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

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Courtesy: Trianel

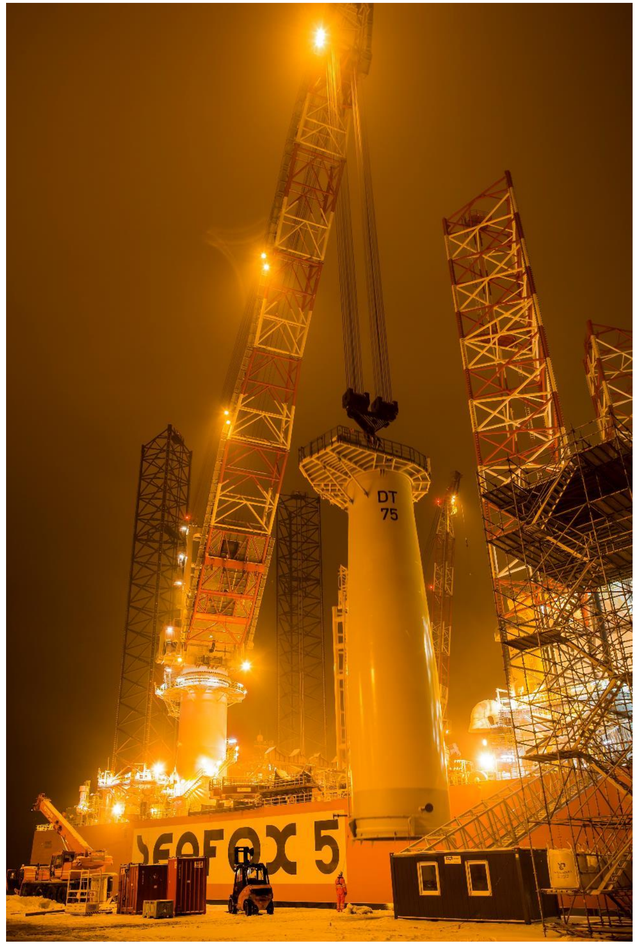
For better **wind projects**

K2 MANAGEMENT



Outline

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



Courtesy: Vattenfall/Jorrit Lousberg



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

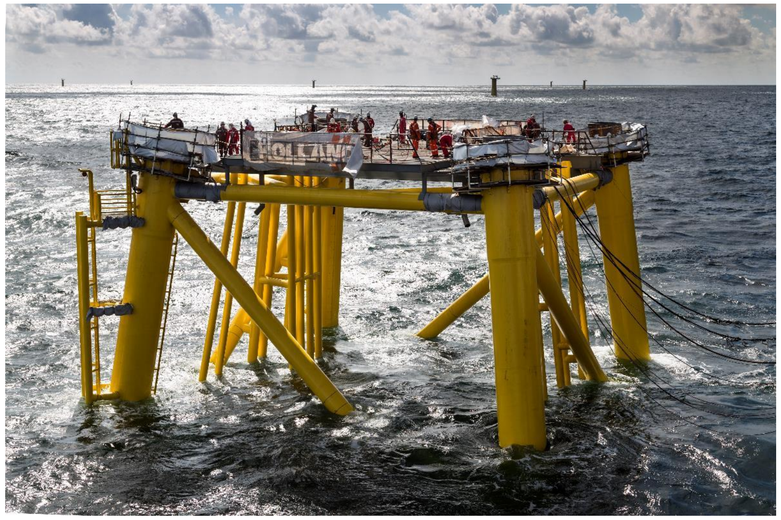
- Full owners engineer for:
  - 402MW Veja Mate offshore wind farm
  - 252MW Deutsche Bucht offshore wind farm



Risk and Uncertainty

<u>Hypothesis</u>

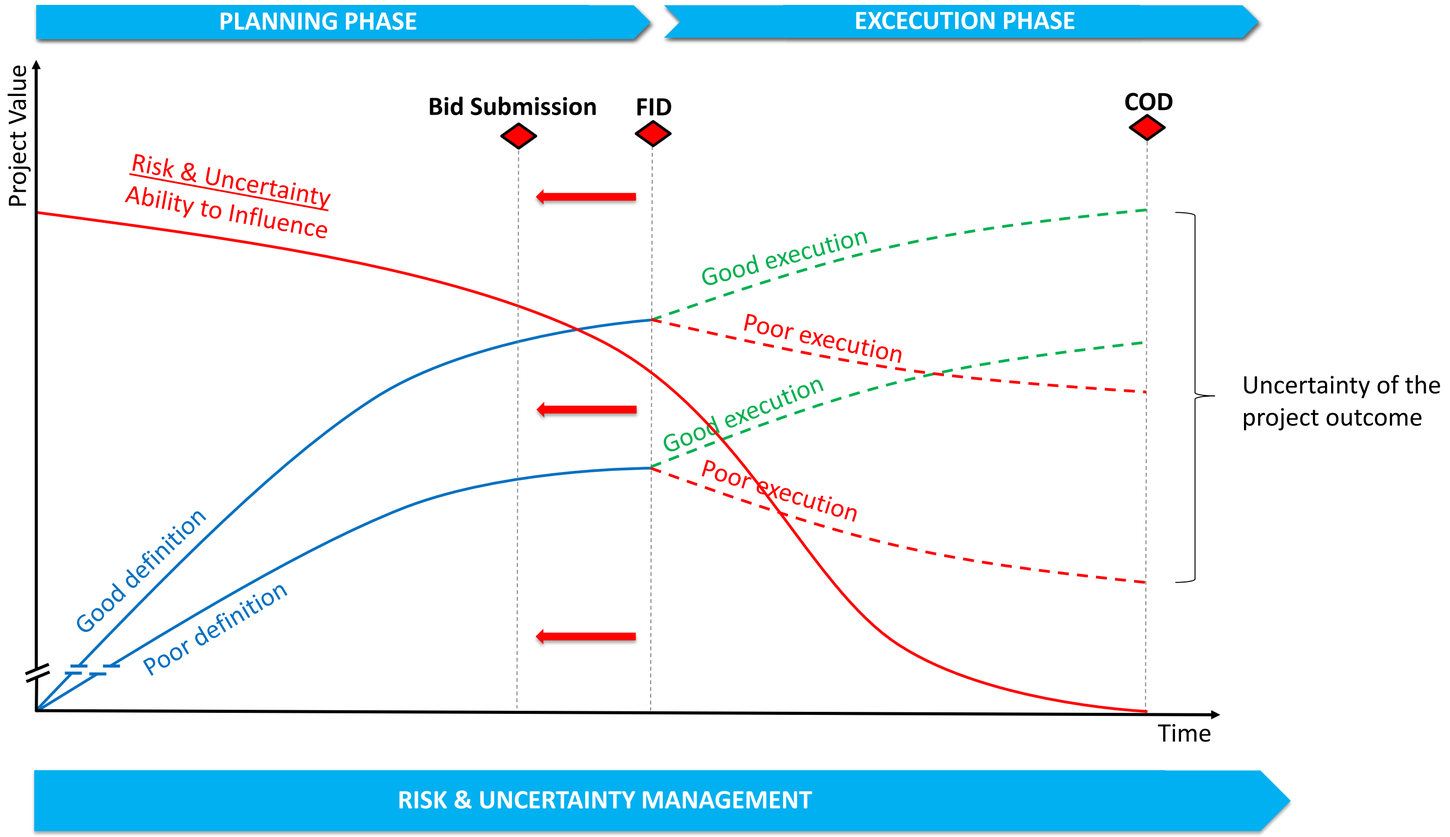
The prudent application of state of the art risk and uncertainty management approaches provides decision makers with analysis and information to make well educated, risk based decisions.



- → Better decisions
- → **Increased success**



Risk and Uncertainty



- 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

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

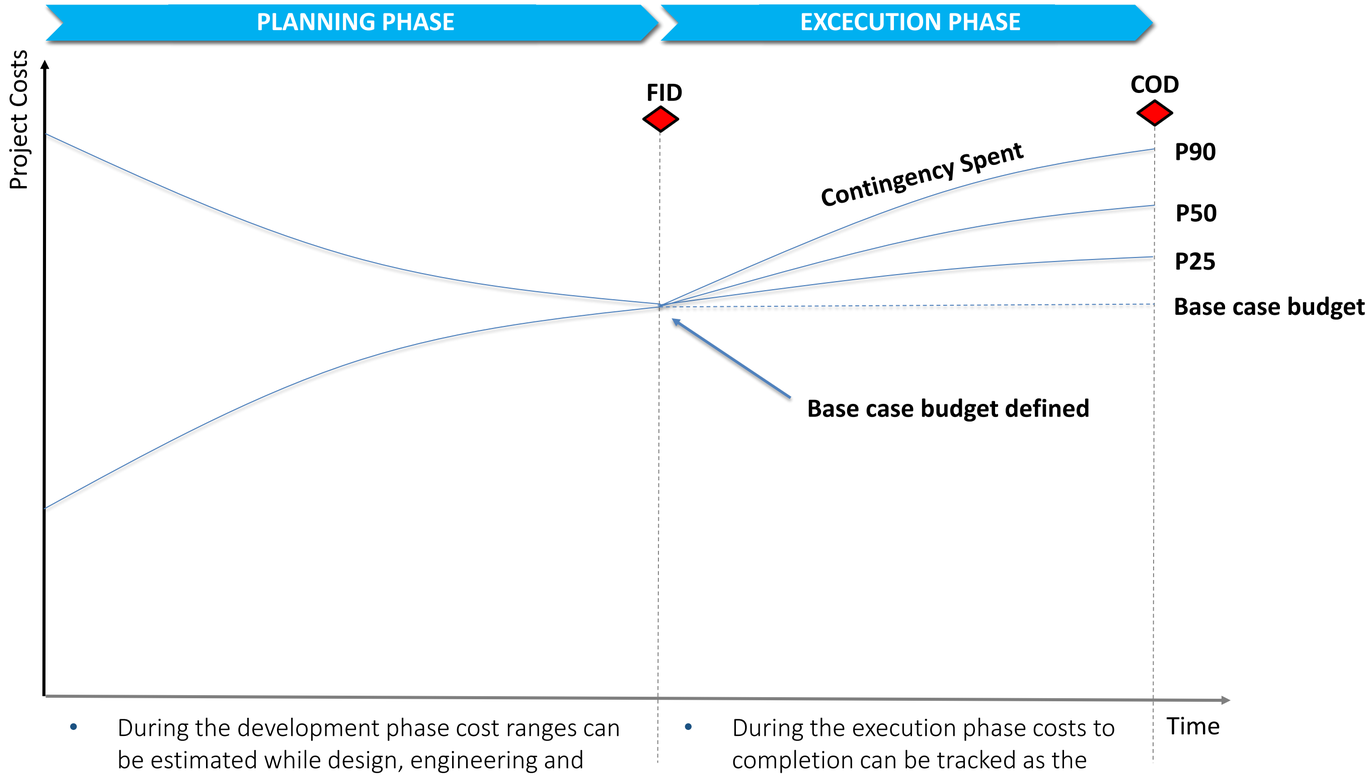
- Complex market conditions
- Increased uncertainty for project developers, contractors and financiers
- Experience gained and lessons learnt on past projects are critical for reducing risk & uncertainty
- Information considered critical to make educated decisions

Practical Examples



Probabilistic Cost Estimates

- Understanding costs uncertainty is a key for making educated decisions



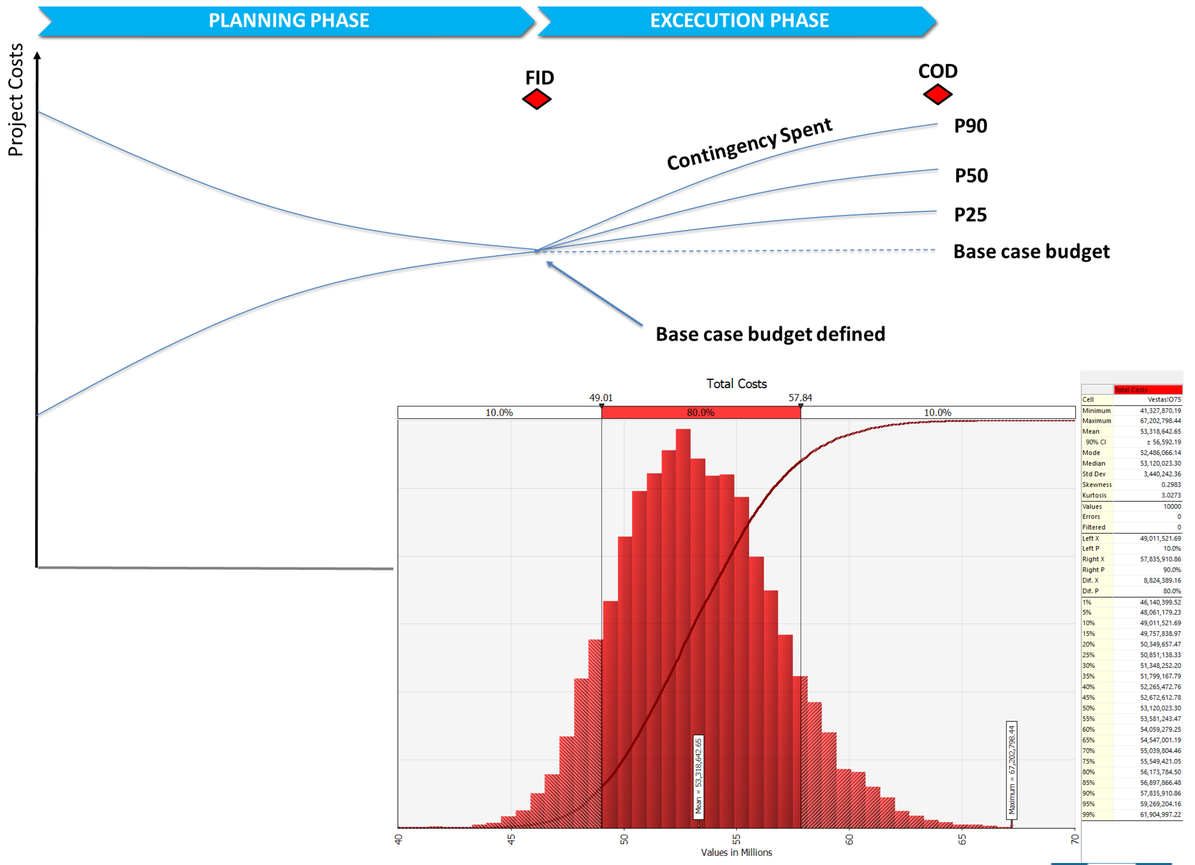
- During the development phase cost ranges can be estimated while design, engineering and contract negotiations progress.
- During the execution phase costs to completion can be tracked as the implementation continues.

- 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



Probabilistic Cost Estimates

- 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





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 down side 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

Applicable costs in case of weather downtime

Expected weather downtime at different confidence levels

Risk Positions for Weather Downtime

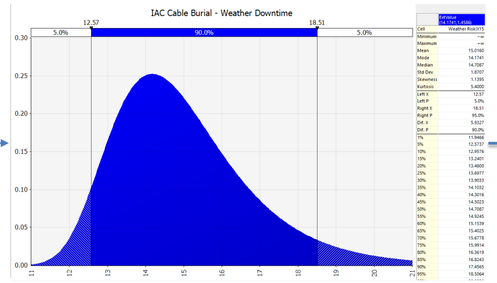
Risk Register

QRA

Quantified Weather Risk at different confidence levels

P-Level	WDD
P5	9
P10	12
P15	14
P20	15
P25	16
P30	17
P35	19
P40	20
P45	21
P50	22
P55	23
P60	24
P65	25
P70	26
P75	27
P80	29
P85	30
P90	32
P95	35

Distribution Fitting



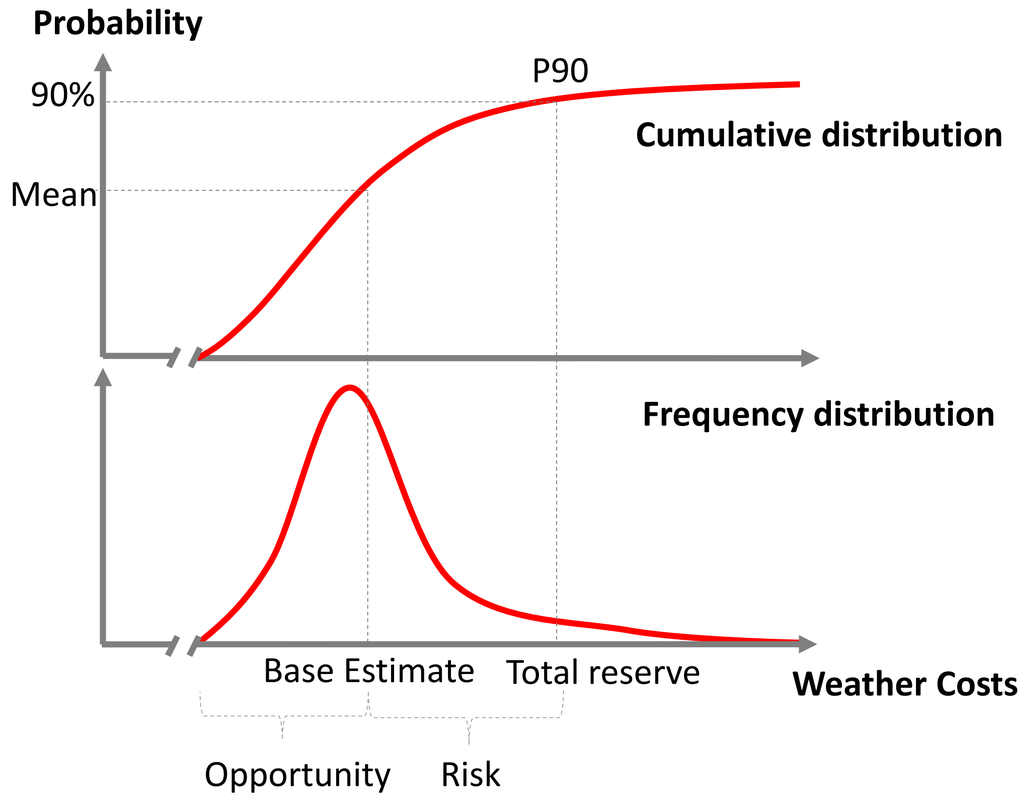
Weather Risk Analysis Output

Quantitative Risk Analysis Input



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.





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

Contact Details

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