1 INTRODUCTION

With over 130 GW\(^1\) of installed capacity as of end-2014, Europe is the second largest stakeholder in wind electricity production, after Asia (142 GW, of which 115 GW\(^2\) are based in China). The European market share represents 35% of global wind activity and the sector seems poised to continue its advance.

The European onshore wind market is perceived as being largely mature. Construction and operating risks are widely accepted in onshore wind transactions: onshore construction is seen as a relatively simple and straightforward process, with one main contractor (the turbine manufacturer); long-term operational risk is accepted on the basis of performance commitments by manufacturers. The pool of equity providers that have invested in wind projects is thus extremely large, ranging from pension funds to private equity companies.

In addition to long term and stable regulatory frameworks, a notable aspect of the developments in European wind market is the role of non-recourse finance structures. Project finance can be of benefit to developing industries, as it provides additional scrutiny and therefore helps quantify and mitigate risks via proper risk allocation and meticulous project development. As a result, project finance cultivates lender confidence, thus bringing the leverage and profitability required to attract investors to the sector. Project finance has therefore played a substantial role in building up the wind momentum in Europe as corporate debt is scarce and expensive for most developers.

This paper will analyse the European case study by providing an in-depth analysis of typical project finance deal structures and the current trends and main terms of the EU financing market.

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2 PROJECT FINANCE DEAL STRUCTURE

2.1 Project finance principles

Large projects are typically developed through a stand-alone project company owned by the project investors, with its own revenues and balance sheet, and thus the ability to raise debt on its own merits. There are only two discrete sources of funding: (i) by the owners, directly via equity or shareholder loans, or indirectly via guarantees and (ii) by banks without recourse to the equity investors – this is called “project finance”.

Lenders need to make sure that the project works on a stand-alone basis, with no third party commitments other than those made when closing the financing. Such commitments must be realistic, credible and durable, both contractually and economically. This typically entails very detailed contractual frameworks and extensive due diligence.

Lenders need risks to be measurable and to have low single digit probabilities of occurring for investment to make sense. Risks which are (seen as) well understood are thus easier to bear. Project finance lenders will usually have priority access to cash-flows and security on all assets, contracts and equity of the project.

The amount of debt that can be provided to a project is calculated, based on two constraints:

1) Capital expenditure constraint:

Lenders require a certain portion of the total investment costs of the project to be provided by the investors (typical investment costs presented in Figure 1). In onshore wind in Europe this portion, called “gearing”, is usually 10% of equity vs. 90% of debt. Investors are usually required to invest their money upfront (i.e. use all of the equity, before drawing on the debt).

![Figure 1: Investment costs breakdown](image)

2) Revenue side constraint:

Project finance lenders require a buffer between the Cash-Flow Available for the Debt Service (“CFADS”) and the debt service. CFADS is calculated as revenues, minus operational and insurance costs (see Figure 2).
Figure 2: Simplified cash-flow waterfall

A ratio called Debt Service Coverage Ratio ("DSCR") is thus defined as: CFADS divided by debt service, for each of the repayment period of the debt.

In onshore wind in Europe, the standard DSCR is in the 1.15-1.20 range, with revenues based on a P90-production scenario. P90 being the energy that the wind project is 90% likely to produce over an average year, given the uncertainties in the measurement, analysis and wind turbine operation. Length of the debt maturity largely relies on the regulatory framework and duration of the feed-in tariff mechanism.

Sizing of the debt has to satisfy the two constraints described above. One of the goals of financial structuring is to ensure that the constraints bring the same ultimate amount of debt (or as close to that as possible) so that no potential debt capacity goes unused or wasted. Various optimisations in contractual structure and finance structure can significantly improve investor return. Ultimately, the contractual structure of the project will determine the funding capacity of the project.

2.2 Market trends in debt financing

Current market conditions and low cost of funding allow very attractive pricing for debt financing in Europe. Margins and base rates have both decreased and overall cost of 15-year debt is now below 3% (see Figure 3). As illustrated in the table below, structures (ratios, maturity, and covenants) are improving substantially. Debt tenor can exceed the feed-in tariff period again, and the appetite from the banking market is perceived as very high.

<table>
<thead>
<tr>
<th>Year</th>
<th>Leverage</th>
<th>DSCR (P90)</th>
<th>Maturity post-completion</th>
<th>Pricing</th>
<th>Maximum underwriting</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006 - 2007</td>
<td>90:10</td>
<td>1.15</td>
<td>18 years</td>
<td>60-90 bp</td>
<td>EUR 100 - 150 M</td>
</tr>
<tr>
<td>2008 - 2010</td>
<td>75:25</td>
<td>1.25</td>
<td>15 years</td>
<td>200-270 bp</td>
<td>EUR 30 - 50 M</td>
</tr>
<tr>
<td>2010 - 2013</td>
<td>80:20</td>
<td>1.20</td>
<td>15 years</td>
<td>175-225 bp</td>
<td>EUR 50 - 75 M</td>
</tr>
<tr>
<td>2014 - to date</td>
<td>90:10</td>
<td>1.15</td>
<td>15-18 years</td>
<td>160-225 bp</td>
<td>EUR 50 - 150 M</td>
</tr>
</tbody>
</table>

Figure 3: Debt financing for onshore wind in Europe

While the financial crisis impacted banks and their ability to finance the infrastructure sector, the share of wind within the project finance market has actually increased. Banks are refocusing on known clients, core countries and strategic sectors of activity, and wind is explicitly seen as “strategic” for many banks today with most regulatory frameworks now considered as well understood and stable. However, merchant risk periods remain one of the key areas of focus.
3 RISK ANALYSIS OF WIND PROJECTS

3.1 Heavy contractual structure

Wind is a quintessential example of a comprehensive contractual structure. Wind transactions are always heavily contracted, as illustrated in the Figure 4 below. Major contracts include:

- Permits, licenses, authorisations
- Construction/supply contracts
- Electricity sales contracts
- O&M contracts
- Financing documents

![Figure 4: Contractual structure of wind projects](image)

3.2 Different risks depending on each project phase

During development, main risks are linked to the permits, the tariff and potential power purchase agreement (“PPA”), the establishment of construction contracts and the lack of funding. However, these risks can be mitigated through project management, detailed planning and by having committed sponsors on board.

During the construction phase, risks are essentially delay and cost overruns, and can be due to gaps in the scope of works of the contractors or any interface risk with subcontractors, contractor delay, adverse weather and accidents. Project coordination, solid contractual protection (such as liquidated damages (“LDs”)), sufficient contingent budget and a comprehensive insurance package are key in order to mitigate these risks.

During the operational phase, downside scenarios include lower availability of the turbines than expected, production closer to P75 than P50 scenario, higher operational and maintenance costs, lower electricity prices (if the revenues are not secured through a fixed tariff and depend on merchant prices). These scenarios can be prevented with similar mitigation tools as described for the construction phase.
3.3 Wind sector specific risks

Wind sector specific risks are mainly linked to the technology, wind, construction and operation, but are unlikely to be seen as deal breakers:

- **Technology risk:** lenders can take technology risk in the wind sector, but preferably with tested turbines
- **Wind risk:** wind variability is a measurable statistical risk and is mostly seen as well understood. Quality of data may be an issue in some countries with less met data available, but this should not be an obstacle
- **Construction risk:** onshore construction is seen as a relatively simple and straightforward process, with one main contractor. Civil works can usually be done by local companies. Logistics (roads, ports) will also be examined carefully. Grid connection will need to be under the control of the project otherwise it will be assessed as an additional political risk
- **Operating risk:** Long term operational risk is accepted on the basis of performance commitments by manufacturers. Spare parts availability and logistics may be scrutinised more carefully.

3.4 Traditional project finance risks

Apart from the specific risk described above, the framework to analyse wind projects is similar to that for other sectors which use project finance, and the following risks are typically assessed:

- **Regulatory / political risk:** lenders will not take any permitting risk at any time. In most emerging countries, lenders will not accept the (political) risk that the regulatory regime may change thus the need for long term stable regulatory. Risk includes access to grid and any requirement to build ancillary infrastructure (port, roads, transmission, etc.)
- **Price / market risk:** project must make sense macro-economically for the country. Lenders will not take any power market risk in emerging markets. This risk is deeply linked to counterparty risk (see below) and nature of buyer (public/quasi-public entity or otherwise)
- **Counterparty risk:** market leading turbine manufacturers are seen as acceptable counterparties even in emerging countries. Other construction contracts are usually seen as less critical. Offtaker risk is critical whether power sales take place under a long term PPA or a regulated framework

Non-recourse finance is available for onshore wind projects, as long as a consistent set of bank requirements, including extensive due-diligence, are met.
4 INVESTMENT PROFILES

The investor universe in the infrastructure sector in general is nearly entirely represented in wind, with a few specifics (public support) and notable differences between onshore and offshore, mainly due to the size (larger offshore projects) and the risk (seen as much higher offshore).

The investors in onshore wind can be sorted in four main categories:

- Developers, from small pure developers to large utilities
- Financial investors, with varying appetite for risk
- Corporates, led by contractors involved in the sector
- Public institutions, at various level (local, national, EU)

4.1 Developers

Many of the onshore wind farms are developed by specialised companies active only in the electricity generation sector. Three discrete groups can be identified:

- Pure developers: these companies, generally not very large, develop the projects from the very beginning to the sale of a permitted wind farm, typically before construction. They can stay longer in the projects with a minority share
- Independent power producers (IPP): they develop and keep ownership of the wind farms. Their main source of revenues is from the sale of the electricity
- Utilities: relative latecomers in the sector, they tend to buy permitted projects rather than do own developments and prefer larger portfolios

4.2 Institutional investors

Amongst the pure financial players, there are as many investment profiles as investors. The following groups can still be recognised:

- Infra funds: they consider renewables as any other asset and apply the same analysis as for roads or hospitals (except for specialised funds, who are generally smaller and more focused)
- Private equity funds: they are willing to take more risks in order to reach higher returns
- Insurance companies: they look for low risk liquid investments with steady cash flows
- Pension funds: seeking investments with stable long term cash flows
- Sovereign wealth funds: the investment arm of the countries with large cash reserves from oil and gas are increasingly looking at investment that prepare their future

4.3 Corporates

A number of companies whose core business is not to generate electricity have been active in the onshore wind market

- Contractors: some of the turbine manufacturers have a development arm and sell projects (using their own turbines) upon completion
- Japanese trading companies: large diversified conglomerates
- Others: typically with strategy to cover their own power demand from renewable sources

4.4 Non-private entities

Public or publicly-owned entities have consistently played a key role in developing renewables:

- Public financing institutions: support to domestic projects (via loans or investments) or to manufacturers exporting wind turbine equipment
- Municipal utilities: very active in Germany
4.5 Risk profiles

Each investor uses its own set of assumptions for the valuation of a project but common behaviour can be highlighted, as shown in Figure 5 below:

<table>
<thead>
<tr>
<th>Class</th>
<th>Sub-class</th>
<th>Assumptions used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developers</td>
<td>Pure developers</td>
<td>Standard</td>
</tr>
<tr>
<td></td>
<td>IPPs</td>
<td>Reasonably aggressive</td>
</tr>
<tr>
<td></td>
<td>Utilities</td>
<td>Standard</td>
</tr>
<tr>
<td></td>
<td>Infra funds</td>
<td>Reasonably aggressive</td>
</tr>
<tr>
<td></td>
<td>Private equity</td>
<td>Aggressive</td>
</tr>
<tr>
<td></td>
<td>Insurance companies</td>
<td>Prudent</td>
</tr>
<tr>
<td></td>
<td>Pension funds</td>
<td>Prudent</td>
</tr>
<tr>
<td></td>
<td>Sovereign wealth funds</td>
<td>Reasonably aggressive</td>
</tr>
<tr>
<td>Institutional investors</td>
<td>Contractors</td>
<td>Standard</td>
</tr>
<tr>
<td></td>
<td>Japanese companies</td>
<td>Prudent</td>
</tr>
<tr>
<td></td>
<td>Other Corporates</td>
<td>N/A</td>
</tr>
<tr>
<td>Corporations</td>
<td>Public entities</td>
<td>Standard</td>
</tr>
<tr>
<td></td>
<td>Municipal utilities</td>
<td>Prudent</td>
</tr>
</tbody>
</table>

Figure 5: Classes and sub-classes of investors in the European onshore wind market

- **Prudent**: Prudent investors use P75 yield assumptions (i.e. the energy that the wind project is 75% likely to produce over an average year) and in any case, the P90 downside scenario is scrutinised. Decommissioning costs are generally included and no end value or repowering is assumed. Lifetime of the wind farm accounts for 20 years of operation. Inflation is based on conservative views (inferior to 2% in continental Europe) and electricity price forecasts as well (annual average increase of electricity price, without inflation, at 2%). High O&M costs are assumed.

- **Standard**: the average set of assumptions used by the shareholders of a project are less pessimistic than the one considered by the banks or the more prudent investors: P50 wind, decommissioning equal to end value (so that net value at the end of the project is null), at least 20 years of operation (depending on the permits and lease), long-term market view for the inflation (2%) and mid-case electricity forecast from the market advisors (annual average increase of electricity price, without inflation, at 3%).

- **Aggressive**: some funds use more aggressive assumptions for their base case, in order to reach their IRR targets: P50 wind scenario, decommissioning considered to be inferior or equal to the scrap value at the end of the period, 25 years of operation, above-market assumptions for inflation (3%) and electricity price (3%). Low O&M costs and high availability of the turbines are also assumed.

The investors who use aggressive assumptions (mainly private equity funds and some infrastructure funds) need to meet high return requirements (superior to 12% on a levered basis) and amongst others manage to do so by using an aggressive set of assumptions as described above. This high return would go down to a value that is closer to an average market (in the 8-9% range) if using a standard set of assumptions.
5 CONCLUSION

In the last ten years, the European onshore wind market has become a mature market and the risks have moved from those of a new industry (technology risk, construction risk) to those of a developed industry (regulatory risk, country risk). The impact of the crisis on the onshore wind sector is not as obvious as in other sectors, as the assets generate stable cash flows not heavily correlated with the rest of the economy, which explains the attraction of the sector to investors. Access to funding may have become harder for small developers, but the low level of the base rates have helped to keep it manageable.

Funding is available for projects which are correctly structured: stable, consistent and reliable legal framework, without volume risk (certainty about grid connection), with incentive and support mechanism that makes the economics acceptable. When using project finance, extensive risk analysis and due-diligence must be done.

In the equity universe, four main classes of investors can be identified (developers, financial investors, corporates and public institutions), based on their risk appetite. Two approaches can be highlighted: the prudent approach used e.g. by the Japanese conglomerates and the pension funds who base their valuation on conservative assumptions, so that the actuals are likely to be better than their investment forecasts. They can therefore show a low level of return which is compensated, to a certain extent, by the conservative assumptions used to evaluate the wind farm. Conversely, the aggressive approach used e.g. by private equity funds allows them to show high levels of returns and meet their internal investment requirements. Equity returns for the same onshore wind project can thus go from 6% to 15+%, depending on the class of investors looking at the project.

We believe that many of the lessons and experience from the European market and players can be replicated successfully in emerging markets currently taking off amongst which Brazil is now looking for financing from the private sector.

6 BIOGRAPHIES

Sophie Cherrier is a founder and director of Green Giraffe (www.green-giraffe.eu). Green Giraffe is a financial advisory boutique dedicated to renewable energy with offices in London (United Kingdom), Paris (France), Utrecht (the Netherlands), and Hamburg (Germany). Green Giraffe offers specialised services with regard to the raising of debt and equity, deal structuring, strategic advisory, project development and contracting for complex renewable energy transactions. Since its creation just 4 years ago, Green Giraffe has completed equity and debt advisory missions in respect of over 5 GW of renewable energy capacity across Europe and North America.

She has been involved in raising the financing of the 325 MW C-Power offshore windfarm (Belgium, 2010) and the 288 MW Meerwind offshore wind farm (Germany, 2011). She was in the lead of raising debt and equity on the 600 MW Gemini offshore wind farm (the Netherlands, 2014), the 332 MW Nordsee One offshore wind farm (Germany, 2015) as well as the 30 MW Deepwater offshore wind farm (US, 2015). She has also worked on the French offshore wind projects as advisor to one of the consortiums bidding – successfully - on the first tender.

Before that, Mrs. Cherrier worked for 2 years in Dexia’s project finance team. During this period she closed a couple of transactions in the public private partnership (PPP) and renewable energy sectors (solar, offshore and onshore wind farms). She graduated from the ESSEC business school in Paris, France.

Floriane Didier joined Green Giraffe 2 years ago. Since then, she has worked on solar, onshore and offshore wind projects in the United Kingdom, Germany, France and the United States. She recently worked on the 332 MW Nordsee One offshore wind farm (Germany, 2015) for which Green Giraffe successfully advised on raising the 900 million euro non-recourse loan facility in a short period of time (6 months). She has also conducted on behalf of Green Giraffe extensive studies and modellisation of the ongoing regulatory regime changes and in particular on the impact choice of revenue regime (feed-in-tariff vs. market based incentive programs) on project economics.

Before joining Green Giraffe, she worked at Ernst & Young in Transaction Services. She was involved in the preparation of sell-side and buy-side due-diligence reports and supported clients in deal executions. She also worked as a portfolio manager assistant at Lyxor Asset Management, a subsidiary of the French bank Société Générale, where she developed a number of tools for portfolio construction and hedging strategies.
Floriane holds an MSc in Engineering from the Ecole Nationale Supérieure de Techniques Avancées, Paris, France and completed her formation with a Master in Project Finance and Structured Finance from the Ecole Nationale des Ponts et Chaussées in Paris, France.