Wind farm project development and financing

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2016 Taiwan Wind Power Investment
International Conference and Exhibition

Courtesy: Trianel

For better **wind projects**

K2 MANAGEMENT



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About K2 Management

2007: Founded by Lars K. Hammershøj and Per K. Melgaard in Denmark

2010: Germany, US and UK

2013: Brazil, Taiwan, South Korea and South Africa

2014: Thailand

2016: Ireland

At a glance:

80+ employees with experience from **1.000+ onshore and offshore wind projects** in **30+ countries**

K2 Management has been involved in 70+ offshore and 90+ onshore projects

100 percent independent

We are global – find us locally

K2 Management locations – supporting wind projects in 30+ countries so far

Key personnel for Taiwan Market

Per K. Melgaard

- Co-founder of K2 Management
- One of the “Top 100 Most influential people” in wind power industry
- Involved in wind farm projects since 2001, initially with NEG Micon and then as Project Director with Vestas Offshore and Vestas China.
- Acting as General Advisor, Project Manager and Project Director for several Offshore and Onshore Wind developers.

Cheng-Hu Hu

胡承祜

- Ph.D in Environmental wind and Computational Fluid Dynamics (CFD)
- Involved in wind power projects since 2007, starting with Vestas Asia Pacific and Vestas Technology R&D in Denmark.
- Joined K2 Management in 2012 as Senior Specialist in Wind Analysis and CFD
- Managing local business in Taiwan and supporting global Wind Analysis works

Our clients

K2 Management mainly serves the following two client groups:

Project developers
onshore & offshore

Financiers

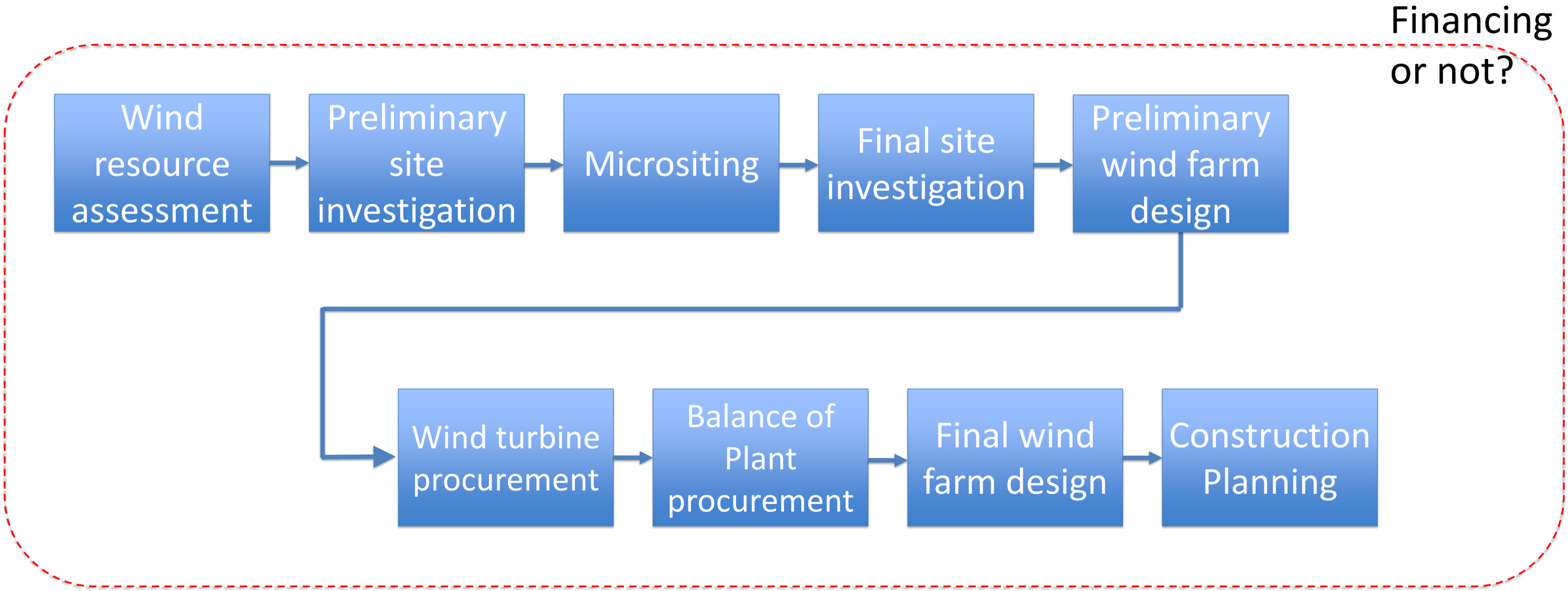
Project reference list is available at www.k2management.com

Client portfolio

Wind Power Project Development Processes

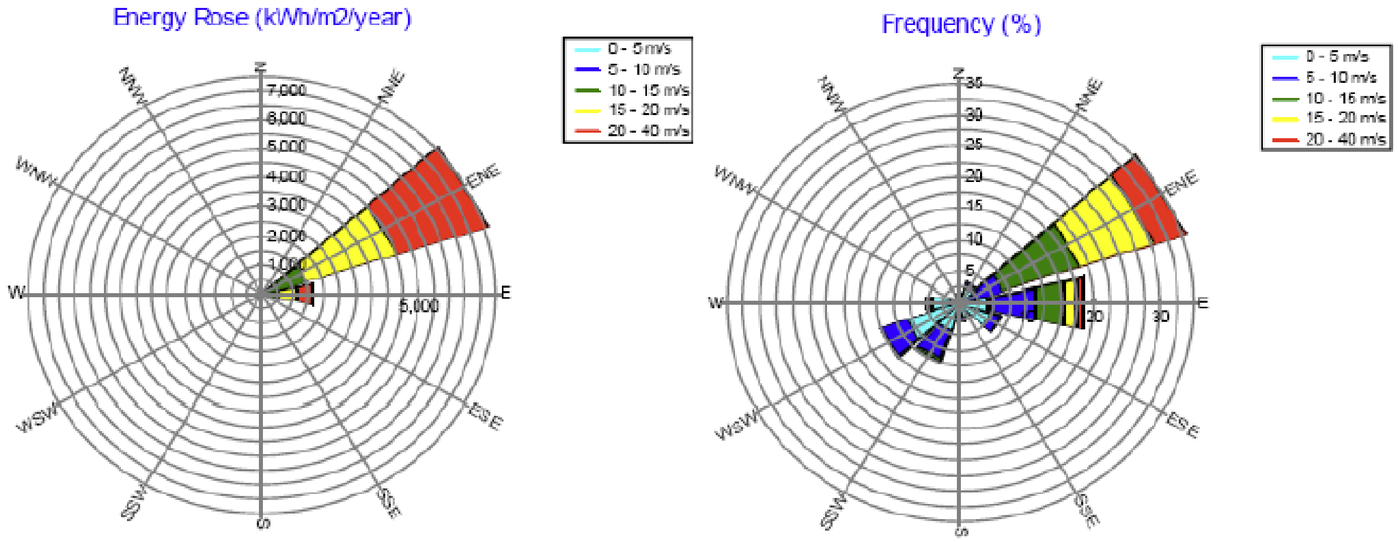
- Area rights, Permitting and Power Purchase Agreement (PPA)
  - Feasibility
  - Environmental constraints
  - Grid connection
  - Permits
  - PPA
- Technical Development
- Financing (non-recourse project financing)

Technical development



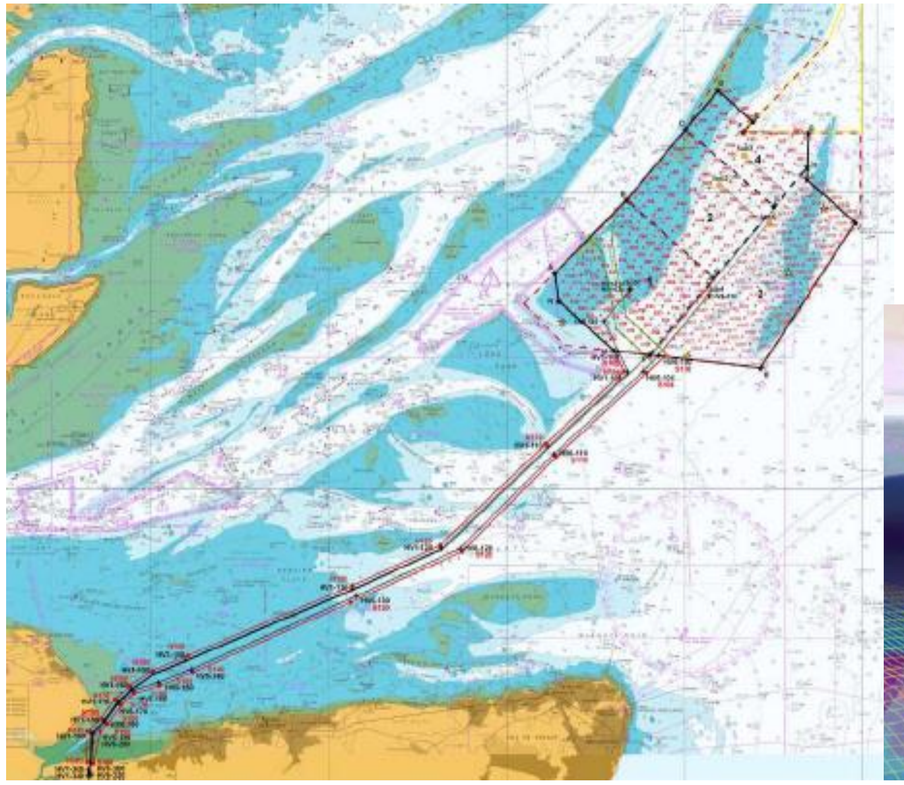
Wind Resource Assessment

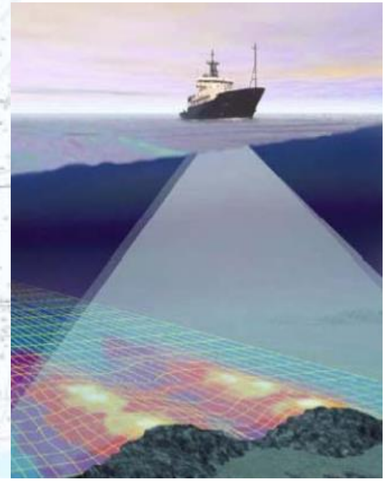
$$P \propto \rho A v^3$$



- This is the first parameter the investors are looking for
- 5% error in wind speed measurement could result in selecting a wrong turbine and 15% error in energy production
- Minimum requirements for a “bankable” wind resource assessment
  - Mast location is representative
  - Measurement height is equal to or above 2/3 hub height
  - Calibrated instrumentation with 3rd party certificate
  - At least one-year measured wind data
  - Long-term corrected wind data is used as the input for AEP calculation
  - P50, P75 and P90 values

Preliminary site investigation



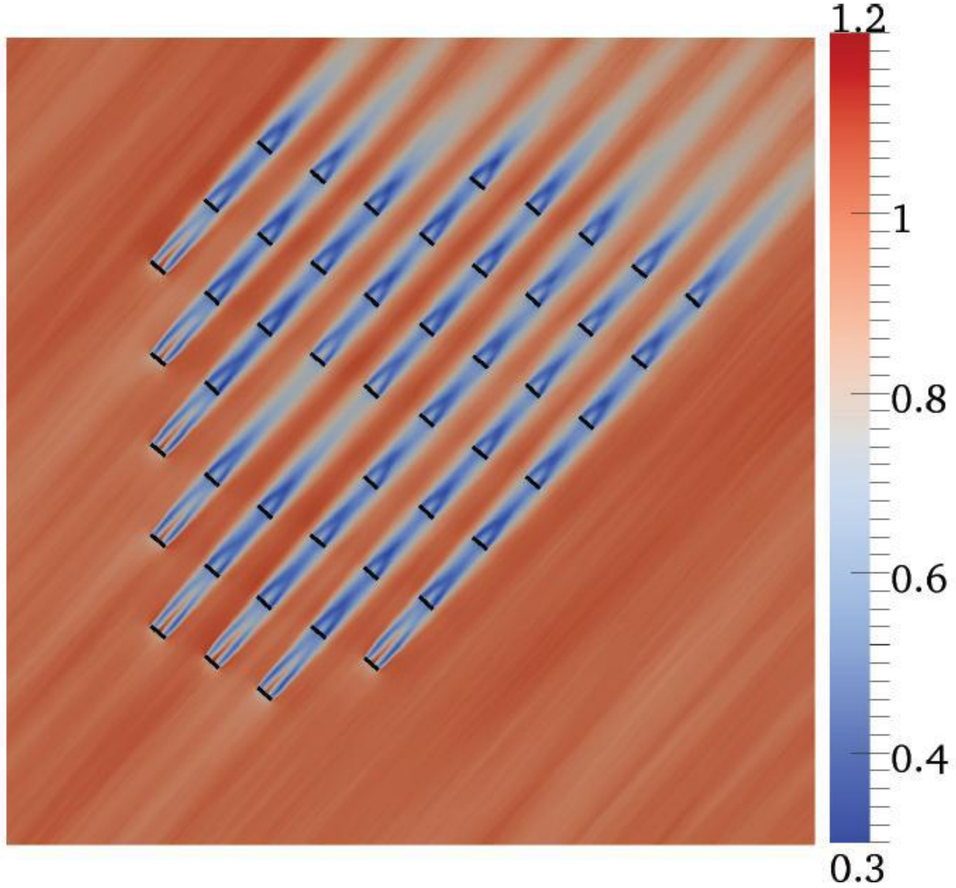


Desktop study of the site area using existing data sources to establish a high level understanding of:

- Seabed (soil) conditions
- Water depths
- Metocean data (currents, waves, tide, temperature, storm surges, etc.)
- Ice patterns (maybe not required in Taiwan)
- Constraints (other users)

- Site surveys (non-intrusive) using a “sail-over” methods using remote sensing techniques (sonar, seismic, bathymetric) to give a better understanding of the findings from the desk top study
- Most likely there will no site specific soil data available and this will make it necessary to carry out a preliminary geotechnical investigation, including a few representative core drillings at representative locations.
- Most likely there will be no site specific wave data available and an early deployment of a wave measuring device should be considered giving access to real time site data.

Micrositing



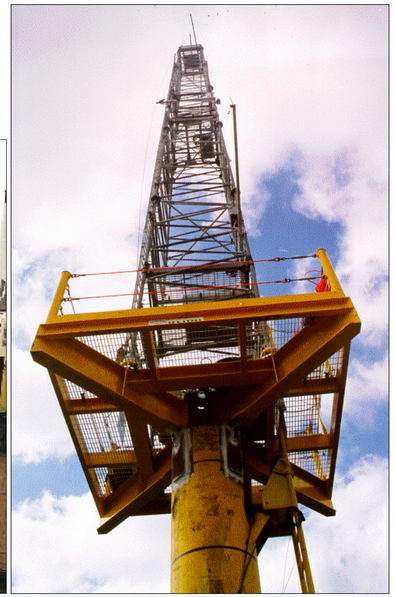
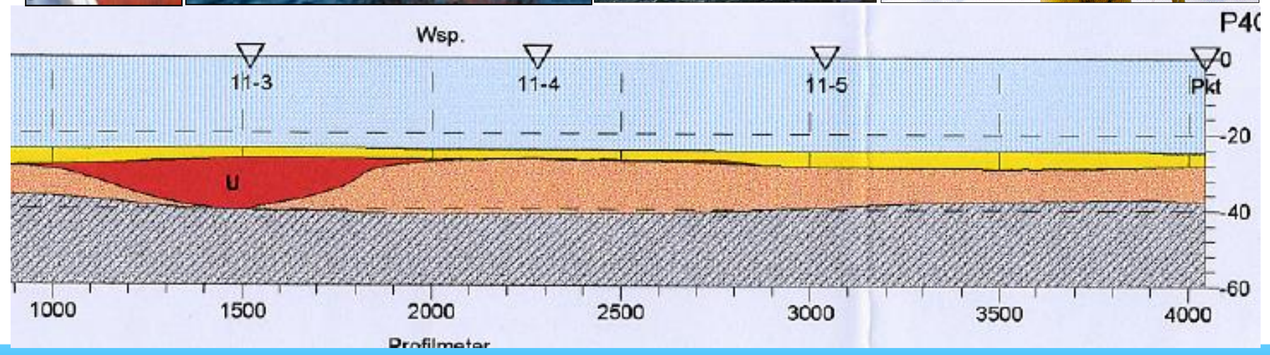
The final location of individual turbines over the site is a complex exercise in which many parameters will influence the results:

- Wind speed/wind shear/turbulence/etc.
- Possible turbine types/rotor diameters/hub heights
- Site restrictions on locations for noise/flicker and other restrictions

- Unfortunately, the final choice of turbine cannot be done from an energy yield calculation alone as factors such as turbine price, Balance of Plant (foundations, cables, substations, etc.) price and service and maintenance costs will all influence the financial model results, so in order to proceed with the development activities in parallel, it is recommended to prepare a micrositing study that can cover several turbine scenarios.
- Please note that the final turbine locations and layout will have to verified and signed off by the turbine supplier to ensure that chosen locations and the effects created by the other turbines will not have excessively negative influences on the loads of the turbines.

Final site investigation

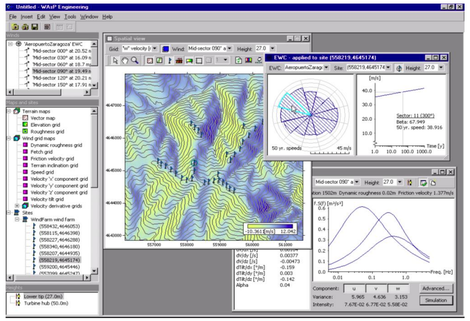


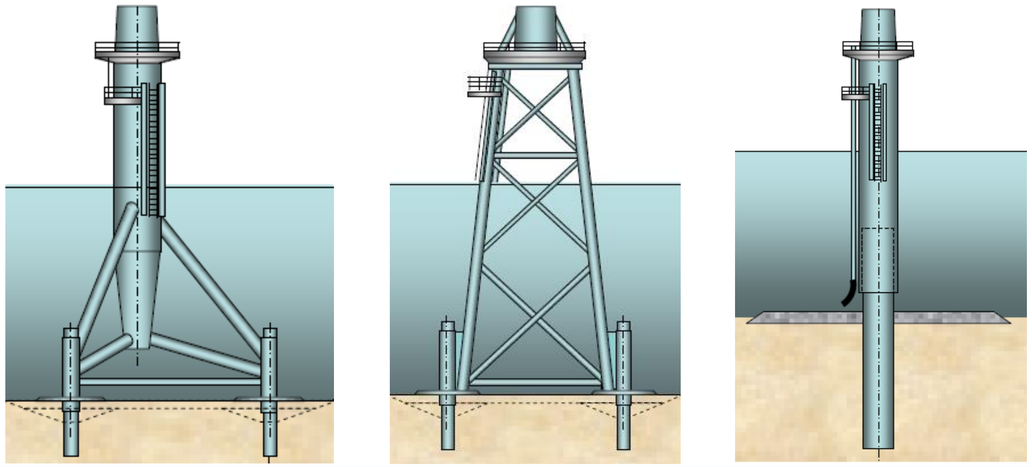




Once final micrositing is completed, a final site investigation programme can be initiated. This will include:

- Borehole and/or CPT soil investigation at each turbine location
- Borehole and/or soil investigation at substation location
- CPT soil investigations at selected representative sections of cable routes
- Soil heat dissipation capacity at selected representative sections of cable routing
- Soil electrical resistivity testing at substation location and selected representative sections of cable routing
- On-site Metocean measurement (waves, tide, current, surges)

Preliminary wind farm design





Based on the lay outs/micrositing and the site investigations a preliminary wind farm design can be carried out. Such design will cover:

- Turbine foundations
- Cable collection system between turbines and substation
- Wind farm substation
- Wind farm export high voltage system
- Onshore substation and other facilities
- Such preliminary design will be used for price estimation of the wind farm Balance of Plant during the turbine procurement process as it will be necessary to estimate the entire wind farm CAPEX during the turbine bid evaluation.
- The preliminary design will also be used for Balance of Plant procurement and pricing, and the permitting process may need a certain level of design input for the construction permits for the wind farm.

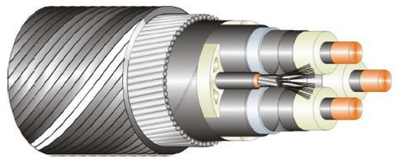
Wind turbine procurement

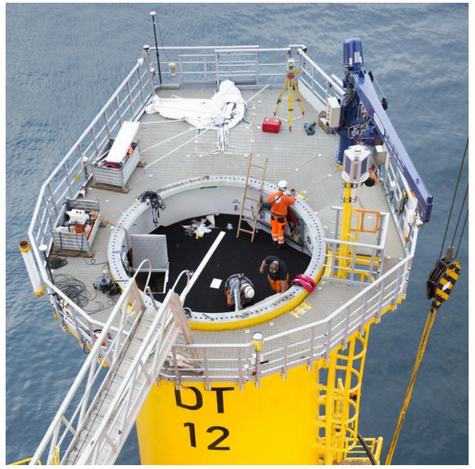
We suggest using a tender process to achieve the best price and contract terms for both TSA and FSA

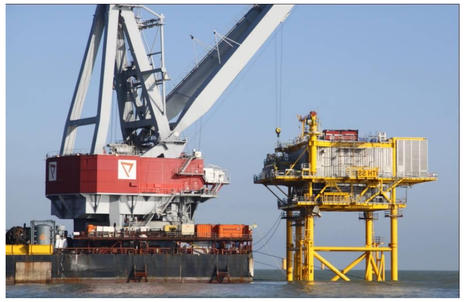
- Preparation of tender documents (technical requirements, contract terms, bid instructions, etc.)
- Issuing of tender to selected turbine suppliers
- Review and scoring of turbine offers
- Preparation of high level Balance of Plant cost
- Clarification meetings with turbine suppliers
- Selection of 2-3 bidders for negotiations
- Contract and commercial terms negotiations
- Continuous update of contract documents during negotiations
- Selection of preferred supplier

The contract structure (and the necessary strength of the terms and conditions) will be linked to the capability of the wind farm owner and the financing structure for the project.

Balance of plant procurement







To ensure that the project will achieve the best possible Balance of Plant prices and the best possible contractual terms for the Balance of Plant contract it will be necessary to procure this via a tender process which will include:

- Preparation of tender documents (technical requirements, contract terms, bid instructions, etc.)
- Issuing of tender to selected Balance of Plant contractors
- Review and scoring of Balance of Plant offers
- Clarification meetings with bidders
- Selection of 2-3 bidders for each package for negotiations
- Contract and commercial terms negotiations
- Continuous update of contract documents during negotiations
- Selection of preferred contractor

The contract structure (and the necessary strength of the terms and conditions) will be linked to the capability of the wind farm owner and the financing structure for the project.

Final wind farm design

Depending on where design responsibility has been contractually placed the final wind farm design will be done by the wind farm owner (developer) or by the contractors with the wind farm owner and his engineers carrying out a design verification. Such design will cover:

- Detailed turbine foundations design
- Detailed subsea cable collection system design between turbines and substation
- Detailed earthing design
- Detailed offshore wind farm substation design (electrical and civil)
- Detailed wind farm subsea export high voltage cable design
- Detailed onshore high voltage substation design
- Detailed wind farm communication network design
- Other designs (SCADA, met masts, O&M buildings, etc.).

Construction planning

During the technical development of the offshore wind farm it will be necessary to develop the project implementation organization and the necessary documentation for the project execution phase. Such documentation will include:

- Project Execution Plan
- Project Master Schedule
- HSE Management Plan
- Quality Management Plan
- Marine Management Plan
- Risk Management Plan
- Contract Management Plans (Variations, Claims, etc.)
- Stakeholder Management Plan
- Etc.

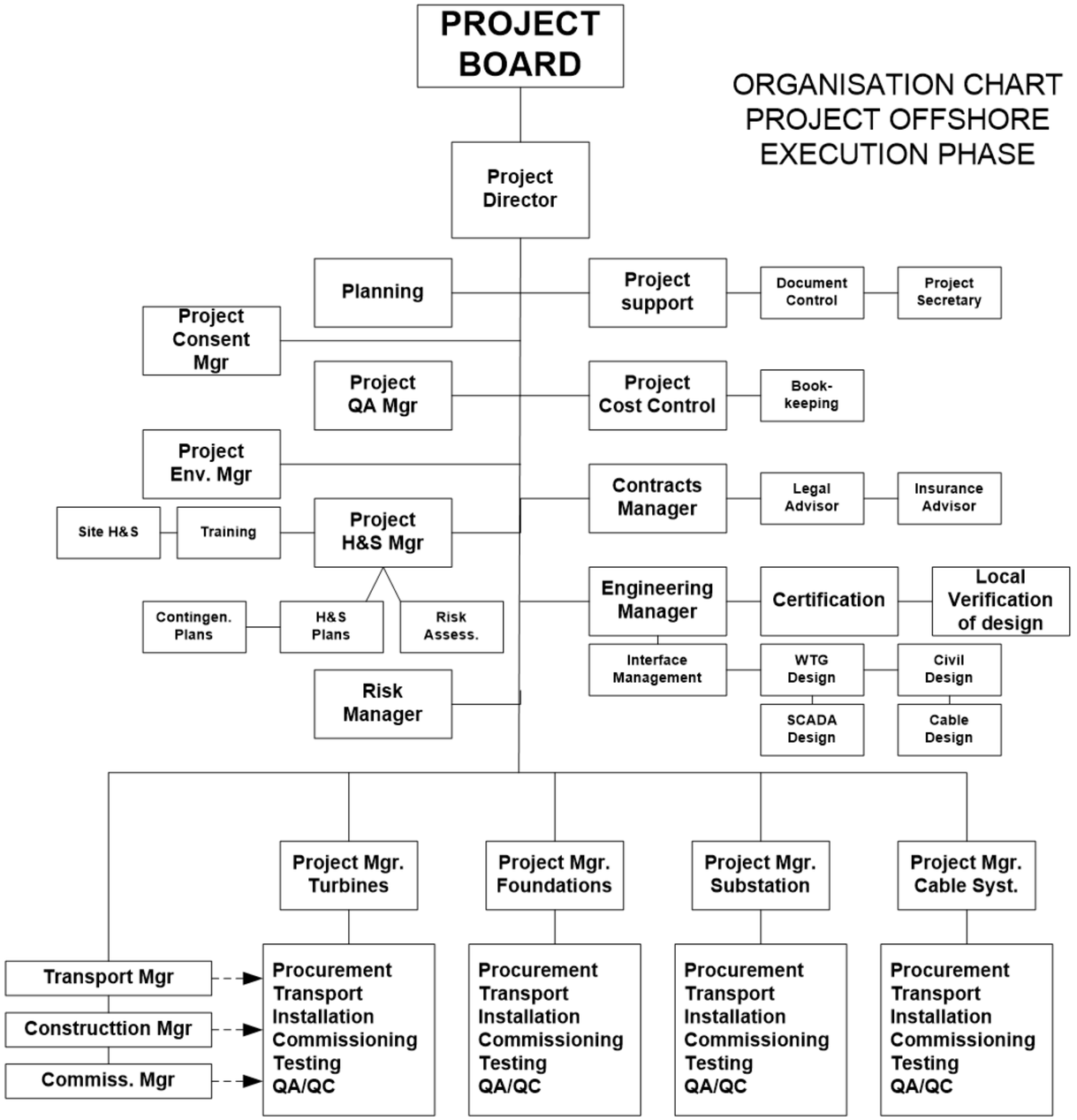
The project management organization should be involved at an early stage and at the latest during turbine supplier and Balance of Plant contractor selection and contract negotiations, and if possible, the project management organization should be involved in the drafting of the technical contract documents.

Financing

- Securing the financing (both equity and debt), if necessary will to a great deal depend on the quality of the activities described above.
- This, in the opinion of K2, makes is necessary that an integrated approach is used where the 3 work tracks are coordinated and the financing structure is clear from the beginning of the development as this will impact issues like turbine selection, contract structures, project organization, insurance requirements, design responsibility, etc.

Minimum requirements

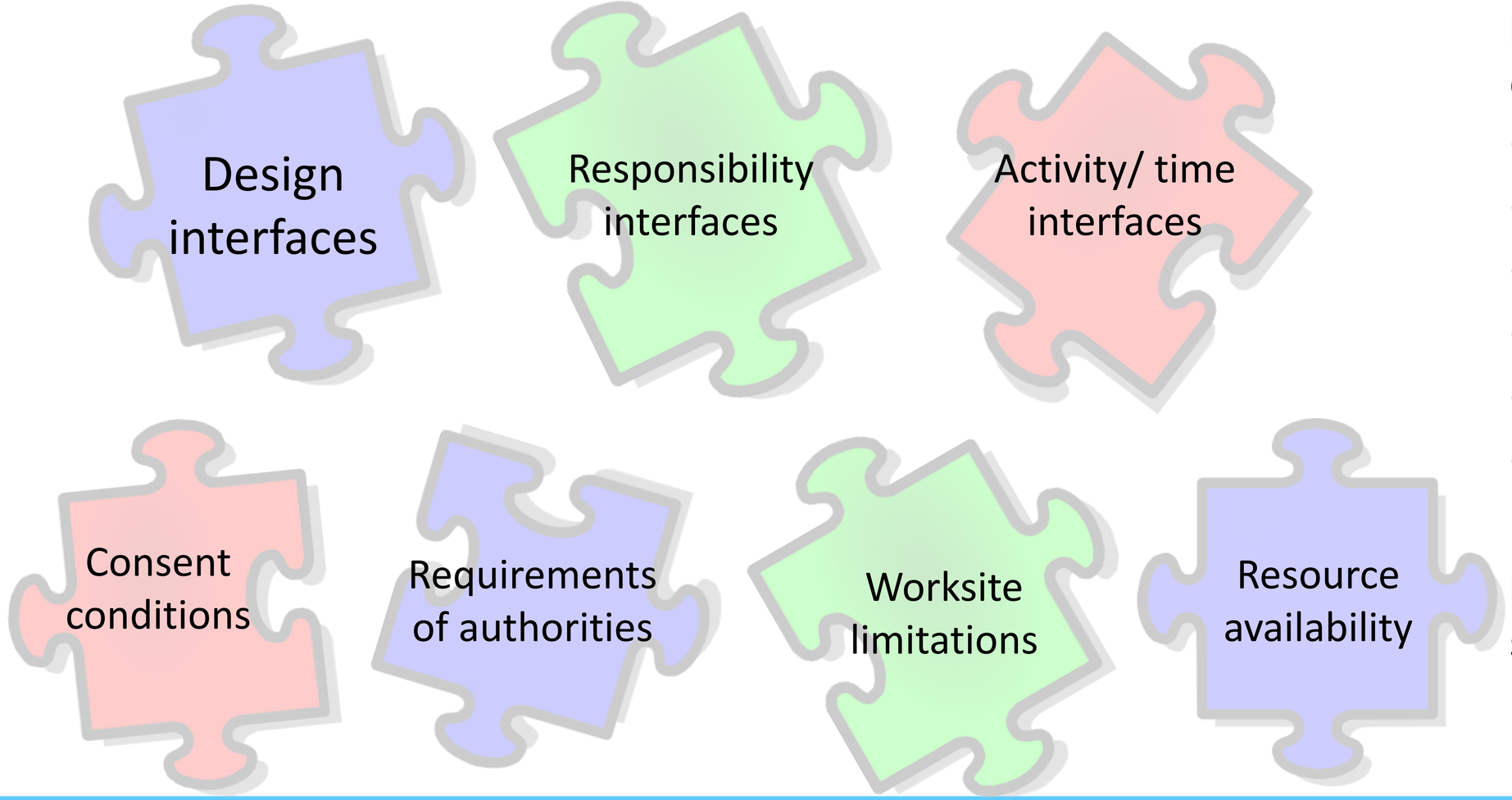
- Certainty on completion date
- Certainty on completion cost
- Certainty on operating cost
- Certainty on performance
- And therefore certainty on debt repayment or return on investment!
- Grid connection offer, with high degree of certainty on date
- Permits; the legal concessions needed to build and operate the project, free from any challenges
- Leases and land rights; access to, and use of, the land needed for the project and its access
- Tender and procurement process at an advanced stage
- “Bank grade” wind report



Organization chart for project execution

- Project participants are one of the biggest risk areas the investors/lenders will look into
- Do you have sufficient resources?
- Can you manage the project?
- Do you understand project financing process?
- Do you have proven track records?
- Can you listen to advices?

Interface management



Poor interface management can cause:

- Inefficiency
- “Fire fighting” solution
- Contract variations
- Delays
- Claims
- Extra cost and time

Investors DO NOT want to see those troubles

Risk Management

- Risk to human health/life
- Risk animal/nature
- Risk to the environment
- Risk to the project (money)
- Risk to the project (time)
- Risk to the project (reputation)

How to manage risks?

- Experiences
- Planning ahead
- Risk management tools
- Adequate insurance policies

Investors do not like risks and want these to be under control!

Insurance

Fact: ”Something will happen”

Employer to take out CAR

- Cover everything (no ”holes”)
- Cheaper/easier to manage

Cover all contracts/work

- ”Site” to cover wind farm site as well as construction ports

Include design cover (LEG3)

Include extended maintenance (24 months)

Include Delay in Start Up

Financial close

- Financial close means the investor is ready to put the money into your project
- Usually the construction of the wind farm can start immediately after financial close
- Conditions:
  - All permits are in place
  - Wind farm design is completed
  - All contracts are signed
  - Interfaces are clearly defined
  - Risks are studied and managed
  - Investor(s) are happy with the project

Recommendations

Get good advice, early, on:

- Technology risk and selection
- Contract strategies and structure
- O&M strategies and contract options
- Wind resource assessment
- Acquisition process
- Realistic expected ROI

- Ensure the “must have” items are in hand before kicking off the finance process
- Build “bankability” into the designs, contracts, schedules and budgets
- Have a clear plan and schedule for the development and financing phases
- It often takes longer (and more effort) than sponsors expect
- Get advice from the right people, at the right time

Thank you

Questions or comments?

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