Risk & uncertainty management in the context of auction models – how to increase success

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Outline

• K2 Management – About us
• Risk and uncertainty
• Practical examples
  • Probabilistic cost estimation
  • Weather analysis and risk quantification
About us

• Founded 2007 by Lars K. Hammershøj and Per K. Melgaard in Denmark
• Today 10 local offices worldwide
• 100 percent independent

At a glance:
• 100+ employees with experience from 1,000+ onshore and offshore wind projects in 30+ countries
• K2 Management has been involved in 110+ offshore and 150+ onshore projects

• Full owners engineer for:
  • 402MW Veja Mate offshore wind farm
  • 252MW Deutsche Bucht offshore wind farm

For better wind projects
**Hypothesis**

The prudent application of state of the art risk and uncertainty management approaches provides decision makers with analysis and information to make well educated, risk based decisions.

→ Better decisions
→ Increased success
A project’s outcome / value depends on:

- the quality of the project definition (i.e. quality of the design and engineering, risk profile of the schedule, quality of the contracts, etc.).
- the quality of the project execution (i.e. execution of the contracts, quality control, claim management, etc.).
- Prudent, state of the art risk and uncertainty management is an essential component to increasing the project value both in the planning and execution phase.
## Risk and Uncertainty

- Changing market conditions

<table>
<thead>
<tr>
<th>Feed-in tariff System</th>
<th>Auction System</th>
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</thead>
<tbody>
<tr>
<td><strong>Key Milestone</strong></td>
<td>Submission of bid</td>
</tr>
<tr>
<td>Final investment decision / Financial close</td>
<td>Creeping commitment</td>
</tr>
<tr>
<td><strong>Typical Design Status</strong></td>
<td>Available site investigations determined by regulatory body</td>
</tr>
<tr>
<td>Site investigations completed (Soil, metocean, wind, etc.)</td>
<td>Typically only conceptual design completed</td>
</tr>
<tr>
<td>Detailed foundation design completed</td>
<td></td>
</tr>
<tr>
<td>OSS conceptual design completed, potentially detailed design commenced</td>
<td></td>
</tr>
<tr>
<td><strong>Contracts</strong></td>
<td>Potentially Heads of terms, Term sheets</td>
</tr>
<tr>
<td>Fully negotiated and signed</td>
<td>Contract negotiations likely only after successful bid</td>
</tr>
<tr>
<td><strong>Realisation probability</strong></td>
<td>High but not certain</td>
</tr>
<tr>
<td>Certain – execution phase to commence immediate</td>
<td>High sunk costs if project is not built – bid bonds</td>
</tr>
<tr>
<td><strong>Market dynamics</strong></td>
<td>Strategic bidding</td>
</tr>
<tr>
<td>Plenty projects for divers players</td>
<td>Consortia</td>
</tr>
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<td></td>
<td>Increased M&amp;A activities by key players</td>
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<td></td>
<td>Increased need for technical innovation (e.g. foundation types, WTG size)</td>
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</table>

- Complex market conditions
- Increased uncertainty for project developers, contractors and financiers
- Experience gained and lessons learnt on past projects are critical for reducing risk & uncertainty
- Information considered critical to make educated decisions
Practical Examples
Understanding costs uncertainty is a key for making educated decisions.

Probabilistic models based on Monte-Carlo simulation technique can capture the uncertainty of the estimated and derive a total cost range rather than a single point estimate.

Cost to completion (Base Case + Contingency Spent) monitored during the project execution phase.

During the development phase cost ranges can be estimated while design, engineering and contract negotiations progress.

During the execution phase costs to completion can be tracked as the implementation continues.
Specific cost models for any package or the entire project can be developed.

Past project experience, market knowledge and project specific knowledge (e.g. conceptual foundation design results if available) are used to size 3 point estimates for both units and costs rates.

Models should be refined as the project development progresses in order to narrow the range and derive more accurate results.

Correlation implemented to avoid inconsistent results.

Key cost drivers can be identified early and specifically focused on during the development.

**Probabilistic Cost Estimates**
Weather Contingency Sizing

- Weather risk is a key value driver accounting for tens of millions EUR for a 400MW offshore wind farm.
- All-in weather risk contracts are available and allow for transferring this risk:
  - Expensive and means no benefits in case of good weather.
- Accurate models to conduct thorough weather risk analysis are available.
- Combined with robust risk management approaches, clear contract provisions this allows projects to successfully manage weather risk.
- Insurance products are available to provide downside case protection.
Weather Contingency Sizing

Weather Risk Analysis Inputs

- Site specific weather data
- Installation methods
  - Sequencing
  - Net durations
- Operational Limits
- Weather Windows

Weather Risk Analysis Output

- Expected weather downtime at different confidence levels

Quantitative Risk Analysis Input

- Applicable costs in case of weather downtime

Risk Positions for Weather Downtime

Risk Register

QRA

Quantified Weather Risk at different confidence levels

For better wind projects
Weather Contingency Sizing

- QRA is considered best practice for robust contingency sizing of large capital projects taking into account the project specific risk profile.
- Same approach can be used to size specific weather risk contingency amounts to be included in the construction budget.
- Using these methods we can provide contingency estimates at different confidence levels depending on the risk appetite of our Client.

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Conclusion

• No need to re-invent the wheel
• Tap into past project experience and lessons learnt
• Use state of the art risk and uncertainty management approaches to:
  • Make well informed, risk based decisions
  • Reduce risk and uncertainty
  • Increase project success
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