



ENERGY

Challenges and risk mitigation in financing wind projects in Vietnam

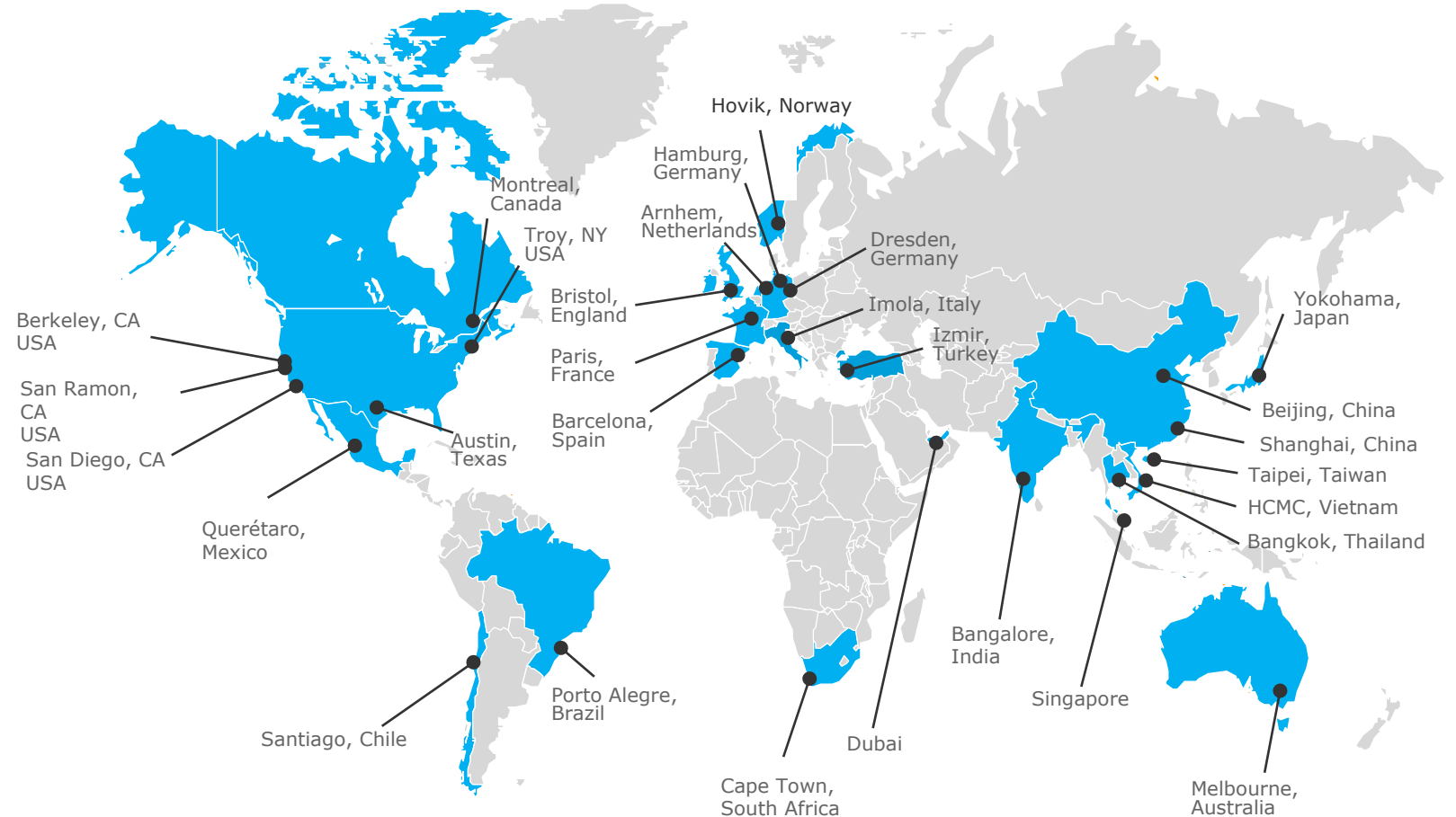
Accelerating Wind Project Financing Vietnam Workshop

Benoit Nguyen

11 June 2019

DNV GL Renewables Advisory has a **global reach, local presence**

- Full range of **advisory services** since **1984**
- Global team of **2,500 energy experts**
- Helping our **customers**, financiers, developers, IPPs and manufacturers, to **manage risk**



Experience in numbers – Several DNV GL statistics

- Performance analysis of **65 GW** of **operational** projects
- **Forecasting 40 GW** in 16 countries
- Power curve **measurements** on **500+** turbines per year
- Advised on over **25 GW** of **solar PV** projects
- Provide SCADA monitoring to **7.5 GW wind farms** and **10 GW solar PV** projects
- **Due diligence** for **25%** of global financed wind farms and **> 40 energy storage** projects



Key facts on wind industry in Vietnam

- By the end of 2018, there were 10 wind farm projects in Vietnam for a total installed capacity of 228 MW
- Vietnamese government targets:
 - 800 MW by 2020
 - 2GW by 2025
 - 6GW by 2030
- Large areas with wind resource in the range 6.5 m/s -7.5 m/s at 120 m hub height
- Attractive 20-year Feed-in-Tariff (FiT) available for wind farms constructed before 1st Nov 2021:
 - 8.5 USc/kWh for onshore
 - 9.8 USc/kWh for offshore or nearshore
- Import tax exemption for renewable energy equipment
- Corporate tax exemption for first 4 years followed by 50% discount up to Year 13

Project lifecycle – Ensuring performance starts in development

11th Jun 2019 ← → 1st Nov 2021

Feasibility

- Feasibility Studies
- Site Screening
- EIA
- Planning
- Market Studies

Development

- Resource Monitoring
- Site Conditions
- Technology Selection
- Site Layout
- Energy Assessment(s)
- Grid Connection
- EIA
- Geotech and Hydrology
- FEED / BoP Design
- Contracts & Specifications
- Grid Impact Studies

Pre-Construction

- Geotechnical Support
- Technology Assessment
- EPC Tender & Bid Evaluation
- BoP Design & Review
- (Final) Energy Assessment
- Project Due Diligence

Construction

- Owner’s Engineering
- Lenders Engineer
- Technical Support
- Commissioning/Testing

Warranty + O&M

- EoW Inspections
- Forecasting
- O&M Strategy
- Operations Monitoring
- Due Diligence (Sale / Refinance)
- Optimisation
- Refurbishment & Decommissioning



1-3 months

Decision to Proceed

1-3 years

Planning Approval
Grid Connection
PPA

6-12 months

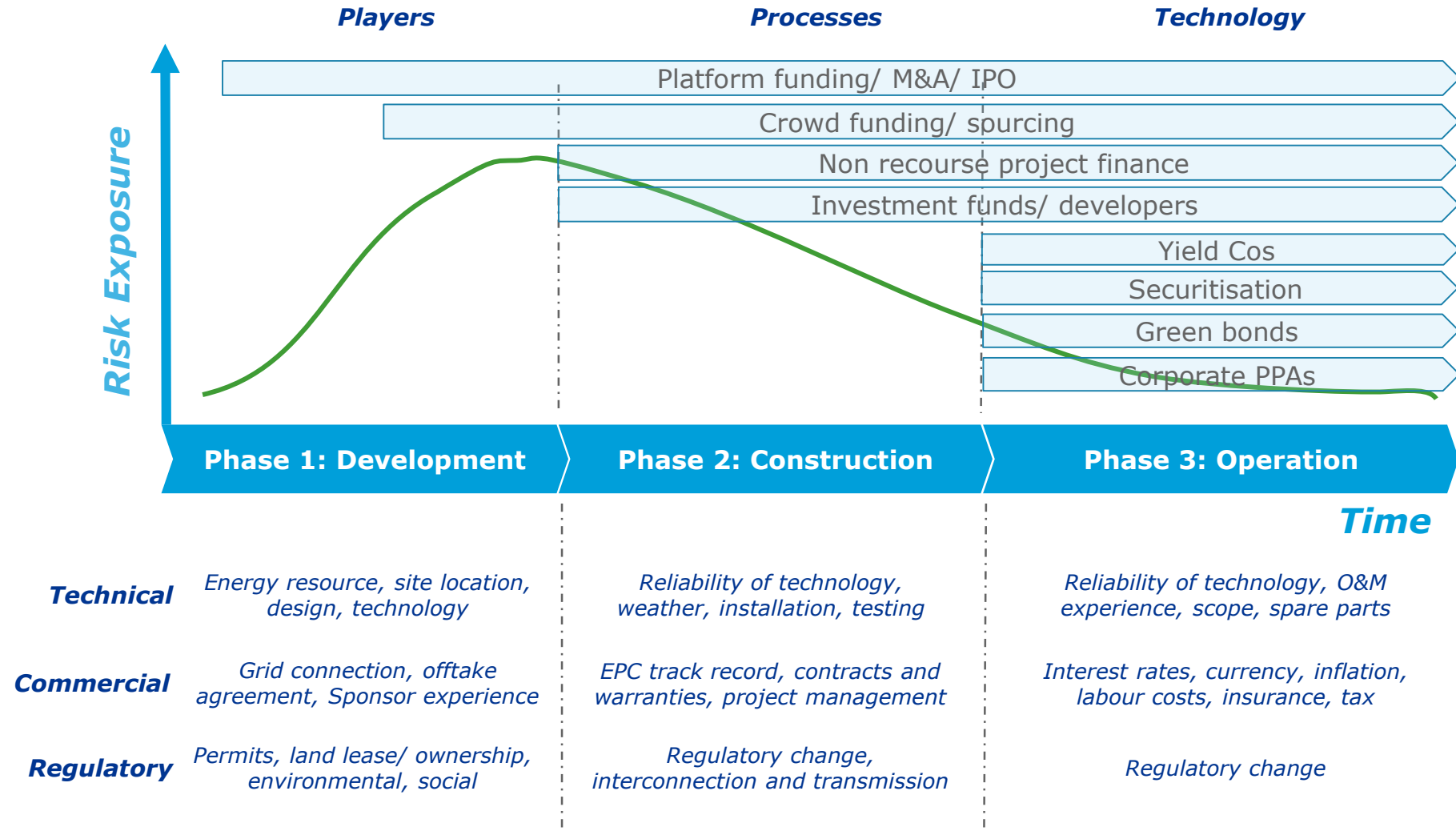
Sign Contracts
Financial Close

12-18 months

Practical Completion
Take-Over

2, 5, 10, 20+ years

Finance type vs risk profile



Key challenges in non-recourse financing in Vietnam

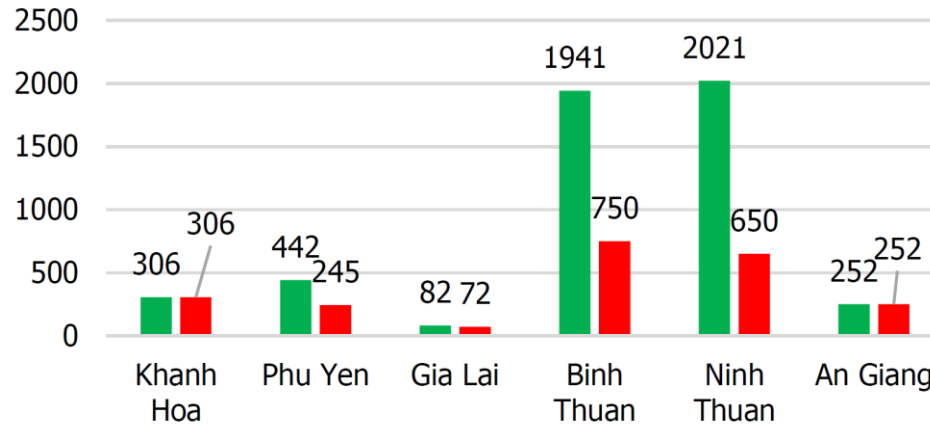
- Power Purchase Agreement (PPA) not considered bankable by most international financial institutions
- Lack of relevant standards or international best practices for wind projects
- Lack of experience in non-recourse project finance from local banks, limited balance sheet
- Complicated permitting process, highly bureaucratic
- Risk of curtailment in some locations due to huge solar boom and network upgrades lagging behind
- High uncertainties, low 10-year P90 energy levels
- Corporate financing currently prevail

Key issues for the bankability of the PPA in Vietnam

- Electricity of Vietnam (EVN) credit rating not investment grade
- No government guaranty
- PPA termination - unclear mechanism on compensation
- Governing law is Vietnam
- Arbitration by Electricity Renewable Energy Department
- No take or pay in case of grid curtailment

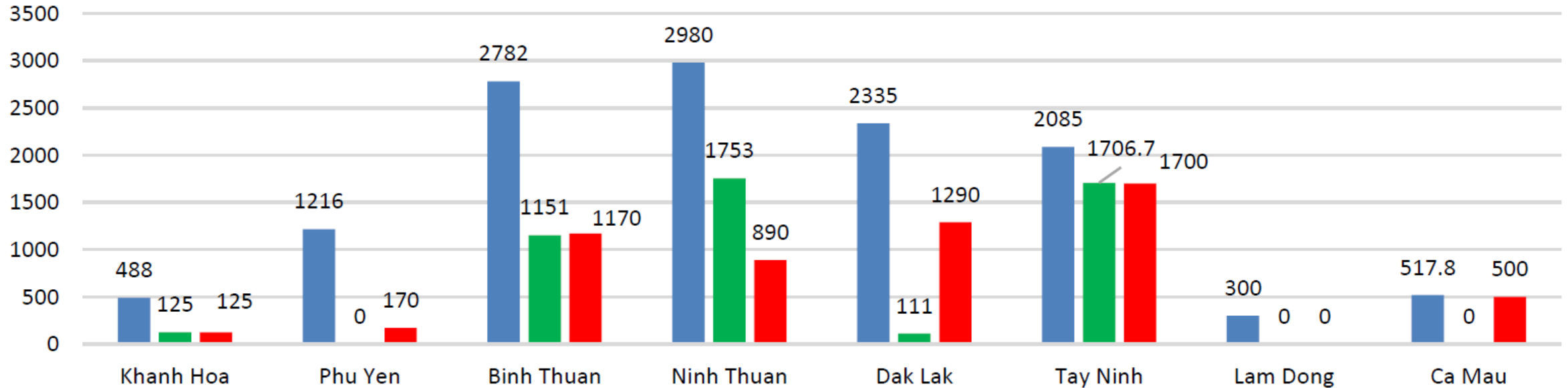
Importance of grid impact studies for renewable energy projects

December 2020



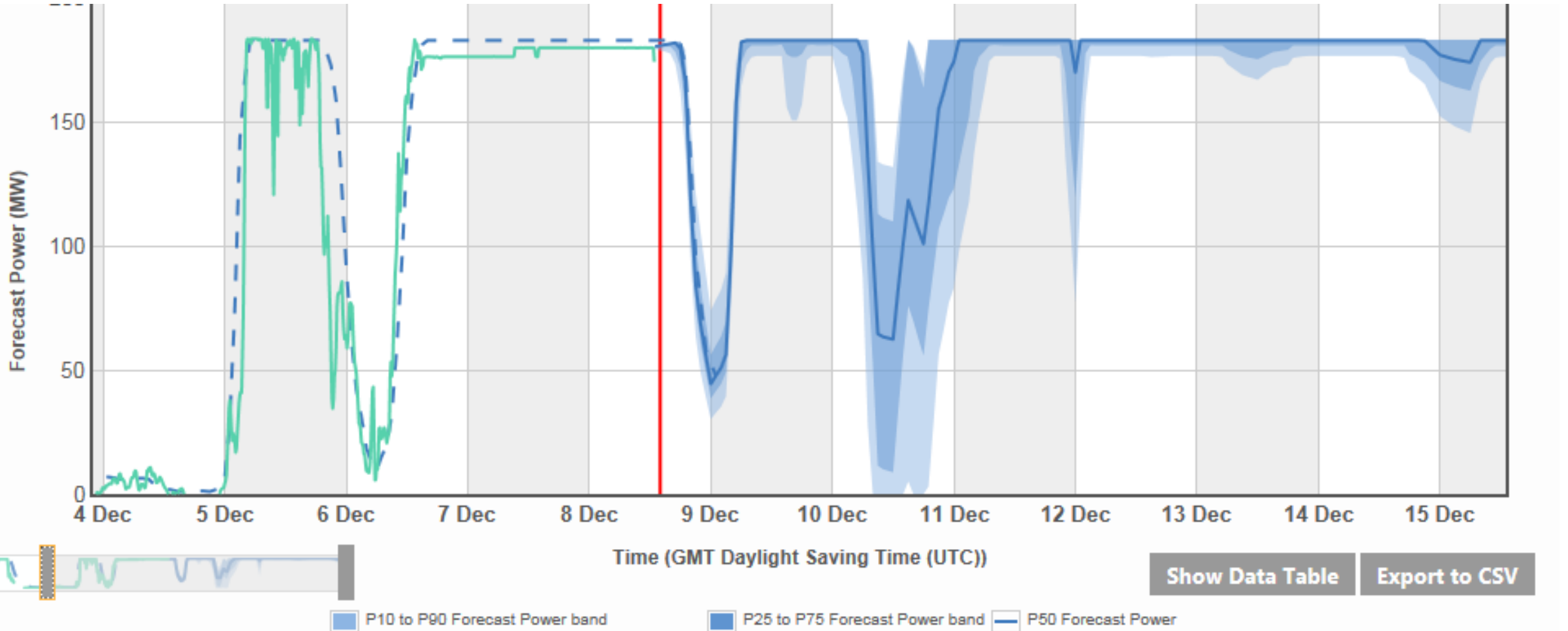
- Usability (MWAC)
- Approved capacity (MWAC)
- Registered capacity (MWAC)

By 2030



Source: Electricity of Vietnam – National Load Dispatch Centre – EVN NLDC

Grid curtailment mitigation: Short-term forecasting



Grid curtailment mitigation: Energy storage - recommended practice (GRIDSTOR)

DNV GL releases one-stop guideline for safe and reliable grid-connected energy storage systems



Wind Resource: There will always be risk, but need to reduce it and understand it

- Accurate measurements - Long enough and in the right locations
- Robust analysis / long term prediction
- Reliable inputs
- Independent verification
- .. Quantify the uncertainty!
- ... Validate the methodology

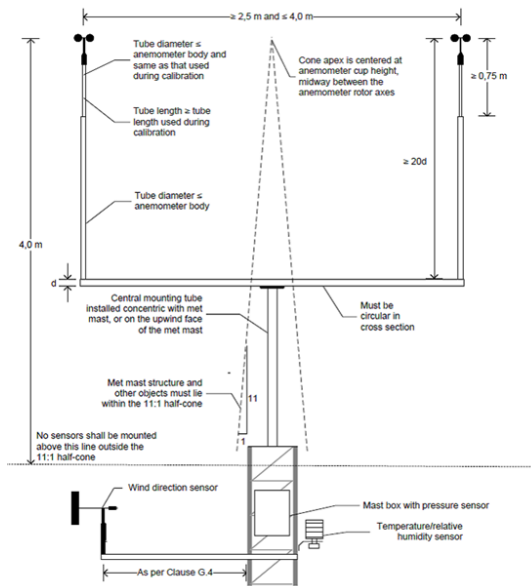
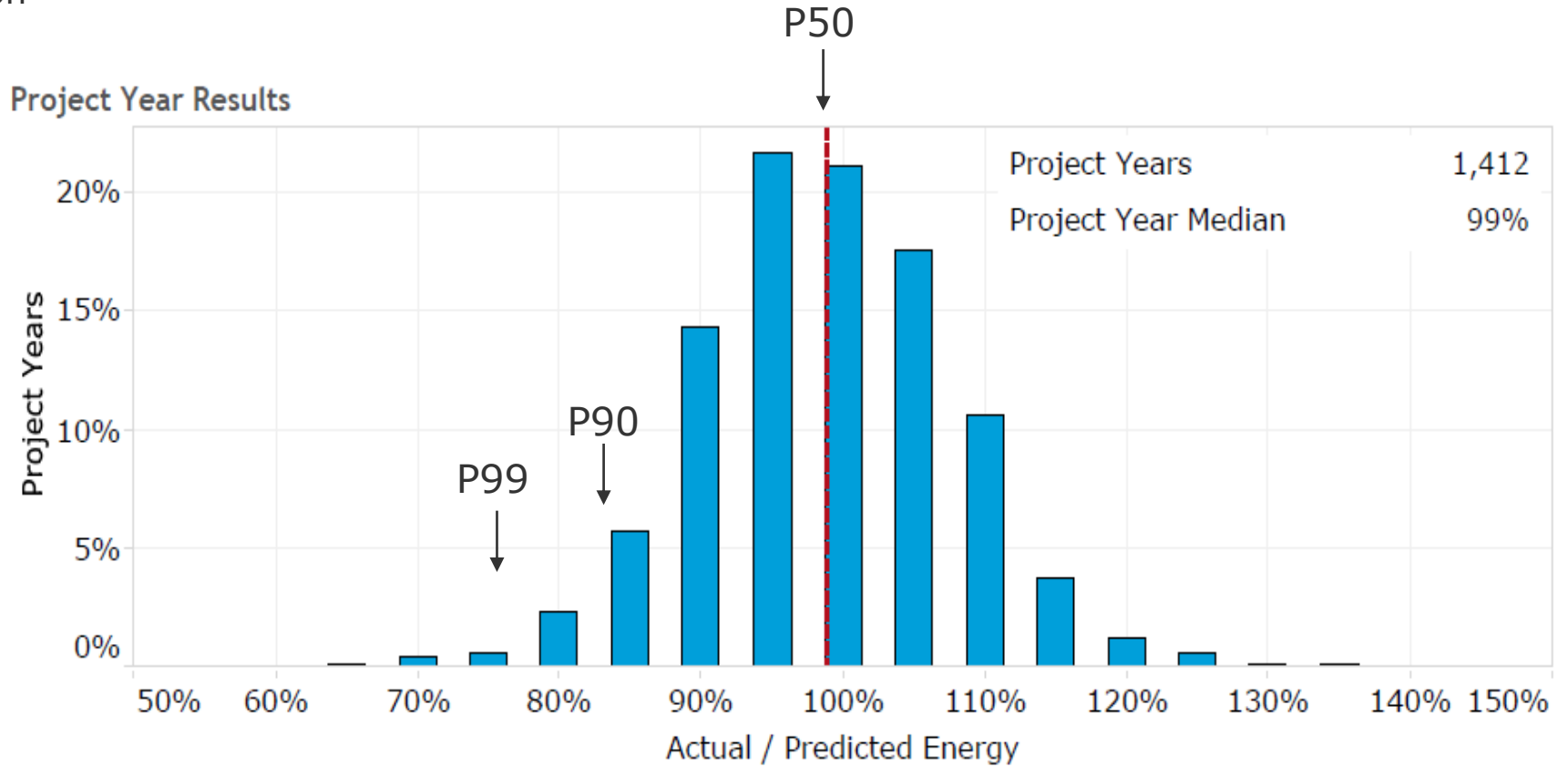


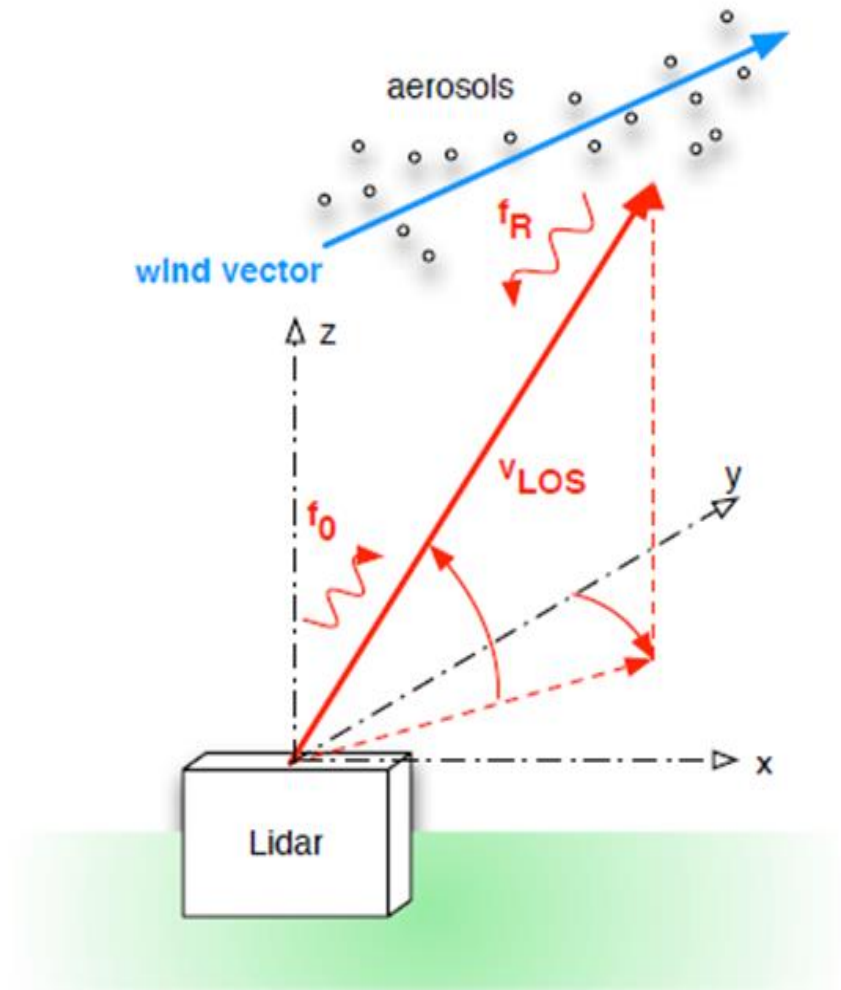
Figure G.2 - Example of alternative top-mounted primary and control anemometers positioned side-by-side and wind vane and other instruments on the boom

Project Year Results



Accurate measurements: Tall onshore or offshore met mast - LiDAR

- **High 10-year P90/P50 confidence level**
 - Gives banks more confidence to loan
- **Currently intertidal projects use coastal onshore met masts**
 - Very high wind speed gradient
 - The closer to the tidal zone the better
- **Vertical LiDAR on offshore platform for intertidal project**
 - Accurate measurements in benign conditions
- **Floating LiDAR bring cost-effective alternative for deep offshore development**
 - Provides on-site data for much lower costs compared to offshore mast
 - Minimum 15-20 m water depth



Growth in wind turbine size – More efficient in a wider range of wind conditions



Gedser
200 kW



Bonus
300 kW



Bonus
1000 kW



RePower
5 MW



Vestas V150
4.2 MW



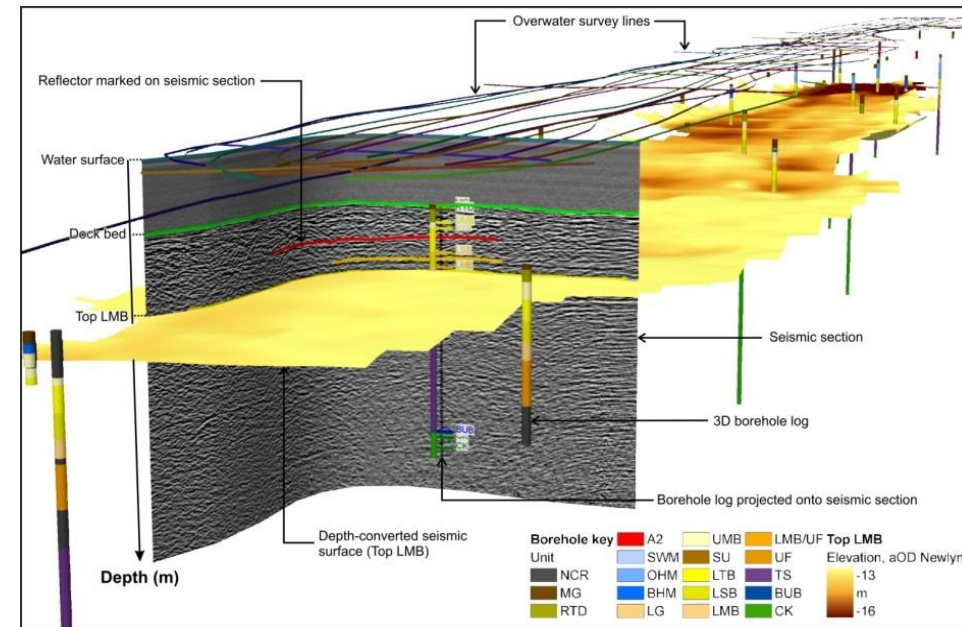
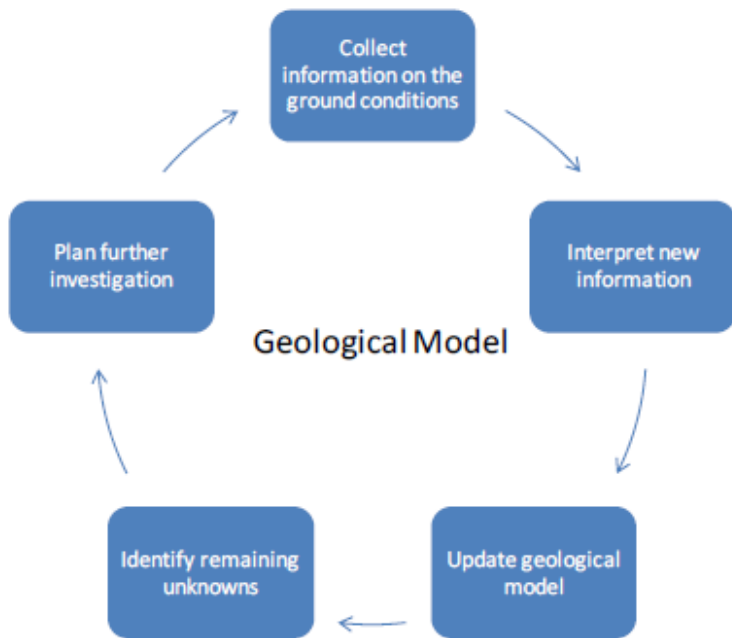
GE Haliade-X
12 MW

1957, 24 m

2020, 220 m diameter

Importance of geophysical and geotechnical surveys

- Varying and complex nature of the geotechnical material in the APAC region, and the varying capabilities of the site investigation contractors operating there.
- Imperative that a comprehensive and adequately supervised campaign of geophysical and geotechnical surveying is undertaken by experienced service providers using appropriate techniques and equipment.

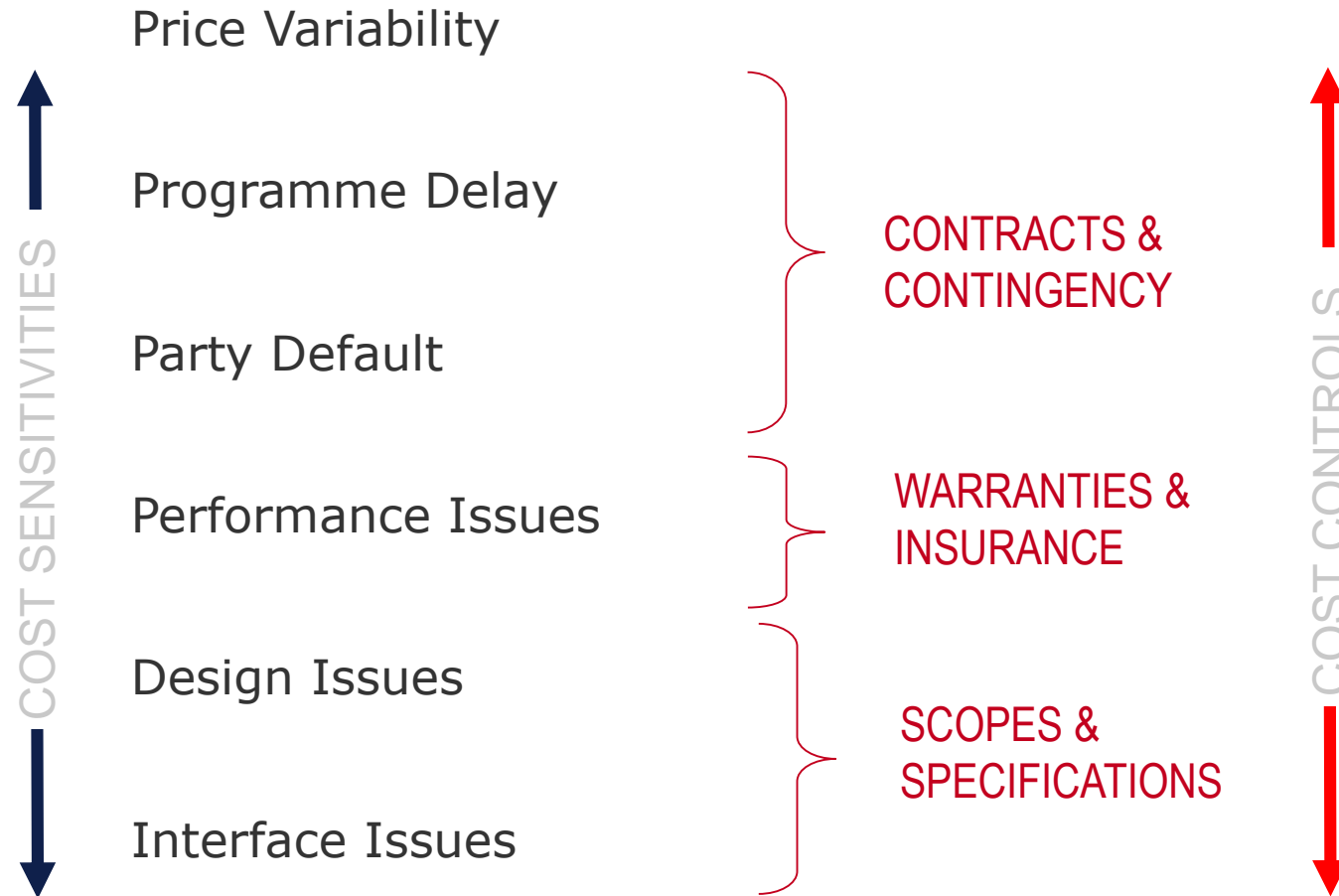


END RESULT = High Resolution Geological Model

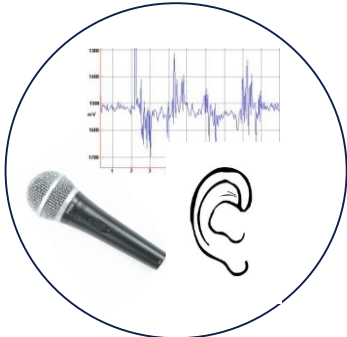
Critical failures due to poor design



How to control the risk of increased CAPEX during construction



Environmental and social impact assessment



NOISE



COMMUNITY



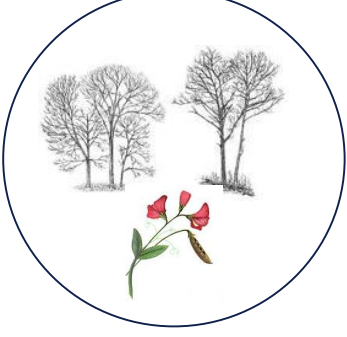
VISUAL



SIGNALS



TRAFFIC



FLORA

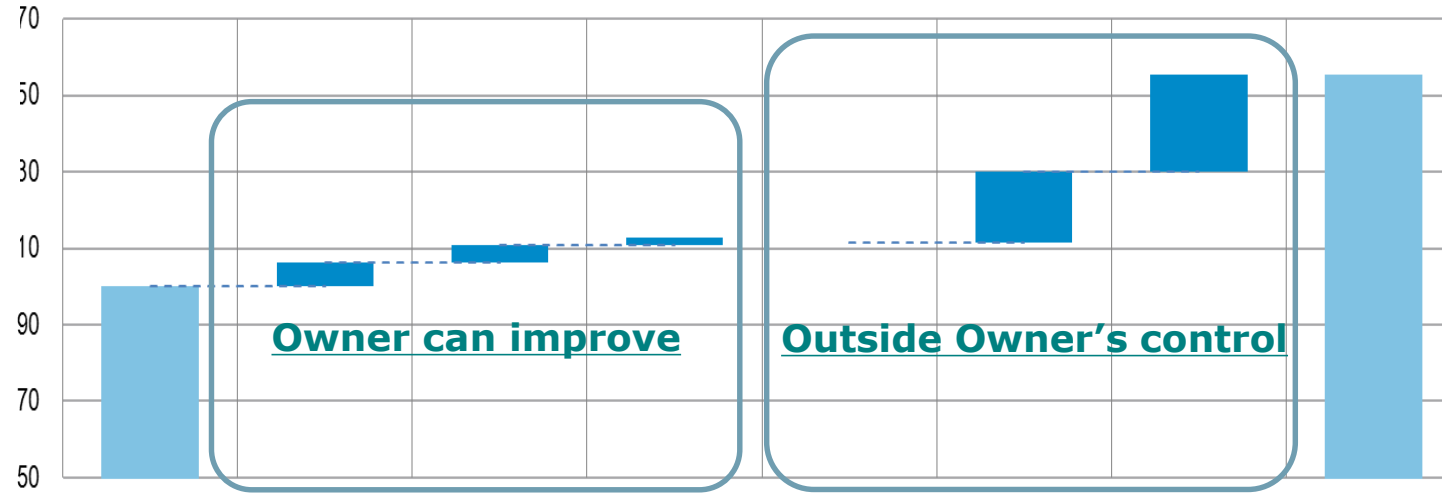
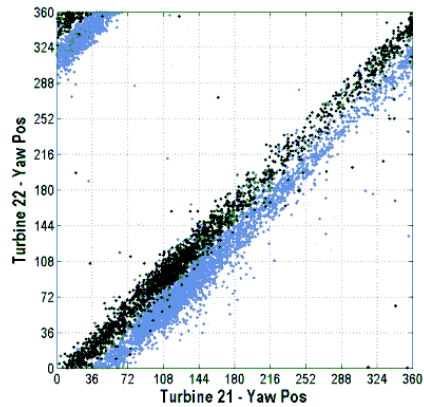
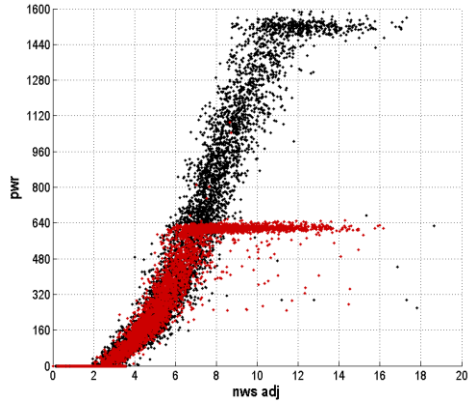


HISTORY

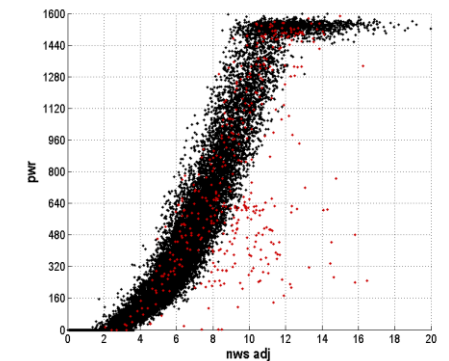
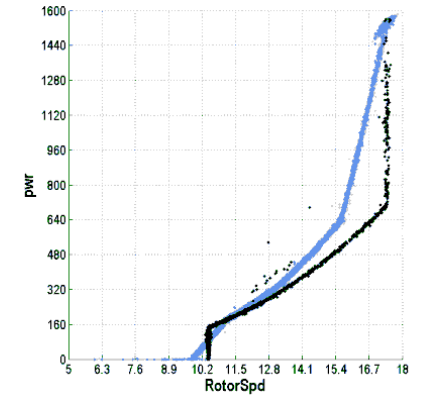


FAUNA

Monitoring of operating wind farms



	Actual	Availability - Turbine	Availability - Other	Power Performance (Excluding Grid)	Wind resource	Availability - Grid Curtailment	Power Performance (Due to Grid)	Potential Future Production
%	100.0	6.2	4.7	1.8	-1.1	18.5	25.4	155.4
GWh	78.2	4.8	3.7	1.4	-0.9	14.4	19.8	121.5



Thank you!



DNV GL's Energy Transition Outlook

Benoit Nguyen

benoit.nguyen@dnvgl.com

www.dnvgl.com

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