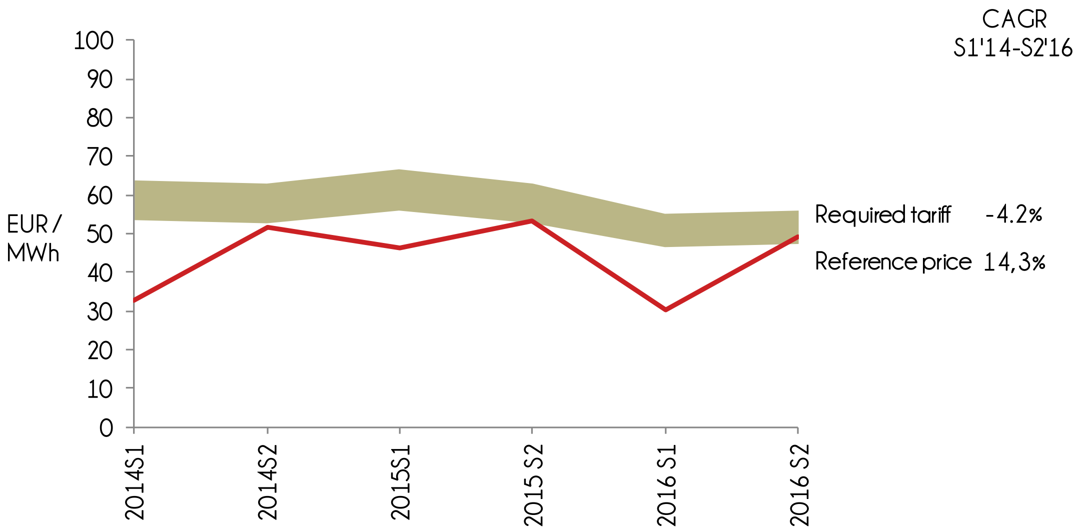


Figure 27: Spain's Generation Parity Proximity

- The decrease in the international price of wind turbines has enhanced the situation for a wind energy producer in Spain, with a project in a high capacity factor location and with a low CAPEX, to reach generation parity in the country. However, it should be noted that the results vary from case to case, and some of the analyzed CAPEX prices would lead to required tariffs above reference price levels.
- Attractive capacity factor levels can be found in the country, although the relatively high return required by equity holders has a negative impact on generation parity results.
- The new renewable energy auctions that will be held in Spain in 2017 will foster the installation of new WPP even when the resultant price of the auction is cero..

3.7 The US

3.7.1 Wholesale market and reference price in the US

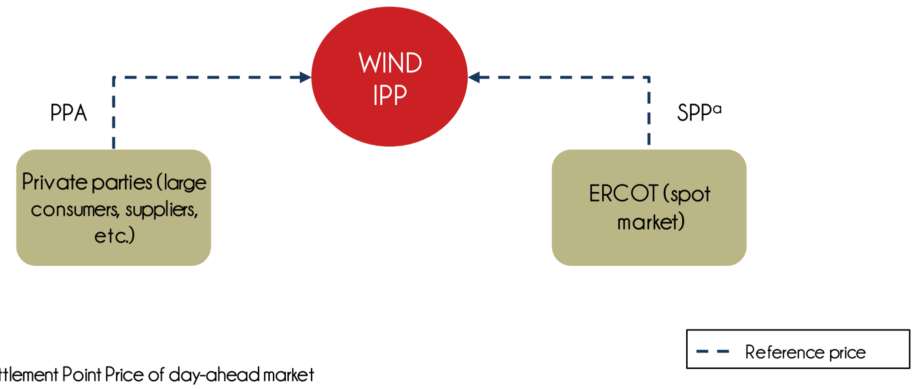
The US power system has specific characteristics that depend on the State being anlyzed. For this study, the case of Texas will be evaluated because it is the State with the highest installed wind capacity (more than 18 GW representing 20% of the total Texas generation capacity[6]) in the US.

The wholesale and retail electric market in Texas is operated by the Electric Reliability Council (ERCOT), which is also in charge of system operation managing 90% of the Texas' electric load.

The Texas market is liberalized so that private actors can trade energy freely through bilateral contracts and also through the spot market. The spot market is divided into: Day-Ahead market and Real-Time market. In the Day-Ahead Market, the market participants submit their bids to purchase or sell energy for the following day. To maintain system's reliability, market participants can offer purchase bids in the Real-Time Market. The Day-Ahead market and Real-Time markets prices are compilated in the Settlement Point Price.

The specific trading options for a wind IPP are shown in the figure below.

Figure 28: Trading channels for a wind Producer in Texas



Note: [a] Settlement Point Price of day-ahead market
Source: CREARA Analysis

There are renewable-energy specific incentives that promote the adoption of clean technologies in the energy mix. Some of these are state-based incentives, while others are applicable at the federal level. For the latter case, one of the main ones is the federal Business Energy Investment Tax Credit (ITC) that reduces federal income taxes for qualified-tax payers

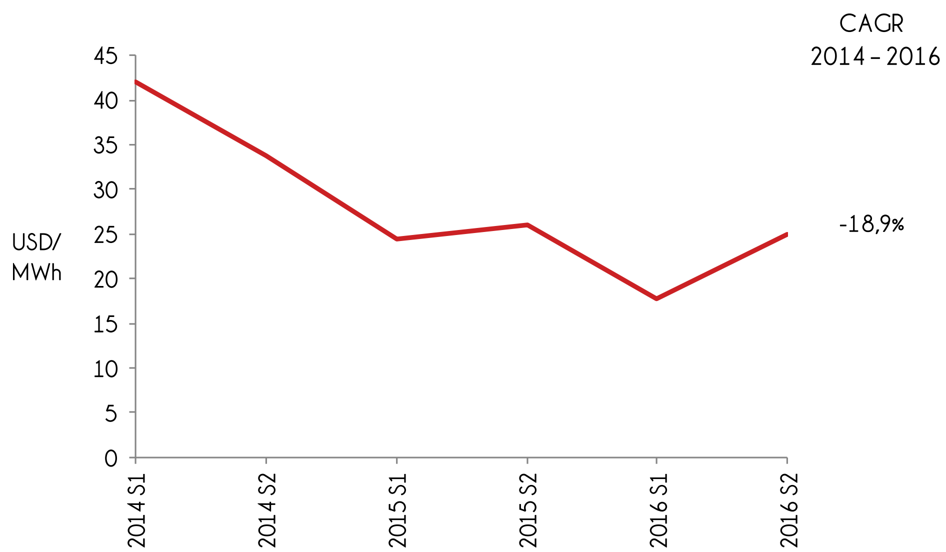
[6] http://www.ercot.com/content/wcm/lists/114739/ERCOT_Quick_Facts_4317.pdf

who are owners of a renewable energy plant. Large wind energy plants could receive a cash grant covering up to 30%[7] of the capital investment[8].

The chosen sales channel for the wind IPP of the case study is the spot market. This market is dispatched based on a model that draws LMPs (Location Marginal Prices), which are later aggregated by zone, the so-called SPPs (Settlement Point Prices). The selected zone to assess the *reference price* corresponds to the region of Midland, therefore the *reference price* is the hourly SPP of the day-ahead market that is aggregated for the West Hub.

The next chart shows the evolution of these prices for the West Hub since 2014. From 2014 to 2015, the price decreased 33% mainly driven by lower natural gas prices.

Figure 29: Evolution of day-ahead SPP prices in the West-Hub of ERCOT market



Source: ERCOT; CREARA Analysis

3.7.2 Generation parity proximity

Wind Parity in the US is calculated for the zone of Texas, considering a merchant plant that is selling 100% in the ERCOT.

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[7] https://energy.gov/savings/business-energy-investment-tax-credit-itc

[8] The 30% credit is available for large wind plants starting operation by the end of 2016 at the latest. After this date, it will decrease to 24%, 18% and 12% for plants placed in service by the end of the following three years respectively.

Figure 30: Comparison of hourly day-ahead market prices of ERCOT's spot market and the required tariff for a wind investor in Texas under a project finance structure

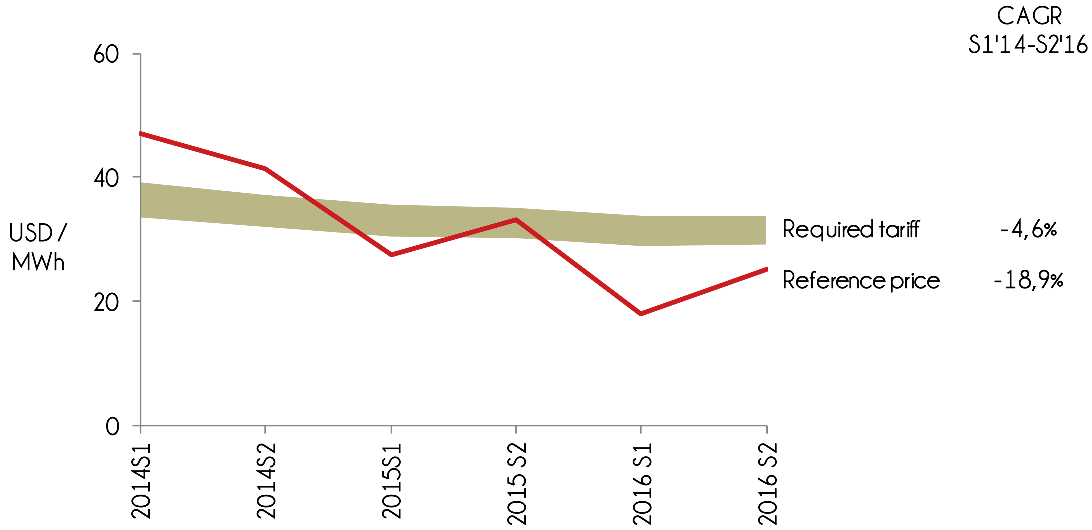


Figure 31: Texas' Generation Parity Proximity

- Although the required tariff for a wind investor in Texas has been below 80 USD/ MWh in the last years (which represents the lowest wind rate analyzed in this study) and is further decreasing, wind generation parity is still distant.
  - During 2014 and the second semester of 2015 generation parity was reached in Texas, although the continuous decrease of wholesale electricity prices has resulted in a decoupling of generation parity.
  - The positive impact of ITC and low discount rates does not compensate for low capacity factor levels and low wholesale electricity prices in the ERCOT market.
- Electricity rates have continued with the decreasing trend of previous years, reaching an annual decrease of 18.9% on average since 2014.
- Even though wind utility-scale is not competitive in the spot market, the relatively low wind generation costs may allow achieving PPA contracts with large consumers or utility companies willing to secure electricity prices in the long term.

4

Methodology

4 Methodology

This Section includes a description of the main assumptions of the analysis and justifies the inputs used in the financial model. The case under analysis is based on a 30 MW wind system. For each of the analyzed countries, the study considers only one location per country, considering a theoretical WPP in a zone with relatively high wind resource. The WPPs considered reflect the characteristics (e.g. WTG technology) present in each market.

The purpose of this study is to evaluate wind generation parity proximity. This assessment is carried out from the perspective of an IPP selling electricity to a pertinent off-taker (e.g. the power exchange or an industrial consumer), according to the structure and characteristics of the power system.

The electricity sold by the IPP would be valued at a *reference price*[9] that corresponds to the one that any other entity selling electricity under similar trading conditions would charge (and without any specific economic support scheme such as a FiT). It is assumed that 100% of the electricity is sold under the chosen trading scheme, i.e. the day-ahead market (or equivalent) of the power exchange or large consumer tariffs.

Generation parity will be achieved when the aforementioned *reference price* is equal to the theoretical tariff that meets the investor's return requirements. In order to invest his funds, the IPP will demand that the profitability of the WPP equals at least his minimum return requirements for that specific project and location. This *required tariff* is calculated based on the main financial statements (P&L and cash flows) of the wind project and for one location on each country as stated in the Introduction. The wind investment is considered to be financed under a project finance structure. It is assumed that this required tariff will increase 2% annually.

The variables that are paramount to derive the *required tariff* are the following:

- WPP economic lifespan
- Initial investment
- O&M costs

[9] Refer to *Introduction, A Note on Reference Prices*

- Income taxes
- Loan payment
- Wind-generated electricity over the system's lifespan, which is highlly dependent on capacity factors
- Required rate of return

For a given wind system, the rate used to discount back the economic factors will define whether the analysis is performed in nominal or real terms:

- Nominal terms: when constant values in nominal currency are used (each years' number of current Dollars, or the applicable local currency if different from Dollar), unadjusted for the relative value of money.
- Real terms: when using a constant value expressed in the local currency corrected for inflation, that is, constant currency of one year in particular.

In this analysis, nominal terms are considered.

The research of the study has been completed with the collaboration of sector experts. CREARA has been supported by the Spanish National Wind Association (AEE) that has validated the economic and financial input information and assumptions for their respective country.

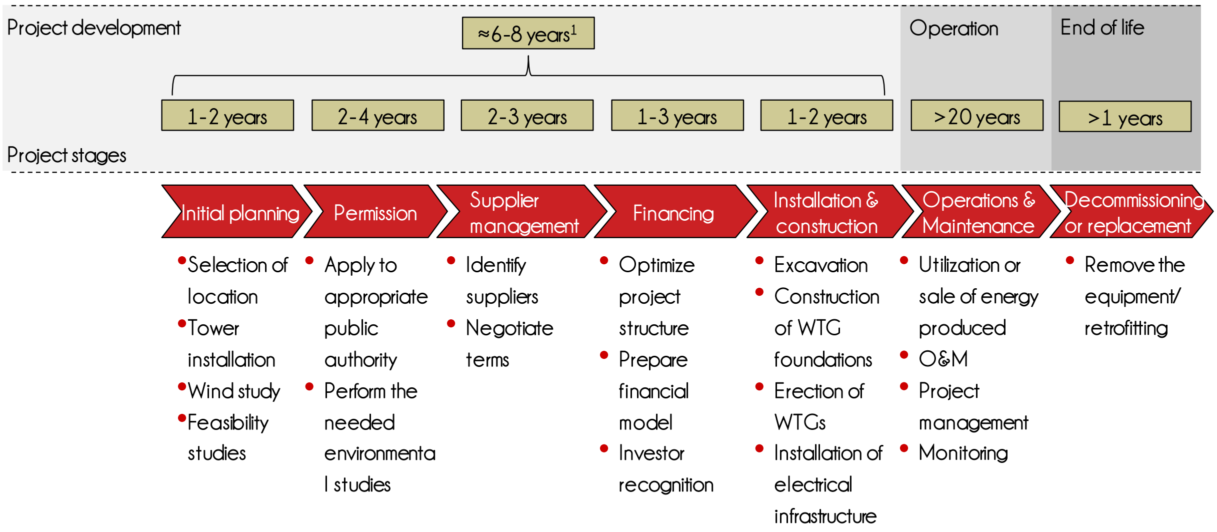
4.1 Life Cycle costs

The lifecycle of a WPP can be divided in three main stages:

- Project development and installation phase: this ranges from the initial planning to the end of construction, and generally requires between 6 and 8 years to be completed.
- Operation: it lasts for the entire lifetime of the wind turbine, which in general ranges from 20 to 25 years according to manufacturers.
- End of life: the decommissioning or replacement of the equipment at the end of the WPP's lifetime.

The next Figure details the activities that are usually performed during each of the main stages in the life of a wind project:

Figure 32: Wind Project Development by Phases



Note: [1]Average number of years; project stages can be performed in parallel in some cases
Source: Application Note Economic Analysis Of Wind Projects, CREARA analysis

In measuring Life Cycle Cost (LCC), two of the most important variables[10] are the Capital Expenditure (CAPEX), which is the initial investment, and the Operational Expenditure (OPEX), which is the sum of the operating costs of the plant during its life. These variables comprise the total costs associated to the WPP during its lifetime, term that is generally referred as LCC. The following Figure illustrates the case of an onshore WPP with geared wind turbines installed in the US or Europe:

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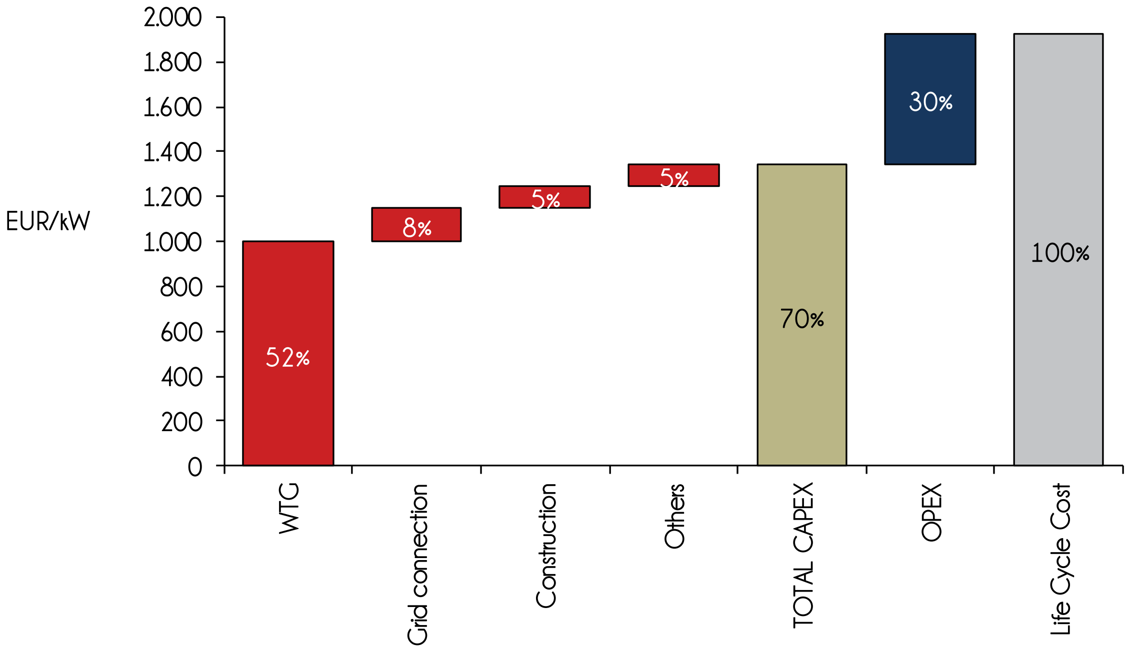
[10] Other key variables such as capacity factor will be discussed in a subsequent Section.

Figure 33: Life Cycle Cost of an Onshore Installation[11]



Source: IRENA 2016, Berkeley Lab 2016, CREARA analysis

4.1.1 CAPEX

The investment cost of the WTG, Wind Turbine Generator, accounts for the largest proportion within the LCC of the wind park.

Total CAPEX for an onshore WPP can vary by up to 50% depending on variables such as WTG technology, interconnection prices and WPP location.

Until recently, these costs have been decreasing sharply mainly due to the following reasons:

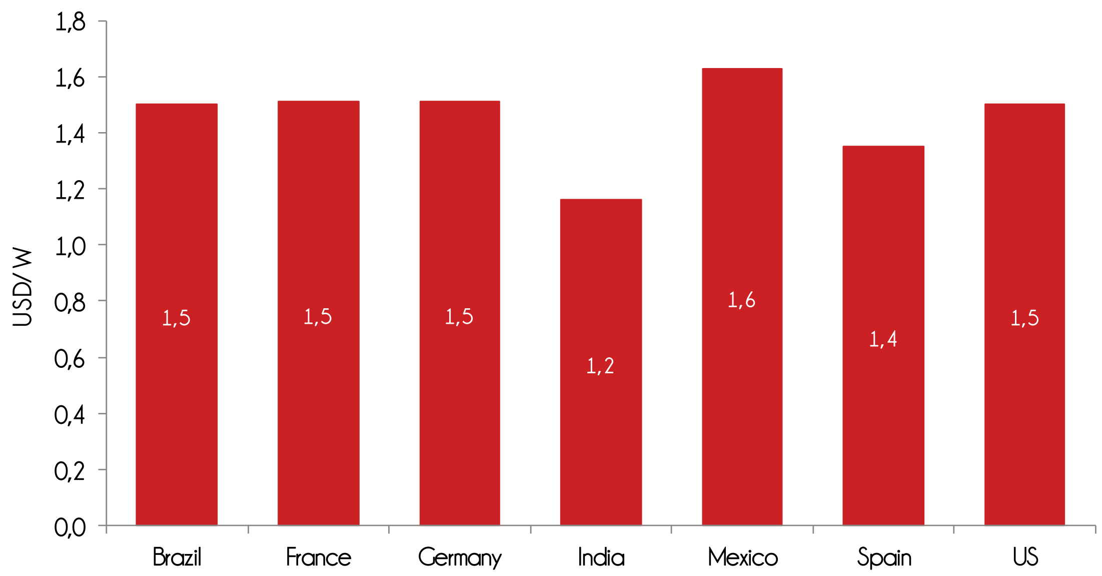
- The increase in installed capacity driven by policy, which enabled economies of scale.
- Technological developments that resulted in the rise of WTG average unit capacity, taking better advantage of available space and decreasing the weight per unit power.
- The introduction of new WTG technologies into the market (such as full converter) that enable better optimization of wind resources.

[11] A lifetime of 20 years and an inflation rate of 2% is assumed.

Investment costs correspond to those that would be incurred by an EPC (Engineering Procurement and Construction) company developing an on-grid 30 MW WPP. Research in available secondary sources[12] has been conducted in order to determine the appropriate ranges of investment costs for each country.

It is worth mentioning that the prices collected in the consultation reflect a competitive situation, but they are not intended for aggressive pricing strategies.

Figure 34: CAPEX for 2016



Source: CREARA Research; CREARA Analysis

For each location, inputs on the investment cost vary depending on two different scenarios: a best-case scenario. Both scenarios define the *required tariff* range which is shown for each country.

4.1.2 O&M Costs

Operating expenses are those that are incurred over the entire lifetime of the project and can be grouped as follows:

- Operation & Maintenance costs (O&M), which represent ~60% of OPEX and tend to increase as the WPP reaches the end of its lifetime.
  - The major cost component is the maintenance of the wind turbine generator.

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[12] Sources: IEA, REN21, IRENA, WEC, JRC, EMIS, GWEC, EWEA, PRNewswire, MDPI, Energies, Fraunhofer ISE, Bloomberg New Energy Finance, IBS and Tamil Nadu ERC.

- Other operating costs (~40% of OPEX), including rent, taxes, and insurance.

To optimize electricity generation during the operation phase of a WPP, three crucial maintenance tasks are performed: preventive, predictive, and corrective maintenance.

As was the case with CAPEX, OPEX costs have also been decreasing on average over time, mainly due to the expertise gained on O&M tasks and the increase in WTG unit capacity.

O&M costs per country are based on secondary sources[13]:

Figure 35: O&M Costs for 2016

Source: CREARA Research; CREARA Analysis

4.2 Other inputs and assumptions

4.2.1 Income taxes

Income taxes are cost flows and as such should be taken into consideration in this analysis. When modeling a utility-scale WPP investment, income taxes depend on yearly earnings and operation costs, interest expenses, depreciation for tax purposes and tax losses of past years. Especially in the first years of operation, accelerated depreciation schemes can be particularly relevant.

In order to estimate the right income taxes for each country, actual cash flows were estimated under a project finance structure. The main variables impacting income taxes are explained below.

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[13] Sources: IEA, IRENA, WEC, EMIS, EWEA, MDPI, Fraunhofer ISE, Bloomberg New Energy Finance, Elsevier and Energies.

4.2.1.1 Corporate tax rates

Nominal corporate tax rates[14] for each of the analyzed countries:

Table 1: Corporate Tax Rates (2016)[15]

Country	2016
Brazil	34.0'%
France	33.3%
Germany	29.7%
India	34.6%
Mexico	30.0%
Spain	25.0%
US	40.0%

4.2.1.2 Depreciation

Depreciation for tax purposes is a means of recovering part of the investment cost through reduced taxes. The method used (e.g. straight line or declining balance) and the depreciation period will affect the *required tariff*: all else being equal, a shorter depreciation period and a greater depreciation amount in the first years are preferred.

Each of the countries under analysis present different accounting rules regarding depreciation of assets. Some of them have implemented fiscal provisions that allow to depreciate investments in a shorter time and in some cases[16], following a declining balance method.

- Brazil: Straight-line depreciation method is used over the useful life of the asset, 20 years.
- France: A linear depreciation applies typically over a period of 20 years.
- Germany: A linear depreciation applies typically over a period of 20 years.

[14] Effective tax rates should be used for the analysis

[15] Source: KPMG

[16] Some of these are applicable for renewable-specific investments

- India: An accelerated depreciation allowance (80% rate to apply in the first year, 20% for the next 19 years) is available for wind generation.

- Mexico: A fiscal incentive for renewable energy allows to use accelerated depreciation for renewable energy investments; 100% of turbine's investment cost can be deducted in year one. The rest of investment costs are deducted in 20 years.

- Spain: A linear depreciation applies typically over a period of 30 years.

- USA: Under the federal MACRS (Modified Accelerated Cost-Recovery System), businesses may recover investments in renewable energy technologies through depreciation deductions. The depreciation is applied for the case under analysis at the following rates[17]: 35%, 26%, 15.6%, 11.01%, 11.01% and 1.38%.

4.2.1.3 Tax losses

A tax loss is defined as a loss suffered by a corporation that can be set against future profits for tax purposes. Depending on the country and the company's decision, tax losses can be carried forward for future years or carried back and be used to claim it against a tax liability from a previous year. In the GPM study, only the case of carrying tax losses forward has been considered.

Depending on the country, tax losses can be carried forward during a specific period of time:

Table 2: Tax Loss Periods (2016)[18]

Country	Period (years)
Brazil	100
France	100
Germany	100
India	8
Mexico	10
Spain	100

[17] Depreciation rates depend on the start of operation with respect to the year; for the analysis it has been assumed that the plant starts operating at the beginning of the year, i.e. first quarter

[18] Source: Deloitte, Internal Revenue Service (IRS)

Country	Period (years)
US (Texas)	20

4.2.2 Cost of debt

It is considered that the investment is financed through project finance and that the debt-equity ratio is 70/30. The loan is based on constant payments and a constant interest rate and has a tenor of 15 years. The interest rates for each country´s national currency were included in the analysis:

Table 3: Interest Rates (pre-tax)

Country	Interest Rates
Brazil	15.4%
France	5.7%
Germany	3.4%
India	10.1%
Mexico	8.7%
Spain	7.5%
US	5.1%

4.2.3 Salvage Value

The salvage value of a WPP is the value of the asset at the end of its useful life, which affects taxable income in different ways depending on the situation:

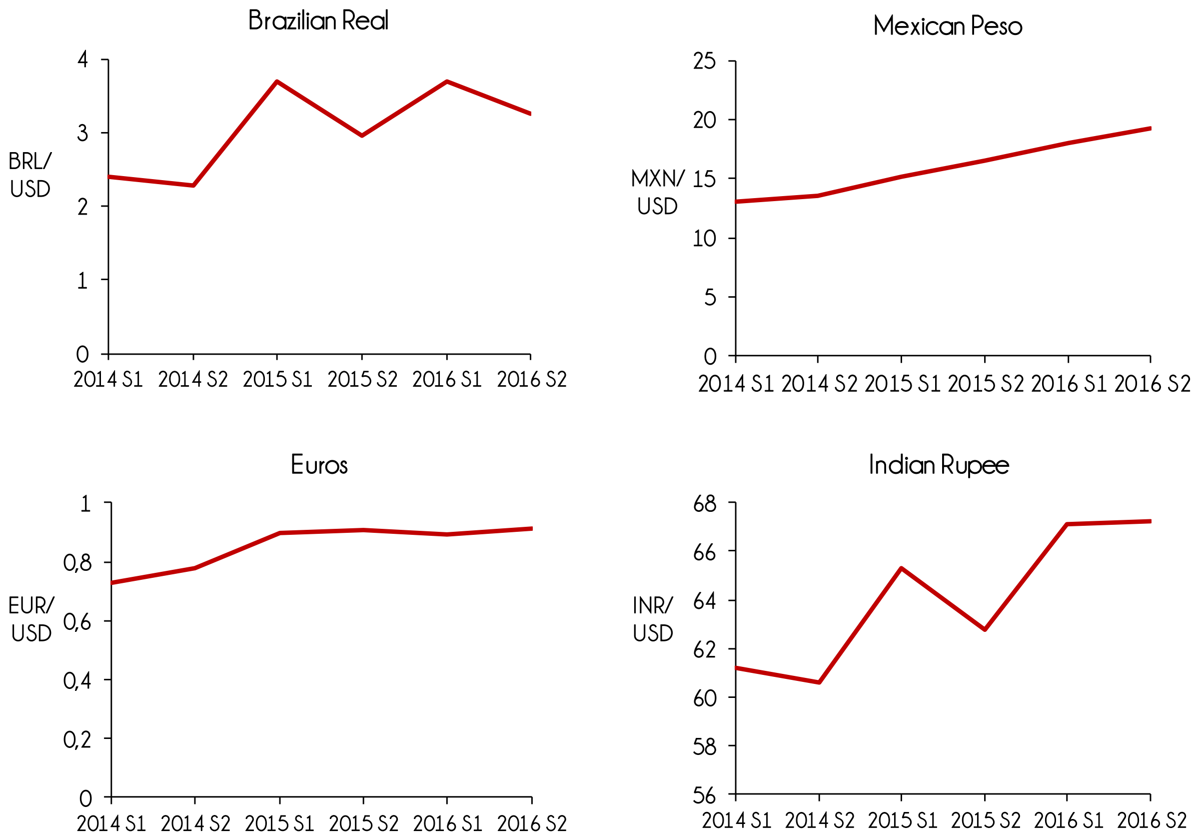
- If the equipment is sold or recycled, an inflow that increases taxable income should be accounted for.
- Alternatively, if costs are to be incurred in order to dismantle the installation, an outflow should be reported.

Although usually some positive value is recognized as pre-tax income at the end of the life of the wind system, this analysis considers no salvage value in order to use conservative estimates.

4.2.4 Exchange Rate

In this report, all costs are expressed in each country's national currency. When necessary, the following exchange rates (number of foreign currency units per USD) were used in the analysis:

Figure 36: Exchange rates – Foreign Currency Units per US Dollar[19]



4.2.1 Inflation Rate

The estimated inflation rate is taken into account when calculating O&M costs for the wind system over its entire lifetime in each country. It is estimated as follows:

- For the years 2014 and 2016, the yearly average percentage change of household prices (expressed as Consumer Price Index, CPI) has been used for each year.
- From 2017 onwards: the estimated future inflation rate of each country, when applicable.

Table 4: Average Annual Inflation per Country[20]

Country	2014 Inflation Rate	2015 Inflation Rate	2016 Inflation Rate	Estimated Future Inflation Rate
Brazil	6,3%	9,0%	8,7%	4.0%
France	0,5%	0,0%	0,2%	2.3%

[19] Source: OANDA

[20] Source: European Central Bank; Focus-economics; Trading Economics; Creara Research, Creara Interviews, IMF

Country	2014 Inflation Rate	2015 Inflation Rate	2016 Inflation Rate	Estimated Future Inflation Rate
Germany	0.9%	0.2%	0.5%	2.4%
India	6.4%	5.9%	4.9%	4.8%
Mexico	4.0%	2.7%	2.8%	4.0%
Spain	-0.2%	-0.5%	-0.2%	2.2%
US	1.6%	0.1%	1.3%	2.5%

4.2.2 Cost of equity

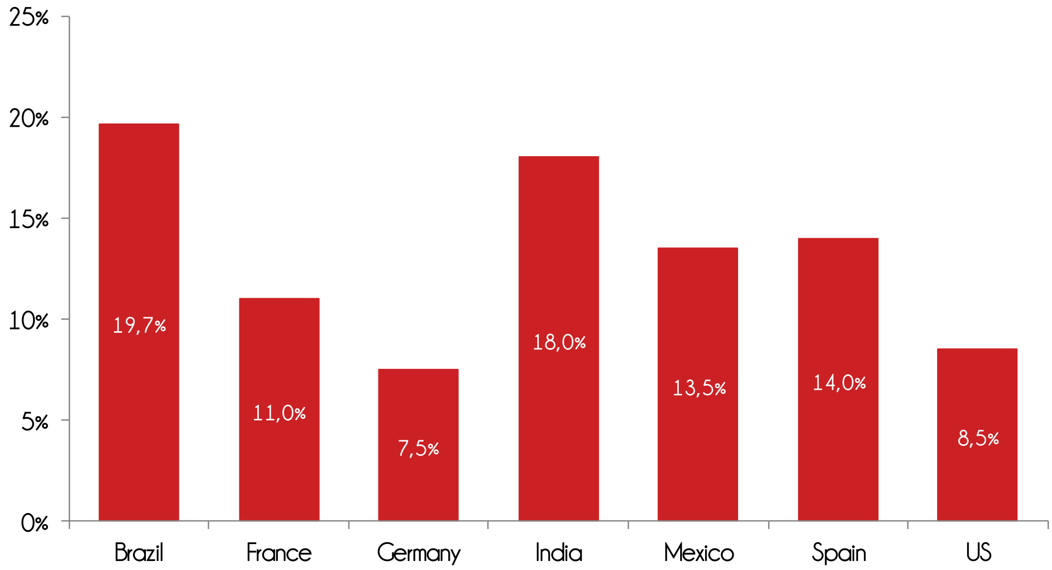
It should be noted that to evaluate the economics of the project, our analysis is performed from the point of view of an IPP investor; i.e., equity holder's cost flows and the cost of equity as discount rate are used.

There are many recognized methodologies to estimate the required rate of return of an asset (e.g., CAPM, dividend discount model or market return adjusted for risk). However, wind merchant plants are a recent phenomenon and little reliable information is available to estimate or collect the required inputs which those methods need.

Therefore, based on available estimates of actual values of cost of equity that wind investors would ask for when investing in a merchant plant in the analyzed countries were collected.

The cost of equity values considered in this report is shown below:

Figure 37: Cost of Equity per country for a merchant wind plant (S2 2016)



Source: CREARA Research; CREARA Analysis

4.2.3 Specific incentives

In Texas, renewable projects can make use of an Investment Tax Credit (ITC) which is granted by the Federal Government. The ITC is recognized as a one-time income tax credit which decreases current tax expenses at the investor level.

For the wind project analyzed in this GPM issue, the credit would be equal to 30% of the CAPEX expenditures, with no maximum limit in monetary terms. After the credit is computed, the basis for depreciation purposes of the wind plant is adjusted by reducing its value a 50% of the ITC amount. The generation asset must be operational within the year in which the credit is first taken.

4.2.4 Wind System Economic Lifetime

The economic lifespan of the onshore wind system was estimated based on the following sources:

- Most of the reports consulted[21] consistently use 15 to 30 years for projections.
- Moreover, IRENA, the International Renewable Energy Agency, estimates that the lifetime of a WPP is between 13 and 25 years.

Consequently, and with the aim of avoiding overestimating the proximity of grid parity, a wind system lifetime of 25 years has been chosen for this analysis.

4.2.5 Wind Energy Generation

The wind-generated electricity is calculated as follows:

Equation 1: Wind Generation on year t

$$E_t = E_0 \, (1 - d)^{t}$$

(where: $E_0 = WSC \times \mathrm{CF} \times \mathrm{h} \times \mathrm{OA}$)

Table 5: Wind Power Generation Nomenclature

Nomenclature	Unit	Meaning
t	-	Year n (n>1)
E_0	kWh	Wind electricity generated on year 0
E_t	kWh	Wind electricity generated on year n

[21] (Not exhaustive) 'Safety of Wind systems" written by the professor M. Ragheb of the University of Illinois in April 2016; "Levelized Cost of Electricity, Renewable Energy Technologies" conducted by Fraunhofer ISE in 2013, etc.

Nomenclature	Unit	Meaning
WSC	kW	Wind System Capacity
CF	%	Capacity Factor
h	hours	Total number of hours of a year
OA	%	Operational Availability
d	%	Degradation Rate

Consequently, In order to estimate the annual wind generation of a 30 MW installation in each of the 7 locations, the following variables were defined:

- Capacity Factor
- Operational Availability
- Degradation rate

4.2.5.1 Capacity Factor

The capacity factor represents the ratio of the real output of the wind system during a certain period of time to its potential output if we consider that the system operates at full nominal capacity over that period of time.

Capacity factors depend on wind resources of the area in which the wind system is located. Thus, capacity factors[22] for each location within the country are used for this analysis.

Table 6: Capacity Factors

Country	CF
Brazil	43%
France	27%
Germany	20%
India	30%
Mexico	40%

[22] Sources: IEA, WEC, IRENA, EWEA, GWEC, REN21, JRC, Elsevier, EMIS, Lazard, EIA, NREL, ABEEólica, NEAC, MNRE, Euan Mearns, Routledge, Justmeans, SeeNews – Renewables and Deutsche WindGuard.

Country	CF
Spain	40%
US	40%

4.2.5.2 Operational Availability

The operational availability of a wind system represents the real amount of time that the wind system is available and ready to operate. It was considered an operational availability of 97% according to the following sources:

- The "Understanding Availability Trends of Operating Wind Farms" study analyzes the distribution of average annual operational availability of wind systems and establishes the standard long – term availability for wind systems at 97%.
- The "Introduction to Wind Turbines and their Reliability and Availability" study considers an operational availability of 97% as an average value.
- 3E investigated the performance of 57 wind systems across Europe in their "Benchmarking predicted and actual production losses" study and determined that wind systems unavailability is usually around 3%.

4.2.5.3 Annual Degradation Rate

The annual degradation rate (d) of the wind system was estimated based on the following sources:

- The study "Profitability of Renewables in Emerging Markets" performed by the EMIS (Emerging Markets Information Service) assumes a 0.2% of annual degradation rate for its calculations.
- The report "A Study on Method for Identifying Capacity Factor Declination of Wind Turbines" establishes that the annual reduction ratio of power performance for wind turbines ranges between 0.4 % and 0.9 % depending on the age of the wind system.
- Experts of the wind industry were interviewed and stated that the average annual degradation rate should range between of 0.2% and 0.3%.

Based on all the above, an annual degradation rate of 0.3% has been consider for the calculation of the wind power generation.

Annex: Abbreviations

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Table 7: Acronyms

Acronyms	Meaning
ACL	Ambiente de Contrataçao Livre
ACR	Ambiente de Contrataçao Regulada
AEE	Asociación Empresarial Eólica
BNDES	Brazilian National Development Bank
CAGR	Compound Annual Growth Rate
CAPEX	Capital Expenditure
CAPM	Capital Asset Pricing Model
CCEAR	Contracts for Commercialization of Electric Energy in a Regulated Environment
CENACE	Centro Nacional de Control de Energía
CFE	Comisión Federal de Electricidad
CF	Capacity Factor
CPI	Consumer Price Index
CTCP	Costo Total de Corto Plazo
DFAG	Doubly-Fed Asynchronous Generator
EGG	Renewable Energy Sources Act
EPC	Engineering Procurement and Construction
EPEXSPOT	European Power Exchange Spot Market
EPIA	European Photovoltaic Industry Association
ERCOT	Electric Reliability Council
EU	European Union
FiT	Feed in Tariff
GPM	Grid Parity Monitor
IEX	Indian Energy Exchange
IPP	Indepent Power Producer
IRENA	International Renewable Energy Agency
ITC	Investment Tax Credit
LCC	Life Cycle Cost
LCOE	Levelized Cost Of Electricity
LMP	Location Marginal Prices
MACRS	Modified Accelerated Cost-Recovery System
MDA	Marginal Local Price (Mexico)
MEM	Mercado Eléctrico Mayorista
O&M	Operation and Maintenance
OMIE	Operador del Mercado Ibérico de Energía
OPEX	Operational Expenditure
PLD	Preço de Liquidaçao das Difereças
PPA	Power Purchase Agreement

Acronyms	Meaning
PROINFA	Programa de Incentivo as Fontes Alternativas de Energia
PTC	Production Tax Credit
PV	Photovoltaic
RPS	Renewable Portfolio Standards
SPP	Small Power Producer
SPP	Settlement Point Price
US	United States
WPP	Wind Power Park
WTG	Wind Turbine Generator

Table 8: Units

Unit	Meaning
BRL	Brazilian Real
EUR	Euro
GW	Gigawatt
INR	Indian Rupee
kW	Kilowatt
kWh	Kilowatt hour
MW	Megawatt
MWh	Megawatt hour
MXN	Mexican Peso
USD	US Dollar

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