MARKET REPORT

KEY WIND INSURANCE RISK CHALLENGES FOR 2019

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Prepared by Price Forbes & Partners and Modern Energy Management

INTRODUCTION

Investor learning curve for wind projects is steep and expensive. Any investor that has invested in at least one wind project certainly has scar tissue from the experience. Despite the fact that wind is notorious for project cost overruns, the industry has been slow to improve risk management strategies.

A key reason for unpredictable wind CAPEX and EIRR is a failure to properly identify and transfer project risks. Too often project contracts and insurance are developed in isolation, without consideration for how they fit together to protect investor interests. To compound the problem, typically neither project contracts nor project insurance fully address project specific risks. This presents "risk transfer gaps" that leave investors financially exposed.

Historically, project insurance has been used as a "stopgap" for investors. Even though wind projects have been unpredictable for investors, project insurers have been exposed to greater and more consistent losses. This is not a sustainable business model for project insurers.

According to leading global reinsurers, in 2018 claims paid out exceeded premiums received. As a result, the insurance market is rapidly hardening; insurers are becoming increasingly selective about the projects, technologies and even investors they want to insure. At best, investors who have not properly de-risked their wind projects will find insurance significantly more expensive. At worst, certain aspects of cover may no longer be commercially available. For investors that do not adopt more thorough risk management strategies, they will see these risk transfer gaps widening, potentially making their projects uninvestable and unbankable.

In cooperation with Poul Hansen of Price Forbes, we have worked with leading global reinsurers to outline key insurance market challenges for 2019 going forward. In the following pages you will find key insights from the project insurer perspective, along with recommendations to address these challenges to maintain "investment grade" status for investor's projects. We trust you find this guidance of interest, and would welcome any comments you may have.

Best Regards,

Aaron Daniels, Managing Director

Modern Energy Management

KEY WIND INSURANCE RISK CHALLENGES FOR 2019

RENEWABLE ENERGY INSURANCE MARKETS ARE HARDENING

Every year Price Forbes hosts representatives of leading global renewable energy reinsurers to visit key clients and projects in Asia. The goal of this trip is to better understand the market and investor needs. At some point during this annual trip insurers drop by MEM's Bangkok offices to compare notes and ask our team about current trends and risk mitigation strategies.

During our last annual meeting with insurers, the message was clear. According to the reinsurers, claims paid out to projects in emerging markets exceeded premiums, making the insurance business model in these markets unsustainable. Going forward, insurers would be much more selective in the projects and markets they insured.

Since that time, MEM has seen the insurance market hardening significantly as the list of insurer subjectivities grows. Simply put, insurers are becoming much more selective about the projects and risks they will accept. Clients who are proactive about risk transfer strategies have found the process manageable. However, clients who have been slow to adopt comprehensive risk management strategies, incorporating mitigation strategies incorporating both contracting and insurance have faced ever-increasing challenges in their projects.

To understand project reinsurer's perspective, we must first contemplate where their concerns start:

WHERE TO TRANSFER PROJECT RISK?

The table below reflects the Project Management Institute's (PMI) academic process of risk analysis and risk response strategy.

Project Risk Analysis process

1.Identify risks
2.Qualitative risk analysis
3.Quantitative risk analysis
4.Plan risk response
5.Control risks

Risk response strategies	Risk strategy owner	Implementation method
1.Avoid	Project Manager	Project plan Operations plan Commercial Strategy
2.Transfer	Project Manager Attorney Insurance	Commercial agreements Insurance cover
3.Migrate	Project Manager	Project plan Operations plan
4.Accept	Project Manager	Project plan Contingency

Figure 1: PMI risk analysis and response strategies

Investors should seek to first ensure project risks have been identified, and then transfer as much of that risk as possible to other parties. To understand project risks, an experienced project manager needs to be involved in the risk analysis process. And as there's only two parties the investor can transfer risk to: the contractor and project insurers. To avoid "risk transfer gaps", the project attorney and insurance broker must work together to make the transfer seamless.

RISK TRANSFER GAP

Unfortunately, many projects fail to both properly identify project risks and to transfer them. Consider this: is the insurance broker consulted in the drafting of the construction and operations contracts? Typically, the insurance broker doesn't get involved until after the contract has been drafted, negotiated and even signed. This is where risk transfer gaps occur, which expose the investor to additional cost during the project lifespan.

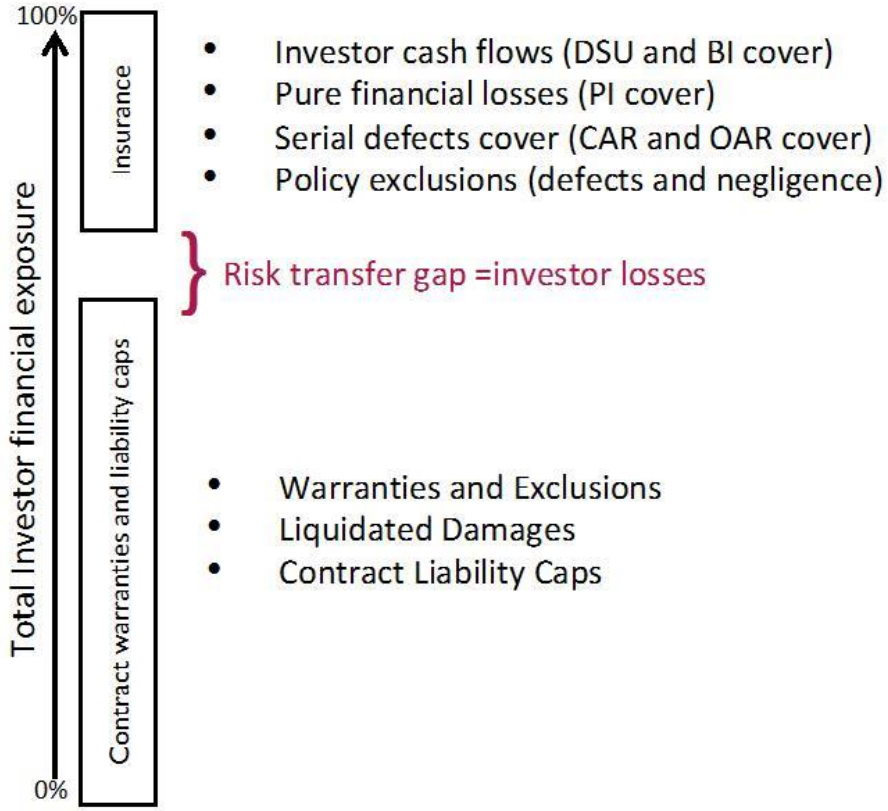

Figure 2: Risk transfer gap

With the rapid hardening of renewable energy insurance markets, investors that don't implement a proper, thorough risk analysis and transfer strategy (balancing both insurance and contract strategies) will see this risk transfer gap grow, ultimately threatening the very investability of the project. It is essential that the risk allocation and insurance strategy is addressed as early as possible, and no later than issuing an RFP (Request for Proposal) or ITT (Invitation to Tender). Any uncertainty or missed risk allocation will certainly be used by the contractor/OEM as leverage later in the negotiation phase.

OWNER CONTROLLED INSURANCE PROGRAMME DURING CONSTRUCTION

If lender finance is being sought, the golden rule is to protect lender and investor interests first by procuring an owner-controlled insurance programme. The reason is a contractor led insurance programme will mainly focus on contractor risks, rather than those of the project/project owners. For example, consider the insurance cover interfaces in the diagram below:

1. Marine All Risk (MAR) / Construction All Risks (CAR) interface: if transport damage is discovered upon receiving equipment at site, but the cause of the damage cannot be determined to have taken place during transport (MAR) or at site (CAR), without a clear cause for the damage, both MAR and CAR may reject the claim. If procured by the owner together, in this circumstance the claim is paid out 50/50 between the investor's MAR and CAR policies.
2. MAR/CAR / Delay in Start-up (DSU) interface: in the event the completion of the project is delayed due to an insured event under the MAR or CAR policy, BI cover pays out the investor's lost revenue for that delay.
3. Operations All Risk (OAR) / Business Interruption (BI) interface: like interface #2 above, if an event insured by the OAR policy causes a loss of revenue (for a single WTG or the wind farm), BI cover pays out the investor's lost revenue.

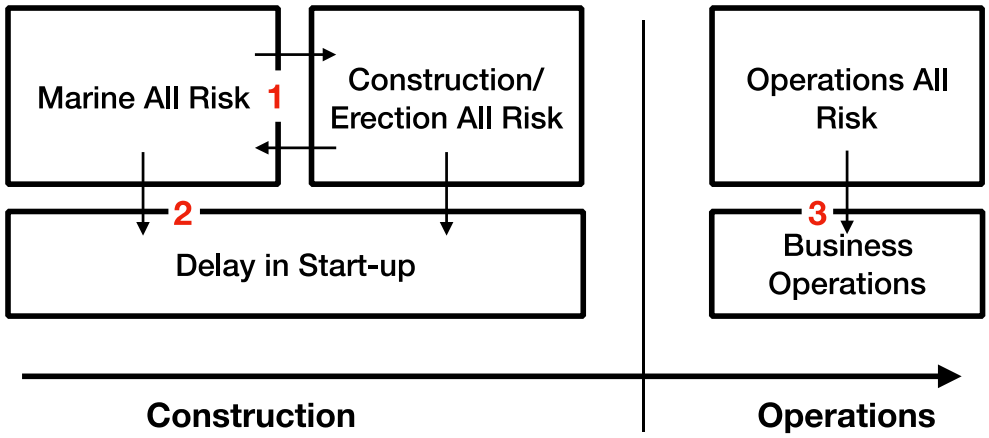

Figure 3: Insurance cover interfaces

The DSU and BI policies are key insurances to protect investor cash flows. To ensure these policies reliably cover investor risks, they must be procured together by the project owner.

Additionally, an owner (and finance parties) controlled insurance programme gives the investor control over the insurance proceeds. Typically according to the contract payment schedule the owner will already have paid for the equipment when an insurance claim is made.

2019 WIND RISKS

Even a year ago, project contracting could be "sloppy"; project insurance could be used as a stopgap to insulate investors from many risk events that were missed by project attorneys working in a "silo" without consideration from the project manager or insurance broker. However, with the hardening of insurance markets, those days are coming to an end. Cover for some risk events may no longer be commercially available. The resulting risk transfer gaps left by inadequate risk transfer strategies are, in some cases, so big that they may leave some construction contracts uninvestable to equity investors, and unbankable to lenders.

Working with insurers and analyzing claims history, Price Forbes has outlined some of the key challenges for insurers of wind project:

COMMERCIAL RISKS

Contractor's negligence

Issue: Over the past 24 months a series of accidents and quality defects (in design and installation) has made the performance of the contractors a serious concern for insurers, particularly where an OEM is acting as both WTG supplier and as a contractor. Investors have made the mistake of looking at a prospective contractor's balance sheet as qualification to deliver construction contracting services, overlooking the key qualification criteria:

- Experience of the project management team
- In-house capability to manage civil, electrical and installation quality
- Track record of successfully delivering the scope of construction/installation work as a contractor

Risk: On an owner led insurance program (where the SPV carries Marine All Risk and Construction All Risk insurance), claims arising from contractor negligence will be paid out by the owner's insurance. This claims history will impact the investor's cost of future insurance premiums, and as insurers become more restrictive as to the project risk profiles they will accept, may impact the investor's ability to insure future projects altogether. As an example, due to poor construction quality and safety management, insurers are already restricting cover for one tier 1 European OEM, leaving project investors to sort out uninsured scope on their projects.

Mitigation: In this changing insurance market, it is critical to bring project insurance into the development of commercial strategy before a tender is released. A project procuring WTGs with a strong track record and technical fit for the project may actually be uninsurable if the OEM is acting as an EPC or installation contractor. Additionally, subrogation must be specifically addressed in both the contract and insurance policies; contractor negligence should be specifically excluded.

Definition of force majeure

Issue: From insurer's perspective, contract definitions of force majeure are often too loosely defined. Claims under force majeure contract language often have root causes in equipment design and manufacturing defects and contractor negligence.

Examples of lightning damage claims originating in quality defects include:

- Lightning receptors installed with adhesive that is conductive when wet, but become insulated when the adhesive cures
- Carbon fibre blades with inadequate grounding to compensate for the conductive nature of the carbon fibre
- Premature leading edge erosion allowing water to penetrate the outer shell of the blade

Risk: As the insurance market continues to harden, insurers will scrutinize contract language and require revisions of force majeure language as a part of insurer subjectivities. At best, this will force investors to re-open negotiations of contracts, leading to delays and the potential for cost escalation with contractors and suppliers.

Mitigation: The prerequisite of "beyond reasonable control" in contract force majeure language should be emphasized with OEM design and manufacturing quality defects in mind. Additionally, the potential for quality defects to be erroneously claimed by contractors and suppliers should be minimized. Examples include limitation of force majeure claims of fire damage to external causes only, and lightning strikes outside specifications of IEC 61400-24 (lightning protection of wind turbines)

Design liability

Issue: With increasing frequency of new, untested technology (i.e. IEC class 3 WTGs) in the market and contractors with limited experience and in-house capabilities to manage engineering, project design risks are growing exponentially.

Risk: Insurers only cover unknown risks (as known risks should be transferred to the contractor or accepted by the investor). As an example, if there is a design defect in WTG foundations which is discovered by the failure of 1 foundation (i.e. a structural crack or break in the foundation), insurance with LEG3 cover should cover related costs to repair or replace that foundation to make that WTG fully functional again (and with Business Interruption cover, loss of revenue would also be covered). However, if the design defect were found to affect all the foundations on the project, the other, as yet undamaged foundations would be excluded from insurance cover (it is now a known risk/defect).

Additionally, with the hardening of insurance markets, contractor PI cover is becoming challenging for contractors to secure. Insurers see the risk profile for contractor PI spread over all of the contractor's projects, and a track record of delivering quality reduces premiums. However, a contractor that purchases PI for a single project may find the premiums prohibitively expensive.

Mitigation: Contractor's Professional Indemnity (PI) cover insures the investor against the contractor's errors in design, engineering and professional services, and covers pure financial losses. In the example above, when design defects are discovered on the remaining, as yet unaffected WTG foundations, contractor PI cover would pay out against the costs associated with correcting the defect in these remaining foundations. Contractor PI cover should be considered carefully as it should not be a "check the box" exercise. Risks mitigated by contractor PI cover could include potential issues with new WTG or tower technology, foundation design, and contractor track record.

"With increasing frequency of new, untested technology in the market and contractors with limited experience and in-house capabilities to manage engineering, project design risks are growing exponentially."

Figure 4: Foundation failure due to design and construction defects

Subrogation against suppliers and contractors

Issue: Contracts reflecting an owner led insurance program typically allow for the contractor to be listed as an additional insured. In such cases, project insurers waive subrogation rights, meaning for claims paid out, insurer may not pursue the contractor for the cost of those claims in cases of defects in engineering, manufacturing or contractor negligence.

Risk: Recently MEM observed an operating project where the complete loss of a WTG was attributed to contractor negligence (the contractor did not manage the quality of WTG installation). In this case, insurers rejected the claim, and the contractor also refused to replace the WTG, insisting insurance should pay. This left the investor "stuck" in the disputed claim between insurer and contractor. The investor suffered loss of revenue and the cost of legal fees during the dispute.

Mitigation: Contracts should reinforce the expectation of the contractor or supplier delivering the correct quality within the specified time and budget. Additionally, contractual scope of owner insurances should exclude defects (design, engineering and manufacturing), resultant damage caused by the defect and contractor negligence, while maintaining protection for the investor.

"Contracts should reinforce the expectation of the contractor or supplier delivering the correct quality within the specified time and budget."

Figure 5: Substation fire caused by construction defect

TECHNICAL RISKS

Prototypical technology

Issue: As investors have moved toward slower wind speed project sites, OEMs have focused on development of new IEC class 3 WTGs and taller tower technology. As investor equity returns improve with these technical advances, investors are more frequently procuring WTGs before they have been fully commercialized. It is not uncommon for investor to contract procurement of WTGs that do not yet have a prototype WTG, or that prototype WTG has not yet satisfied insurer required 8,000 operational hours.

Risk: Without operational fleet experience, the reliability of prototypical WTG technology cannot be assessed. Additionally, the industry has learned that WTG technology is not scalable (i.e. an OEM cannot simply make an existing, IEC class 2 rotor and drive train bigger to create and IEC class 3 WTG). (Reference Clipper wind turbines).

The market move toward larger WTGs with limited or no operational track record presents technology risk to investors, which at present cannot be quantified by insurers. At worst, if new IEC class 3 technologies prove prone to design and manufacturing defects investors may see an increasing list of exclusions to insurance cover.

Mitigation: Insurers will limit cover unless WTG OEMs to put "skin in the game" by way of warranties, performance LDs and contract liability caps. Measuring the "risk transfer gap" between contracting and insurance cover commercially available will be crucial to protecting investor interests and satisfying insurers regarding the project commercial risk profile.

IEC type certification

Issue: As above, WTGs that have been procured before they've fully achieved commercial production often will not have completed their full IEC type A certification (a requirement for insurers). This will limit insurance cover available.

Risk: In the prototypical stage of WTG development, insurers will only offer LEG1 cover until IEC type A certification has been achieved, and thereafter only LEG2. LEG2 will likely be sufficient for lender finance, but in the case of damage caused by defects in design or manufacturing, will only cover resultant damage, but not cover the defect itself (as LEG3 would). Typically OEMs see resultant damage caused by defects an insured event, leaving investors exposed to this risk.

Mitigation: Contract defect warranties must include resultant damage caused by design and manufacturing defects. Further, contract liability caps should be considered in context of the potential value of defects plus resultant damage, which could be, in case of fire, the value of the WTG itself.

Lightning damage

Issue: Force majeure clauses typically include lightning as a force majeure event. However, IEC code 61400-24 (lightning protection of wind turbines) requires WTGs be designed to receive lightning strikes within specified parameters. Defects attributed to some WTG OEM's failure to manage quality of lightning protection systems has led to excessive lightning damage claims. Additionally, as some OEMs move back to use of carbon fibre in blade manufacturing (carbon fibre being a conductor of electricity), this has exacerbated the problem for insurers.

Risk: The cost of a typical fibre repair due to lightning damage in emerging markets can be 30-50kEUR (including mobilization of a qualified fibre tech, crane or man-lift mobilization and rental as well as lost production of the affected WTG). Lost revenue claims in Asia are typically more expensive due to the additional repair time required as fibre repairs cure slowly in the humidity of SE Asia. The cost for a "real" force majeure lightning strike is high. The cost of repeated lightning damage due to design and manufacturing defects is even higher. Insurers will begin to limit or exclude insurance cover for lightning damage, leaving investors fully exposed to this risk.

Mitigation: Project insurer's exclusion of lightning damage is a result of the OEM's track record of failing to address design and manufacturing defects. If the investor can no longer transfer lightning risk to insurers, an argument can be made that OEMs should accept this risk. If OEMs are confident in their blade design, they could accept lightning risk themselves, or OEMs can procure their own insurance for this risk, at t heir own cost. Barring this, noting that IEC 61400-24 specifies WTGs be designed to withstand lightning discharge within the parameters specified, investors should limit force majeure damage due to lightning damage outside IEC 61400-24 specifications.

Leading edge erosion

Issue: Over time, the friction created by the blade moving through the air results in erosion of the leading edge of the blade. While this phenomenon is not new, the rate and extent of damage is accelerating significantly across markets. MEM has seen leading edge erosion on IEC class 3 WTGs as early as 1 year after commercial operations. Site environmental conditions are a contributing factor in leading edge erosion, but blade quality defects are typically the root cause if blades begin showing leading edge erosion early in the project lifecycle. This is typically a result of insufficient coating of the blade

(manufacturing defect) or transport and installation damage during construction (installation defect). Noting that the tip speed of the significantly longer IEC 3 blades being dramatically faster than other IEC class WTGs, the wear we are seeing on IEC class 3 WTGs may indicate gel coating specifications for this class of WTGs is not fit for purpose. Penetration of the blade's gel coat caused by leading edge erosion also contributes to water entering the blade, exasperating lightning damage.

Risk: Leading edge erosion is a contentious topic in the industry. OEMs will attribute the phenomena to "normal wear and tear" and "site conditions", even in cases where the blade is worn to the point of failure within the first year of commercial operations. At best leading edge erosion will reduce energy yield, necessitating costly repair at site (leading edge restoration) to correct the issue. At worst, left unchecked leading edge erosion may lead to the blade delaminating and splitting (like a banana peel). In addition to the total loss of the blade, if the blade impacts the WTG tower hard enough to dent the tower, it may lead to the collapse of the WTG itself.

Mitigation: To address OEM's argument leading edge erosion is caused by site conditions, commercially, investors should seek to pass risk of site data (to include site location, environmental conditions and wind data) to the OEM. From a technical perspective, there are 3rd party leading edge protection (LEP) options on the market. These are protective strips glued to the leading edge to shield the fiberglass blade from friction.

"MEM has seen leading edge erosion on IEC class 3 WTGs as early as 1 year after commercial operations."

Figure 6: Leading edge erosion

Design criteria for climate and natural catastrophe risks

Issue: As cases of contractor negligence increase, project insurers are taking more active interest in project design. For example, in Vietnam the main project risks (generally) are flooding, lightning and high wind speeds. As an example, we are now seeing insurer subjectivities specify civil design contemplate flooding risk as high as 1:250 years flood risk (typically we would expect to see 1:100 or 1:150 years flood risk).

Risk: The change in civil design to contemplate 1:250-year flood risk vs. 1:150-year flood risk can have dramatic impact to the cost of civil works in the balance of plant. And in some countries, 250-year flood data may not even be available. This may leave project investors caught between either having an uninsurable project and having a project with a CAPEX that makes the investment untenable.

Mitigation: MEM recommends working with the insurance broker to pull a NATCAT (Natural Catastrophe) report as a part of investor due diligence prior to making an investment decision. Having an understanding of environmental risks – and more importantly, insurance subjectivities related to these risks will allow the investor to make more informed decisions about project costs and equity returns.

CONTRACTOR AND OEM CO-INSURANCE

The hardening of renewable energy insurance markets is the result of project insurers paying the cost of poor quality and contractor negligence in the field. As a result, insurers are now rejecting these risks or passing the cost of this to investors in terms of restricting cover and increasing the cost of premiums. Investors who do not have a deliberate and systematic risk analysis process, contemplating dimensions of technical (project manager), commercial (contracting manager) and insurance (broker) are likely to see challenges in procuring lender approved insurance cover with reasonable premiums.

As contractors and suppliers are the root cause of the hardening insurance markets, investors should seek to identify the risks insurers are no longer willing to cover and reallocate these risks back to the contractor and

OEM. By forcing the contractor/OEM to procure their own insurance for these risks, the direct (project) cost and implication of future insurability lies solely with the contractor/OEM.

ABOUT MODERN ENERGY MANAGEMENT

Modern Energy Management (MEM) delivers project lifecycle certainty to renewable energy financiers, developers, operators and investors working in rapidly expanding emerging markets. Its remit is to source, develop, build and manage clean energy projects throughout the emerging markets.

The firm's team of project managers, consultants and engineers enable financiers and investors to successfully develop, construct and deliver complex, profitable projects in remote, rapidly expanding international markets.

MEM established its corporate offices in Thailand in 2013, and has since registered in Singapore to accommodate its growing international project pipeline. MEM is currently managing wind, solar and a number of other renewable energy initiatives in the developing markets of Southeast and Central Asia, Latin America and Africa.

Contact:

Aaron Daniels, Managing Director

aaron@modernenergy.management

+66.89.926.6652

ABOUT PRICE FORBES & PARTNERS

Price Forbes & Partners Limited is an independent global specialty insurance broker with offices in Bermuda, Brussels, Chile, Dubai, London, South Africa and Malaysia.

The Renewables team at Price Forbes is commercially minded and technically skilled, with direct experience in renewable energy project development, OEM supply, equity and debt funding, in addition to transactional insurance. We work with globally based clients, helping to agree practical solutions and design the risk strategies. We deal with the local and international insurance markets to negotiate and deliver the best possible terms and pricing.

Price Forbes clients range from small-scale solar and wind developers through to large-scale national utilities. Our wordings are client-friendly and tailored per risk.

We have had over 11 successive years of growth, placing non-standard risks for large multi-national companies. Our team of experts works closely with clients ensuring they are aligned with the best markets, people and products available to achieve the right solution.

Contact:

Poul Bach Hansen, Head of Renewable Energy

poulhansen@priceforbes.com

+44 (0) 20 7105 3010