Project Finance
Global
Criteria Report

Rating Criteria for Onshore Wind Farms Debt Instruments

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Scope and Summary

This report describes Fitch's rating approach for debt instruments whose repayment is dependent on cash flows from the operation of onshore wind farm projects. These criteria discuss the risks and the rating analysis specific to this type of project and should be read together with Fitch's general criteria for project finance transactions (see the report titled "*Rating Approach to Project Finance*" published on 12 August 2004 and available at www.fitchratings.com).

To form an opinion on the adequacy of the cash flows to service the rated debt in accordance with its terms, Fitch's credit analysis focuses on the risk factors that may impact the project's economics and on the financing structure.

When assessing the risks relating to the project's cash flows, Fitch considers the economic and legal framework in which the project operates. In the case of heavily regulated markets, the agency aims at forming a view on the long-term stability and reliability of regulatory frameworks, although it should be noted that Fitch does not rate for change in law. The agency also assesses the exposure to price risk: as this increases, Fitch will impose an additional price stress scenario while maintaining the target levels of debt service coverage ratio (DSCR).

For projects under construction, completion risk also forms part of the analysis. Construction of onshore wind farms is considered relatively straightforward and fast. Past experience, however, shows how constraints in the supply chain may result in material completion delays. Fitch reviews the potential for scheduled delays and cost over-runs and, supported by experienced third party assessments, assesses the contractual terms with respect to the certainty of the construction price and the adequacy of guarantees, contingencies and liquidated damages.

A wind farm's power output depends on the available wind resource and on the project's technical performance. Based on the assessments performed by independent engineers, Fitch forms an opinion of the wind farm's long-term expected energy production and analyses the stresses caused by below-average wind conditions. The technology used in the projects and the experience of the operator are also considered to estimate the wind turbines' availability and performance during the life of the project as well as the maintenance expenses.

To date, capital market wind farm financings involve portfolios of projects whose number, size and technical characteristics may vary significantly depending on the nature of the transaction and the countries where the wind farms are located. A certain degree of diversification by number of turbines and locations is viewed as a positive factor as it generally contributes to the stability of the cash flow and it reduces the exposure to single-event risks. These criteria were developed with portfolio financings in mind. Although the fundamental criteria also apply to debt secured by a single wind farm, the severity of certain stress scenarios may be increased to reflect the lack of diversification.

This report does not cover offshore wind farms. While some of the considerations outlined in this report also apply to such projects, the challenges associated with their construction, operation and decommissioning result in their risk profile materially diverging from that of the typical onshore project and, therefore, in the need for a specifically tailored analysis. Fitch has not rated any offshore wind power transaction at the date of this report.

The analysis of the financial structure addresses the debt structure, including priorities, amortisation, maturity and interest rate risk. The provision of liquidity, reserves, financial covenants and triggers are considered in the context of the project. Counterparty risk arising from off-takers, warranty providers or pure financial transaction parties is assessed for its impact on the rated debt.

Regulatory and Price Risk

Given current market conditions and technological progress, wind turbines still cannot compete on price alone with thermal power plants. Public incentives are essential to foster the development of the sector. As is the case for any industry relying on public subsidies, the financial performance of wind farm projects is therefore dependent on such regulations not being modified within the timeframe of the financing. To this extent, Fitch reviews the relevant regulatory frameworks, also paying attention to whether the interests of incumbent operators have been preserved in the past when new laws have been enacted. The country's level of commitment towards renewables also forms part of the agency's more qualitative analysis.

Incentives vary greatly from country to country and can be broadly classified into four categories:

- Feed-in tariffs – commonly seen in continental Europe (Germany and France, for example) and Canada, these are characterised by a specific price, set for a period of several years and, in some jurisdictions indexed to inflation, that grid operators or distributors must pay to the renewable power producers. A variation to this scheme, as seen in Spain, is where the government sets a fixed premium to be paid to the renewable energy generators on top of the market electricity price.
- "Green Certificates" – as seen in Italy or in the UK, this is a system where renewable energy is sold at conventional market prices. The government, however, sets a minimum quota that each power company has to generate from renewable sources. Companies with a shortfall of renewables in their portfolio can buy "Green Certificates" from other generators that have an excess, typically renewable energy producers.
- Tender process – a system common in China and India, the government places a series of tenders for the supply of renewable energy, which is then delivered at the price resulting from the tender.
- Tax incentives – typical in the US market, this approach reduces the tax burden via production tax credits, accelerated depreciation, and similar tax benefits. Notably, these incentives do not result in cash available for debt service and therefore enhance credit quality only if they get monetised through their sale to a third party.

Price Risk

This report does not intend to provide a description of the different regulations present in the various jurisdictions. For the purposes of the credit analysis of wind farm transactions, what is relevant to assess is the degree to which the project is exposed to price risk. This increases along a continuum, with the fixed-price, long-term off-take at one end and pure market risk at the other. As the risk increases, the level of DSCR necessary to achieve an investment-grade rating will also rise. In practice, Fitch will impose an additional price stress scenario while maintaining the expected coverage levels.

The most investor-friendly incentive systems have proved to be those that give to wind farms priority of dispatch, thereby removing balancing and dispatch risks from the project, together with long-term fixed prices. These systems allow for certain, long and stable price assumptions under which to structure the debt repayment, typically taking the form of full amortisation within the asset's economic life. On the other hand, projects where the debt is not fully amortised within the regulatory timeframe, or by the power purchase agreement (PPA) maturity, suffer from the uncertainty arising from the exposure to price risk during their final years.

In certain jurisdictions offering regulated price protection, for example in Germany, the feed-in tariff is reviewed after an initial period and adjusted according to the plant's performance, with the wind farms located at the better wind sites potentially receiving a lower tariff for the remainder of the regulatory period. In these cases, Fitch assesses the risk that a strong performance during the initial period may expose the project to lower tariff levels during its remaining life by running sensitivities with different combinations of energy outputs and tariff levels.

In case of projects exposed to price risk, whether in the form of exposure to the price of wholesale power or to that of Green Certificates, Fitch analyses the transaction under various stressed market price scenarios while maintaining the target levels of DSCR. The price scenarios are generally based on projections prepared by third party market advisers and may be adjusted depending on the agency's view of the particular risk.

Market risk can be mitigated by off-take contracts for power and for Green Certificates with third parties. This option, however, leaves the project exposed to the credit risk of the off-taker, which is assessed by Fitch as part of the rating process.

The agency notes that, to a certain degree, credit risk with regard to the off-taker also exists in jurisdictions offering regulated price protection, as power is normally bought by the regional electricity supplier. In these countries, however, local grid operators are required by law to purchase the electricity produced by the wind farms. In the case of a default of an off-taker, therefore, the same obligation would continue to apply to the grid operator replacing the defaulted entity. The risk to the project therefore is only one of a temporary suspension in inflows, and not of exposure to market risk.

Construction Risk

Construction risk for onshore wind farms is significantly lower than for thermal power plants. There is wide experience of building wind farms, especially in Europe and the US, with three decades of industry practice, and the process is relatively straightforward and fast. Once turbine supply agreements are in place, the risk of material cost overruns is generally low. However, a number of projects have, in the past, incurred significant construction delays, primarily as a result of bottlenecks in the turbines' supply chain. This situation is considered by Fitch when assessing the construction schedule's attainability.

Completion delays may also arise because of longer than anticipated times for the granting of all the necessary planning and construction permits or as a result of opposition from the local communities. These delays do not normally affect the wind farm transactions Fitch rates, as it is customary to have permits in place as a condition precedent to financing. As part of its analysis, the agency, however, also reviews the availability of the required permits and consents and assesses the potential effect on the construction schedule.

Wind farms, especially large projects, are generally erected under a single fixed price and date certain turnkey contract, although it is not unusual to see separate contracts for civil engineering, electrical connection and, in particular, turbine procurement. In all cases, turbine manufacturers are key counterparties, as the cost of the turbines and their installation represent the most significant portion of the project's construction cost. Fitch analyses each party involved in the construction process to form an opinion on their experience and credit quality. The relative simplicity of the asset and the short building timeframe help mitigate some of the concerns linked to the creditworthiness of developers and equipment suppliers.

When forming its opinion about the likelihood of the projects incurring construction delays and their extent or cost overruns, Fitch looks at the magnitude of construction risk (ie the percentage of installed capacity not yet in operation), the stage in the development process (the closer a project is to commissioning, the lower is the uncertainty and, therefore, the construction risk), where the projects are located and the parties involved in the construction.

Depending on the projects' characteristics, Fitch typically considers a potential delay in construction of between three and nine months, possibly more for projects located in jurisdictions with a less mature wind power industry to reflect the lower experience of the developers. The agency looks at the expenses the project will incur during such period (including operation and maintenance (O&M), property taxes, overheads, debt service payments and potential cost overruns) and compares these against available funding (contingency, liquidated damages, debt service reserve, revenues, and so on). If adequate funding is available, if Fitch is satisfied with the contractors' experience and credit quality, if the magnitude of construction works is reasonable and provided that such late completion does not result in a termination of off-take contracts or in the failure to benefit from public incentives, construction delays are considered to represent only a temporary stress to the transaction and may not constrain Fitch's assessment of the debt's credit quality.

Energy Production

Energy production, essentially a function of the local wind conditions and the project's technical performance, is a major driver of the project's cash flow. Any analysis of a wind farm's financial risks is therefore heavily influenced by the energy production expected to be achieved by the project.

Wind Energy Assessments

A typical wind energy assessment for a greenfield project involves modelling the local wind speed, duration and direction. The assessment relies on local wind measurements, usually available for a short period of one to three years, which are correlated to a long-term reference through the use of an index or with data obtained from a nearby meteorological station. Site-specific characteristics, such as the topography and wake losses between the wind turbines, are incorporated into the wind energy assessment.

Fitch believes that all wind assessments carry with them a degree of uncertainty and potential for error. The classic method involves numerous correlations between data points, extrapolations for elevation and allowances for weather that rely on the consultant's assumption. Further uncertainty is introduced by the assumptions about the project's technical performance, for example in respect of the turbines' power curve (the function describing the relation between wind speed and electrical power output) and their future availability. In addition, energy production estimates assume that the historical data considered are representative of the climate over longer periods. This may not necessarily be the case: as the debate on climate change continues, for example, the possible effect (positive or negative) of such long-term trends is not considered in the forecasts.

Once a wind farm is in production, many of the correlations can be improved or replaced. For example, wake and topography effects can be measured instead of simulated, and wind measurements are replaced by actual production data. To the extent actual wind farm data is incorporated in the assessment, the modelling uncertainty of non-wind-related variables is significantly decreased. Fitch has been advised by independent engineers that it is good practice to update the energy assessment after the first year of operation of the project as this allows for a considerable improvement in the energy forecast's precision.

The result of the wind energy assessment is a prediction of the wind farm's long-term average production as well as various levels of production that can be exceeded with a corresponding degree of confidence, reported as a probability of exceedance associated with a certain time period. Accordingly, the output level termed P50 is the long-term annual average output that will be exceeded with a probability of 50%. All production levels apart from the P50 are associated with a specific period: a 1-year P90 value refers to the annual output level that should be exceeded over any 1-year period with a 90% probability, while a 10-year P90 value refers to the average annual output over a 10-year period that should be exceeded with a 90% probability. Since the variance over a 1-year period exceeds the variance over a 10-year period, a 1-year P90 estimate results in a lower annual production compared to the 10-year P90 estimate.

When a portfolio of different wind farms is considered, there is the potential for an overall reduction in the uncertainty of the ensemble compared to the sum of the individual projects. This is commonly referred to as "portfolio effect" and it is due to the statistical independence of some of the uncertainty parameters between projects. The extent of this diversification benefit depends on the diversity of the wind farms both geographically, due to the variation in regional wind regimes, and technically, in terms of the variation of turbine technology and project infrastructure. Fitch has been informed that, for a well-diversified set of projects, the portfolio effect may result in an increase in the aggregate 10-year P90 estimate by some 2% to 5% compared to the sum of the 10-year P90 of the single projects.

Fitch Assumptions

Energy production assessment methods continue to be refined, primarily thanks to the availability of more performance data and through the use of more sophisticated models and improved data sources. Nevertheless, Fitch believes that all wind assessments carry with them a degree of uncertainty. Available data and studies suggest that wind farms are, on average, underperforming compared with the original wind energy assessment, particularly in the case of studies performed pre-construction. Fitch uses the P50 estimate as its base case energy production assumption. To allow for these uncertainties, and in light of the performance observed in a number of wind farms, the agency typically applies a 5% haircut to the results of the wind energy assessment for most greenfield projects. For operating projects with a pattern of performance, Fitch may reduce or even eliminate the production haircut. Conversely, a more sever haircut (up to 10%) may be imposed if appropriate for the project's circumstances.

When assigning a rating to wind farms debt instruments, Fitch primarily focuses its analysis on how the cash flows are affected by single year events. In the case of energy production, this translates into analysing the effect of a one-year below average wind pattern. To evaluate this risk, the agency uses the 1-year P90 estimate in its rating case, giving adequate credit to the portfolio effect if relevant. This amount is also adjusted depending on the haircut applied to the P50 when calculating the Fitch base case assumption.

Technical Availability

When analysing the energy output expected to be produced by the project over the life of the debt, Fitch also pays particular attention to the assumptions made in respect of wind farm availability. This is intended to represent the time a project as a whole is ready to produce revenues. Only standstill periods due to operating conditions (high wind shut-down, for example) are excluded while any other down-time regardless of the cause counts against availability.

Availability levels are primarily dependent on the reliability of the technology and the quality of the maintenance services. This is not only a function of the skills of the operator but it may also be influenced by specific market circumstances. Historical information suggests that long-term system availability of European wind farms averages around 97%. Fitch has been informed that North American projects experience slightly lower availability levels compared to their European peers due to scarcity of spare parts. Furthermore, the agency's research indicates a wind farm may require up to three years to resolve the initial teething issues and settle on the long-term performance level. There is limited information about turbine performance after an extended period of operation but it appears reasonable to expect a deterioration in performance, particularly if O&M budgets are not suitably increased to counterbalance the ageing of the equipment. Some attrition in the number of operating turbines may also occur, for example because of difficulties in keeping the equipment properly maintained as a result of manufacturers going out of business.

Fitch bases its assumptions regarding system availability on the independent engineer's opinion. Some stresses may be applied depending on Fitch's assessment of the degree to which the considerations above are addressed in the analysis.

Operational Risk

When analysing the risks affecting the operation of the wind farms, Fitch focuses first on the technology used in the project. Indeed, the use of turbines with a track record of proven and reliable performance is key in mitigating the risk of the project experiencing performance issues after completion.

This is particularly relevant in an industry which, as a consequence of its dramatic growth, suffers from lack of skilled labour and, in some cases, spare parts. Although these issues may only be the result of temporary market constraints, they are an example of how an experienced operator is critical for mitigating the risk that the project may suffer a reduction in productivity as a result of outages and/or failure to meet expected performance standards or, alternatively, the wind farms may incur costs that are greater than projected. A good operator will also be instrumental in ensuring not only that the turbines are ready to generate, but also that their operating performance is optimised.

In addition to assessing the experience of the operator, Fitch evaluates how the operator is incentivised to maximise the project's performance. This is particularly relevant in the case of third party operators, as a link between the fee payable to it and the project's technical performance allows for an alignment of the interests of the operator and those of the lenders. This may be less of an issue when an operator is also the sponsor of the project, as the ability of the operator to efficiently perform its obligations may influence the return it receives as sponsor.

While O&M expenses do not generally represent a very significant percentage of revenues during operation (no fuel costs, limited labour), Fitch reviews in detail the assumptions on which such costs are budgeted. In its assessment of the O&M budget, the agency looks favourably at the availability of consistent and reliable historical project data, as these are expected to provide a reasonably precise indication of the costs that can be expected to be incurred. Availability of long-term data on the O&M requirements of the turbine model being used also contributes to forming a more precise opinion of the expected future O&M costs. Some stresses are likely to be applied in other cases. The teething issues normally experienced by wind farms during the first years of operation suggest that O&M costs are higher in the early years. Increases in O&M costs are also likely to be sustained late in the life of the project as a result of the ageing of the equipment.

The risk of incurring higher than expected maintenance costs is analysed in conjunction with the conditions under which O&M services are performed (by the project company or a separate company under a long-term O&M agreement on a fixed-price or cost-plus basis, for example). The adequacy of guarantees and liquidated damages (delays and performance) under the contracts as well as the insurance cover contracted by the project are also assessed and incorporated into the analysis.

Some of the transactions analysed by Fitch are structured with maintenance reserves to cover for unexpected maintenance costs. In other transactions, an amount equal to the excess of forecast maintenance expenses over actual outflows is trapped in a dedicated reserve account. Fitch views positively these structural features as they increase the long-term stability of cash flows available for debt service by reducing the impact of future potentially lumpy outflows.

Diversification

Diversification may come in different forms and its presence is generally viewed as a positive factor, contributing to the stability of the cash flows.

As previously mentioned, diversification plays a role within energy assessment studies by reducing the uncertainty on some of the parameters under analysis (the portfolio effect). Geographical diversity is by far the most significant advantage in this respect, as bundling together wind farms in different locations helps reduce a portfolio's dependence from specific wind conditions compared to single-site projects. Similarly, variations of turbine models and technical infrastructure between projects, as well as a high number of turbines, may contribute in reducing the uncertainty in energy production by mitigating the impact on the transaction cash flows of disruptions in the working of some equipment.

It should however be noted that the benefits of diversification can be difficult to quantify and that diversity may carry with it issues that need to be properly assessed and factored in the risk analysis. Geographical diversity, for example, may have material positive effects only if the wind farms are in different wind regions, not simply in different locations. Furthermore, while a multi-site portfolio may benefit from exposure to different wind conditions, its scattered geographical distribution may result in higher maintenance costs compared to a single-site project. Indeed, while diversification across different turbine models does not overly expose a project to defects with one particular turbine type, it is also true that the use of one single reliable technology may equally be a positive feature for a portfolio, as this is likely to result in easier maintenance and, possibly, in a more dedicated service by the turbine manufacturer.

Fitch reviews the characteristics of the portfolios under analysis to incorporate into its assessment of the project's credit quality the advantages, but also the challenges, that diversification entails.

Financial Analysis

When analysing a wind farm transaction, Fitch first builds a scenario that the agency considers as likely to occur based on its experience with the industry and with similar projects (the "Fitch base case"). This scenario is intended to reflect Fitch's expectations about the transaction's long-term average performance and it typically incorporates some mild stresses to the sponsor's base case (if it is deemed reasonable and supported by experienced third party opinions). The Fitch base case is used by the agency to assess the transaction's expected average financial coverage and to compare it with similar projects. Furthermore, the Fitch base case is used for monitoring purposes to identify when and why the transaction is coming under some stress.

The rating assigned to a project is based primarily on its expected performance under a scenario incorporating a harsh but feasible, combination of stresses that may simultaneously affect the transaction (the "Fitch rating case"). This scenario does not aim to represent an average long-term performance and therefore Fitch does not place emphasis on the average DSCR under this scenario. Rather, the agency identifies the year with the weakest coverage and it stresses the cash flows to assess the minimum level of financial coverage under stressful conditions. The level of stress is a function of the nature of the specific project and its risk profile, as well as Fitch's assessment of the reliability of the underlying data.

In addition to the Fitch base and rating cases described above, the agency runs scenarios incorporating severe stresses on the project's performance drivers ("stress cases"). The aim of the stress cases is to identify whether the transaction is particularly exposed to a combination of events (eg harsh deterioration in availability together with a spike in maintenance costs) or to a specific risk (eg energy production, O&M costs, inflation, interest rates and so on). If this is the case, the idea is to satisfactorily incorporate the analysis of such element into the Fitch base and rating cases. In addition, the stress cases may highlight that a particular risk factor, because of its nature and the dependency of the transaction performance on it, acts as a constraint on the ratings. With respect to single variable stresses, it is of particular interest to assess the decrease in availability that the project is able to withstand while still meeting debt service payments. Interpreting the result of this stress test as the maximum number of turbines that may be off-line at the same time also allows an assessment of whether the portfolio is sufficiently diversified and if technical issues affecting a limited number of turbines may result in shortfalls in the cash available for debt service.

The table below is intended to provide illustrative guidance on how Fitch might undertake its financial analysis. In the case of typical onshore wind farm debt, the agency considers a minimum DSCR of 1.30x under the Fitch rating case to be in line with an investment-grade rating. Different stresses and coverage levels may be taken into consideration depending on the specific characteristics of each transaction. In particular, it should be noted that, while relying on the independent engineer's opinion, Fitch reflects in its rating analysis the patterns normally

Financial Analysis Summary

	Fitch base case	Fitch rating case
Energy production (subject to the assumptions on availability)	Average long-term energy production at P50 subject to adjustment (between 0% and -10%) depending on Fitch's assessment of the reliability of the production estimates (primarily the length of operation).	Energy production at 1-year P90 with portfolio effect (if any) subject to adjustment reflecting Fitch's assumption on the average long-term energy production.
Availability	Based on independent engineer's opinion - this should reflect considerations on: • lower initial availability with gradual build-up to long-term level; • cap on long-term availability, typically at 96% in the US and 97% in Europe (Germany, France and Spain); and • availability decrease after the 15th year of operation.	In line with base case assumption but subject to 1% decrease after the 15th year of operation and a further 1% reduction every two years thereafter.
O&M costs	Based on independent engineer's opinion - this should reflect considerations on: • higher initial O&M costs to address teething issues; and • availability of demonstrated O&M pattern profile - ie additional contingencies for new technology, greenfield or recently commissioned wind farms as opposed to projects that have been operating for a number of years.	In line with base case assumption but subject to a 10% increase after the 15th year of operation.

Source: Fitch

observed in the operation of the projects. As outlined in this report and highlighted in the table below, this may result in the agency applying additional stresses to the wind farm's availability level, the O&M cost projections or the project's energy production.

Together with the analysis of the quantitative factors directly contributing to the project cash flows, Fitch incorporates in its rating analysis the availability of structural features that generally reduce volatility (debt service and maintenance reserves, cash trap mechanisms, hedging of interest rate and inflation risk and so on) as well as the project's qualitative characteristics. In this respect, Fitch considers projects that display the characteristics outlined in the table below to be in line with an investment-grade rating.

Qualitative Characteristics of a Typical Onshore Wind Farm Project that are Consistent with Investment-Grade Ratings

Construction risk	Fixed-price Engineering Procurement and Construction contract with experienced contractor; adequate completion guarantees and liquidated damages provisions; permits granted.
Operational risk	Technology with track record of proven and reliable performance; experienced operator; appropriately structured insurance (including business interruption insurance).
Price risk	Limited exposure to market risks; investment-grade off-taker.
Project size	Minimum capacity of 100MW and diversified by number of turbines (more than 70).
Structural features	Fully amortising debt over the asset's economic life or limited and mitigated refinancing risk; minimum of six months of debt service reserve; sufficiently tight cash-sweep or equity lock-up triggers; major maintenance or operational reserve.

Source: Fitch

It should be noted that the absence of a few of the above characteristics or the achievement of a minimum DSCR in the Fitch rating case marginally below the 1.30x target may not preclude the assignment of an investment-grade rating if the rating committee, considering all factors, deems this appropriate. By the same reasoning, while meeting all of the characteristics listed above, a transaction may not achieve an investment-grade rating because of specific circumstances such as, for example, sovereign risk.

Surveillance

To maintain its ratings, Fitch expects the rated transaction to issue regular information reports. These are expected to be timely in nature and sufficient to enable the agency to review the overall performance of the borrower. Information required by Fitch on an ongoing basis includes:

- profit and loss and cash flow data;
- reporting on financial covenants (both compliance with and levels);
- technical performance data (energy production and availability);
- management commentary on operational performance; and
- if possible, regular meetings with the agency.