Assessing the Financial Viability of Offshore Wind Farms

BMT

Copenhagen Offshore Wind
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Overview of this presentation

- Financial viability
  - critically dependent of knowing the installation cost, the operations and maintenance (O&M) cost and the resulting operational availability
  - required for all involved in the route to market
- Basis of our systems and methods
  - developed for and used by the oil & gas industry
- Show some results

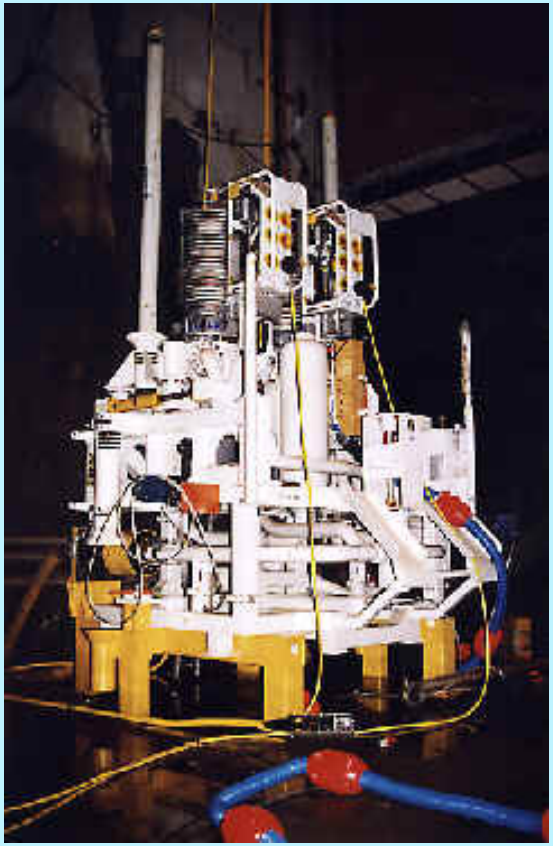
Drivers of cost and availability

- Equipment selection and installation methods
- Contractual arrangements
- Servicing and repair
  - preventive and corrective
- Operational constraints
  - transit times, weather, tide, time of day, etc.
- Resource constraints
  - ships, people, tools, spares, etc

Operational ideal

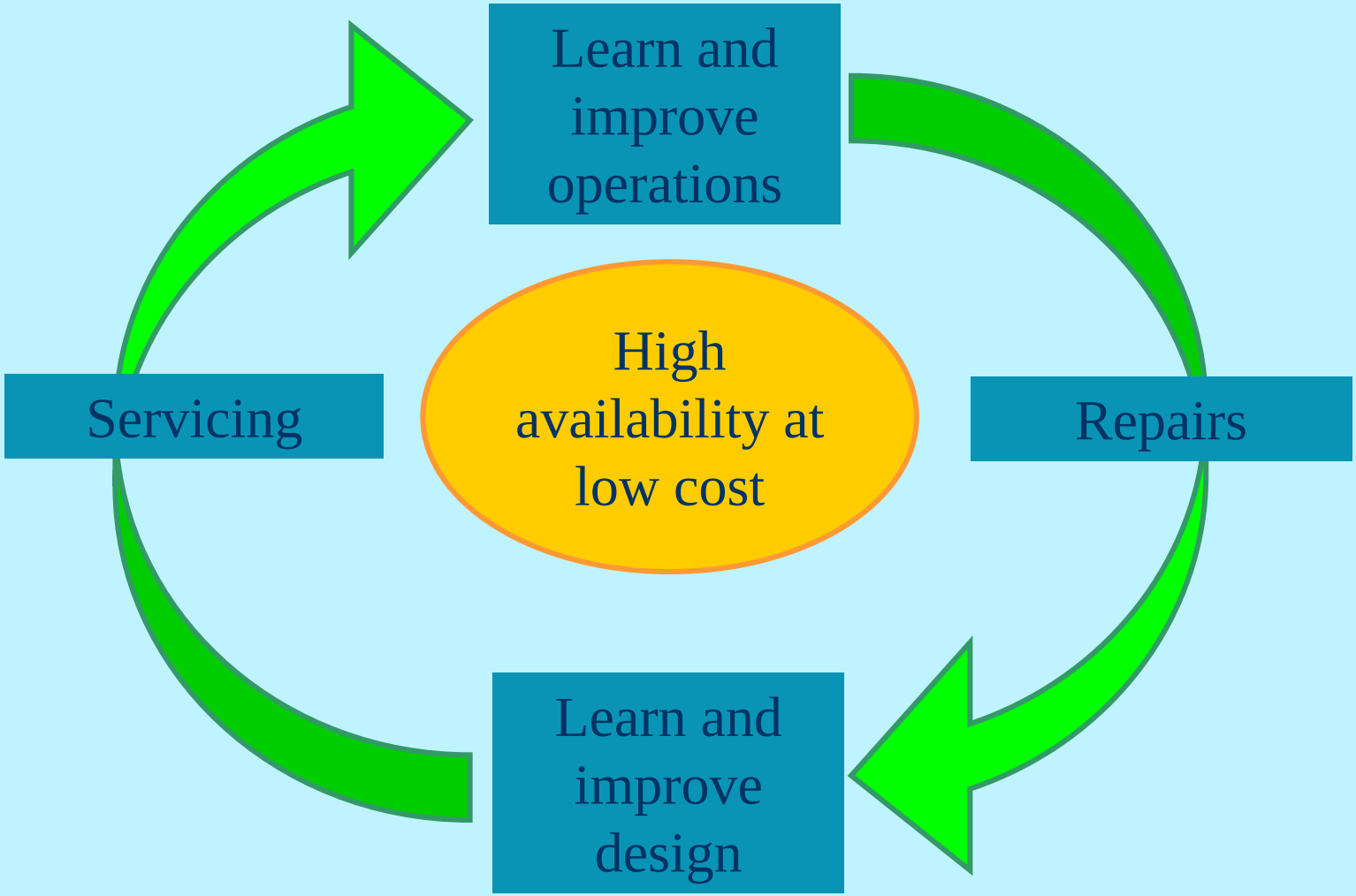
- High reliability
  - no servicing
  - no repair

Achieved in deep space

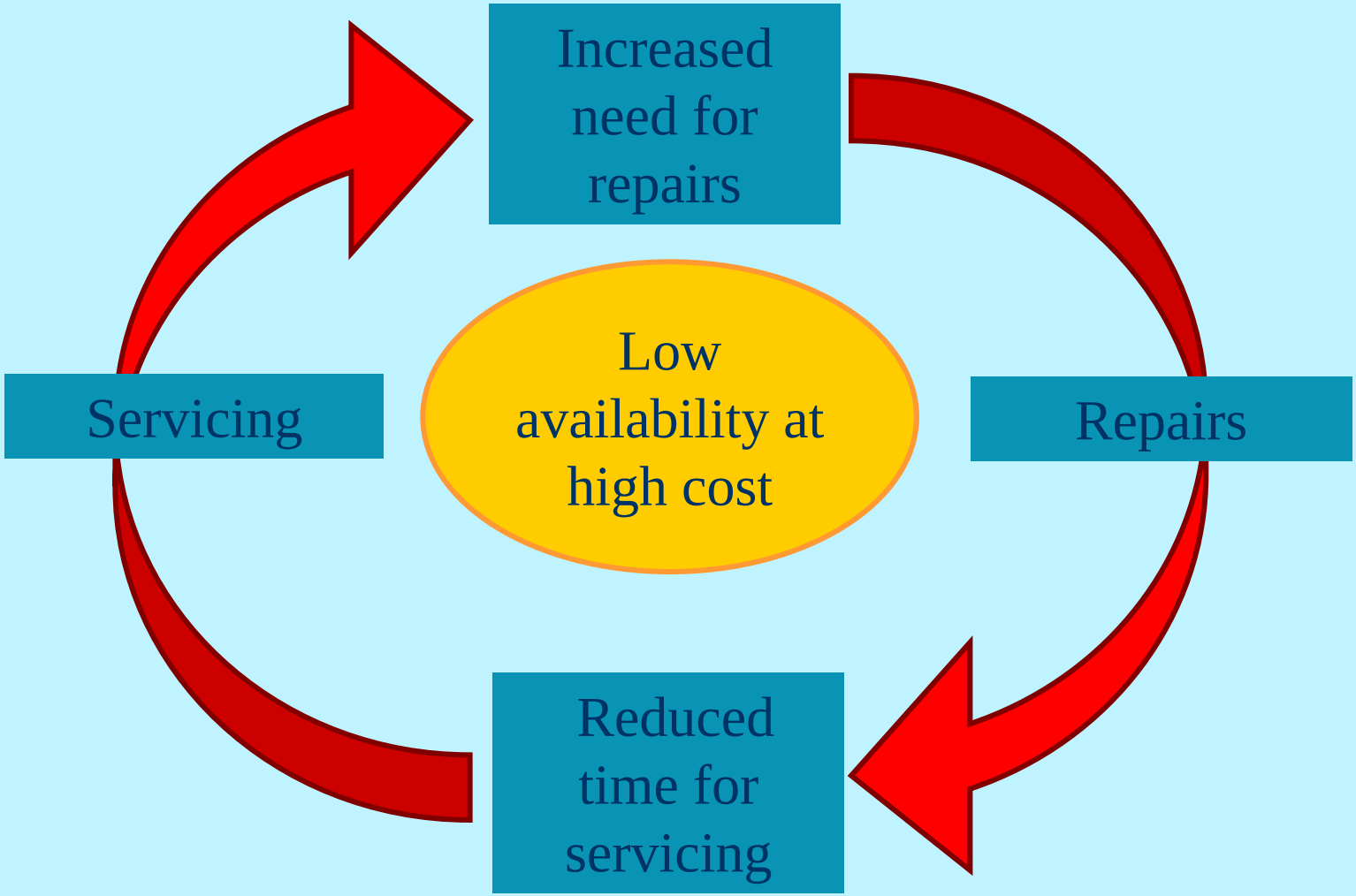


Worked towards in oil & gas

More realistic ideal – the virtuous circle



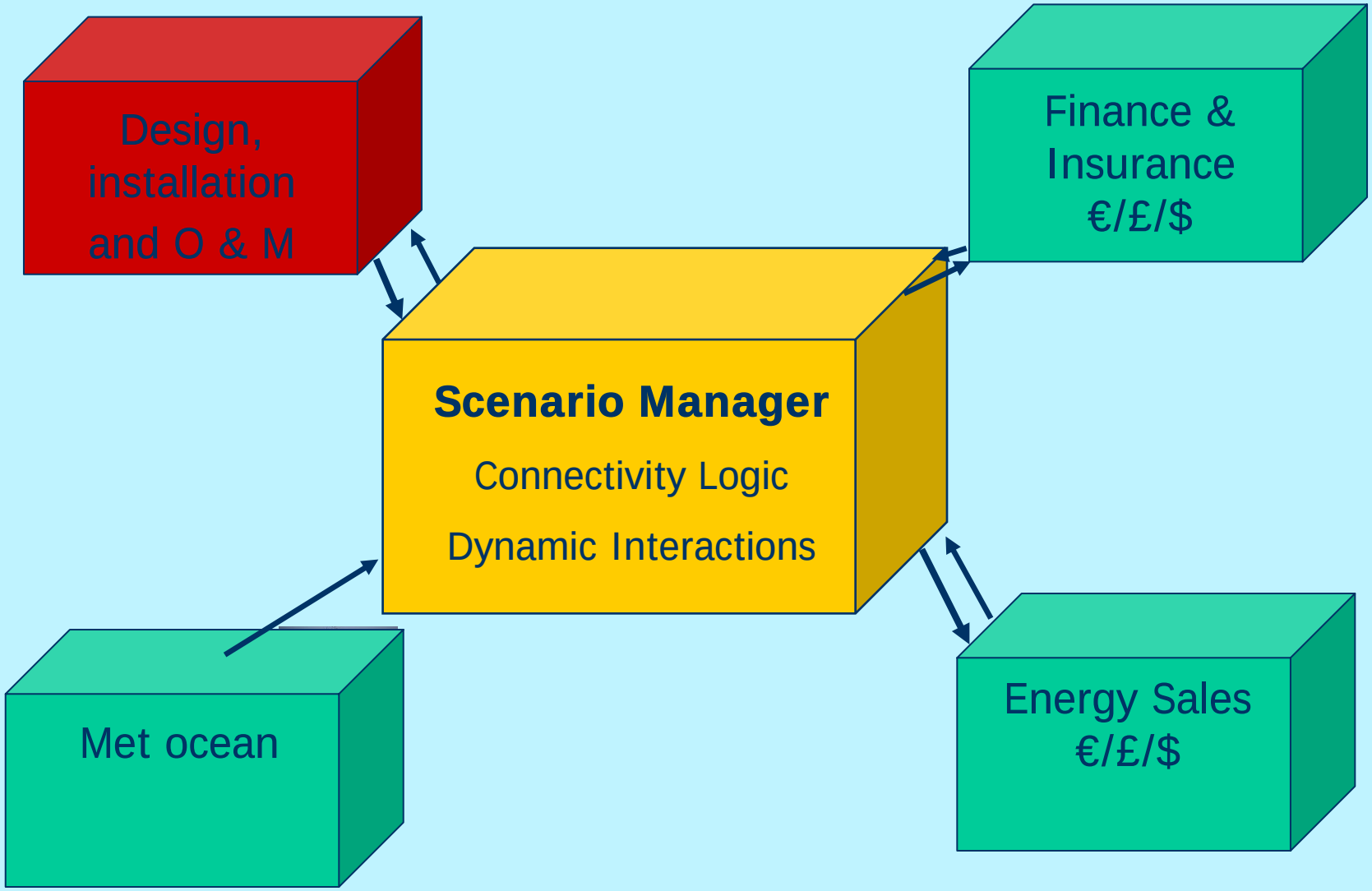
Threat – the vicious circle



Need to understand drivers

Offshore - <u>everything</u> is linked to weather

Created a system - *MWCOST*



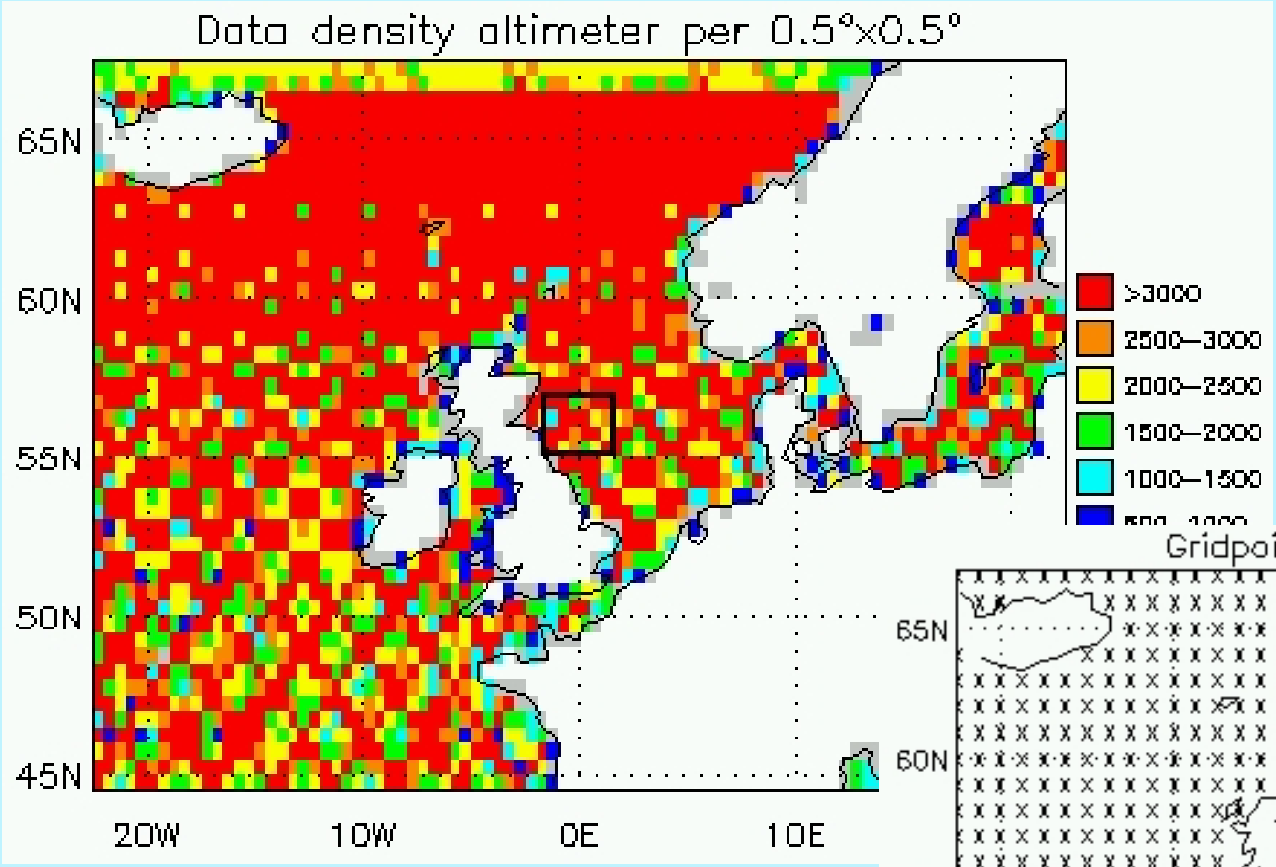
Basis of the system - use of simulation

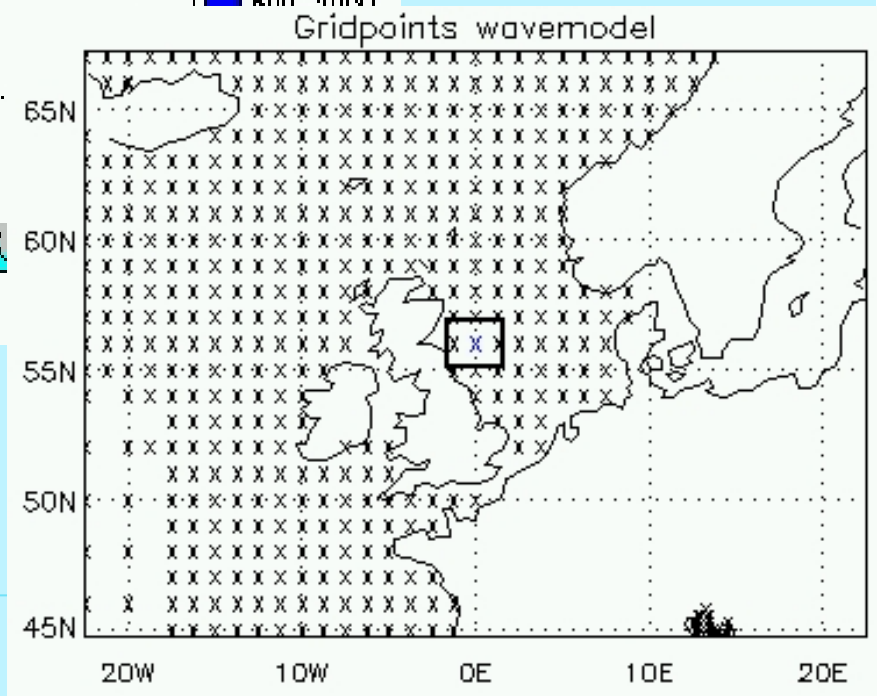
- Extended “whole system” probabilistic simulation
  - advanced Monte Carlo techniques
- Integrated treatment of system performance, support and logistics
- Single model capturing:
  - location of the wind farm
  - configuration of the wind farm
  - the weather
  - reliability of the components
  - servicing and repair policies
  - logistics infrastructure and spares strategy
  - … and the complex interactions among these factors

Testing of the system – reference models

- Reference models
  - based around a hybrid of location, configuration, equipment and support vessels (Beatrice)
- Reference weather data
  - European Space Agency contract to link EO statistical data into a statistical support model
- Spatial mapping
  - linked to spatial mapping

Example reference weather data

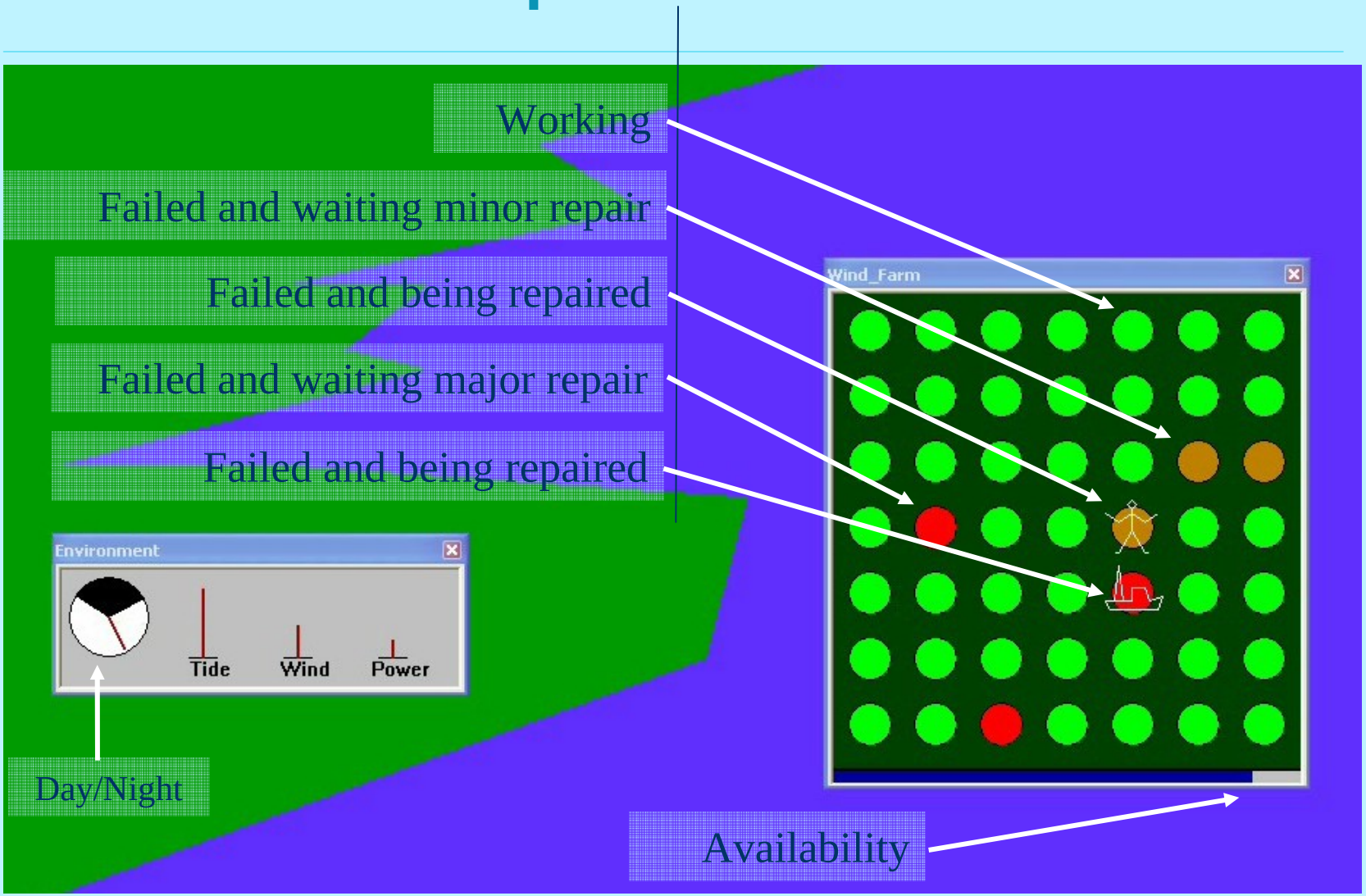




Scope of the system – evaluate costs and risks

- Financial viability
  - required for all involved in the “route to market”
- Everything in a wind farm is technically and economically coupled with the weather
  - need to include the wind in all aspects of the modelling
    - plus waves, tides, visibility and ice when offshore
- *MWCOST* models this coupling including the dynamic interactions between the wind/weather with
  - the energy market
  - the technical performance
  - the installation and supportability strategies
  - the availability of support resources
- Outputs based on
  - nominal performance and statistical variations

Simulation example



MWCOST designed to answer questions

Cost questions

- **Strategy**
  - what is the best preventive, predictive and corrective maintenance strategy?
- **Assets**
  - how many support vessels are needed, where should they be based and what capability should they have?
- **Equipment and tooling**
  - what equipment and tools are needed, how many are needed and where should they be kept?
- **Spares**
  - which spares should be carried, how many spares should be carried and where should they be kept?
- **Staff**
  - how many staff are needed and are they needed all year or seasonally?
- **Support sharing**
  - what savings can be achieved by sharing support with other offshore installations?

Risk questions

- **Contracts**
  - How should the turbine and O&M contract specification be developed?
  - What should the contract performance measures be?
- **Warranties**
  - What is the value of warranty negotiation?
  - What is the post warranty exposure?
- **Financial risk management**
  - Where should limited resources be focused to give maximum value for money?
  - What are the risks associated with periodic net cash flows and debt coverage?
  - What are the risks of not achieving financial targets?
  - What is the risk exposure (due to either project implementation or service operation)?
  - What is the optimum corporate risk retention-risk transfer balance?

Stakeholder dimensions

- Risk and Rewards can be considered for each stakeholder, stakeholder grouping or project

  e.g.

- Developer
  - what turbine warranty do I need to get financing
- Turbine Supplier
  - what turbine warranty can I offer to get selected

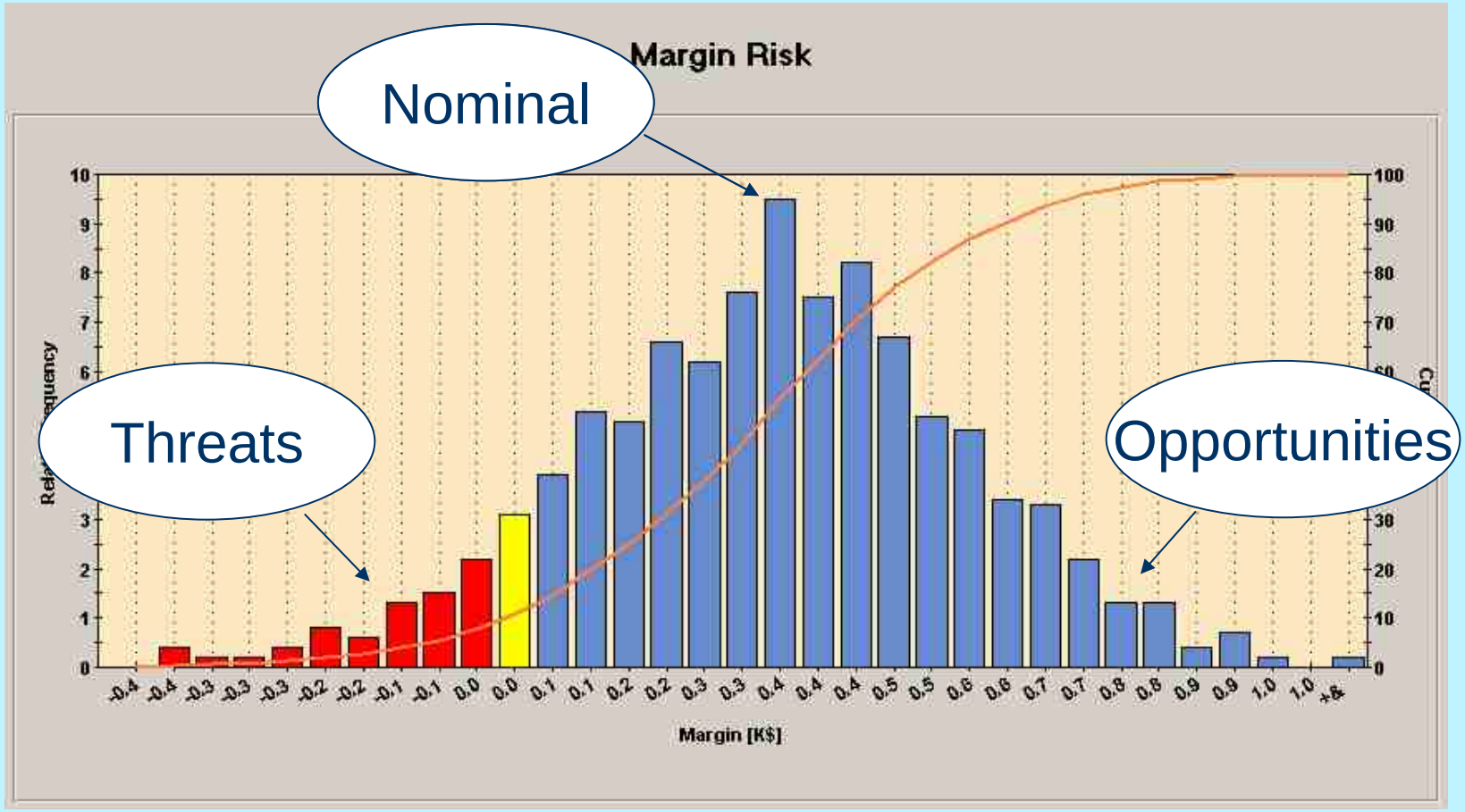
Example financial outputs

- Nominal performance
- plus
- Statistical variation

Project margin analysis

Negative margin is marked in red columns, positive margin is marked in blue columns and the zero margin column is marked in yellow colour.

Project margin analysis

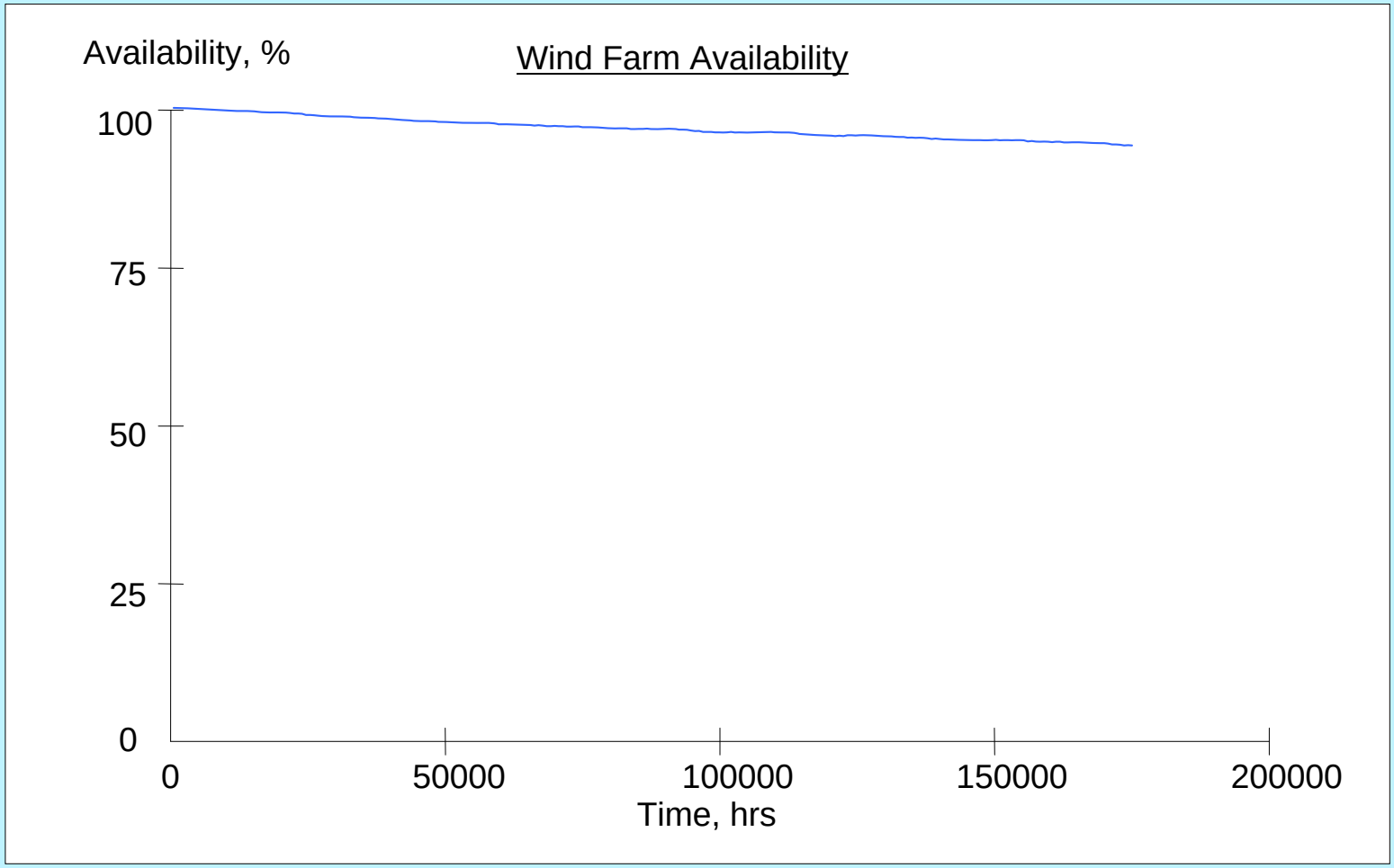


Negative margin is marked in red columns, positive margin is marked in blue columns and the zero margin column is marked in yellow colour.

Example availability outputs

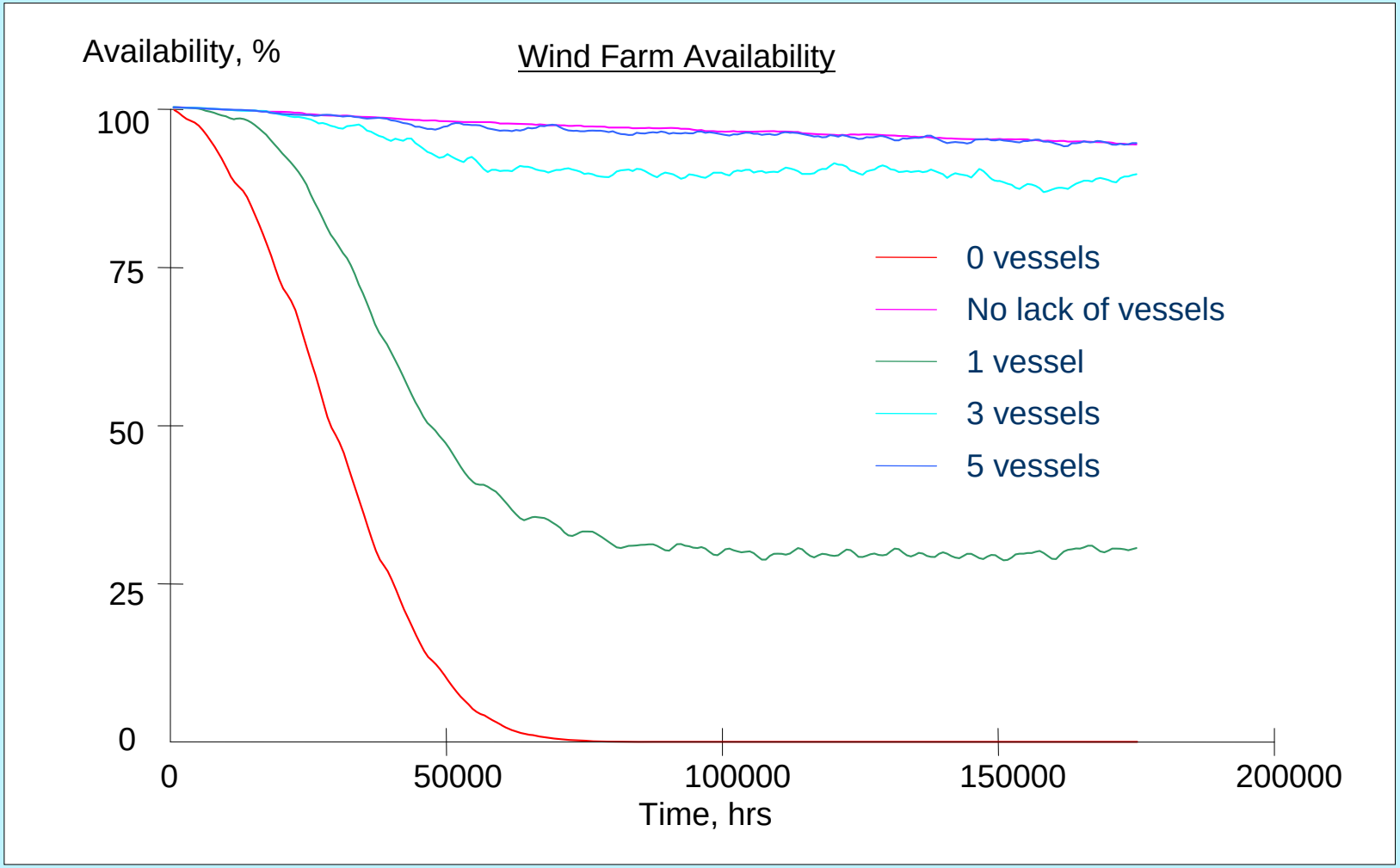
Best performance

No lack of support vessels or spare parts



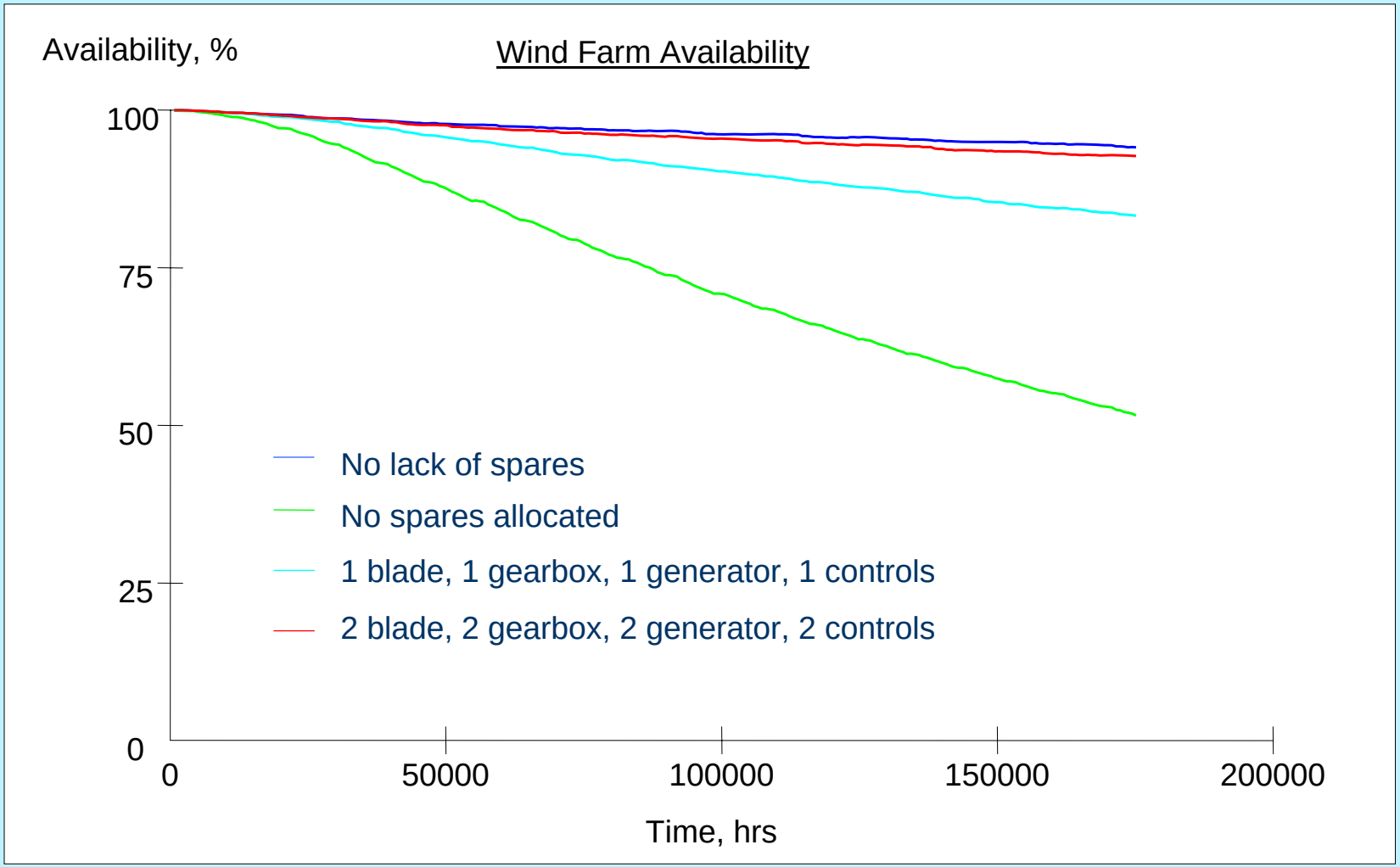
Effect of the number of vessels

No lack of spare parts



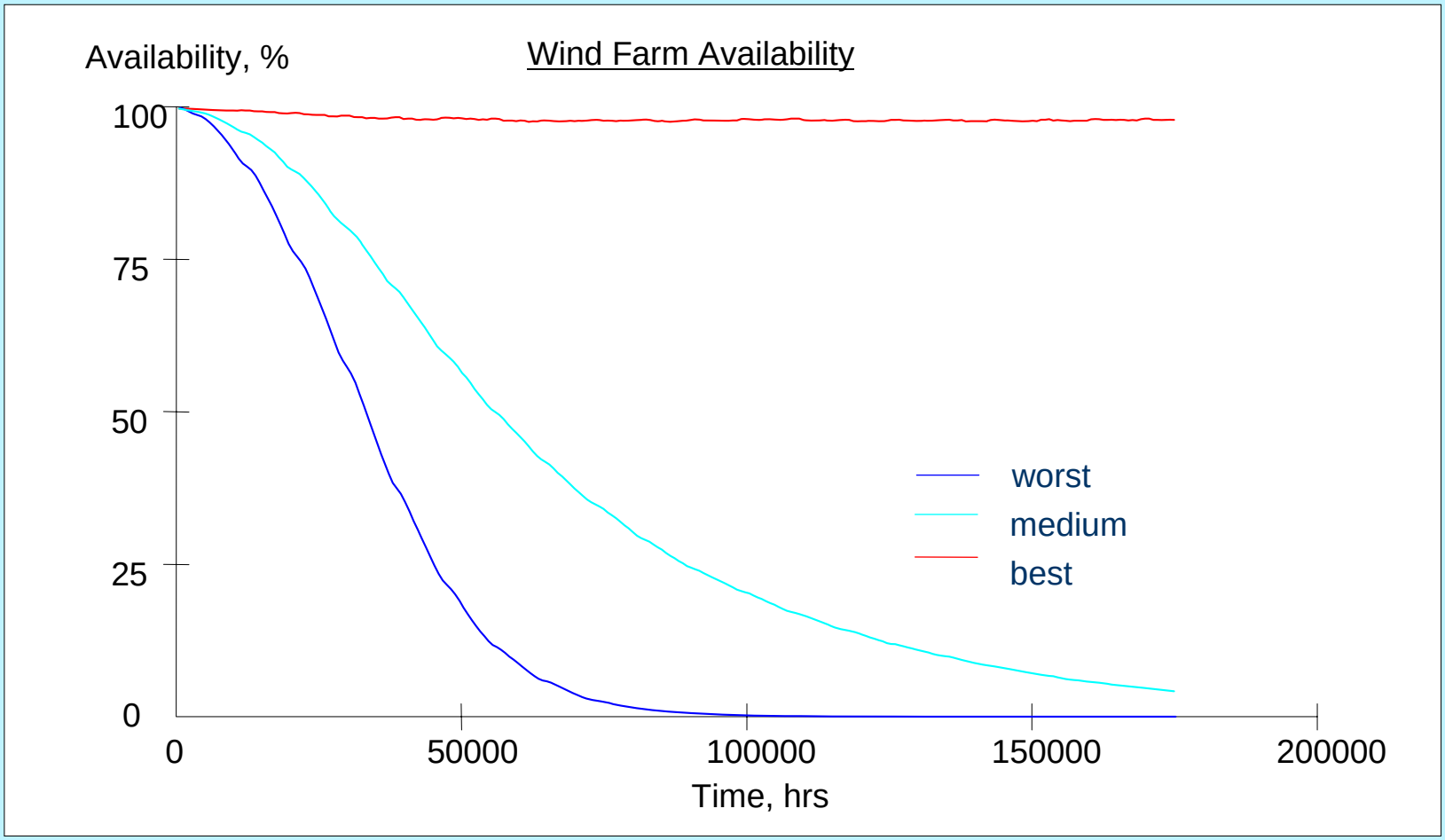
Effect of the numbers of spare parts

No lack of support vessels

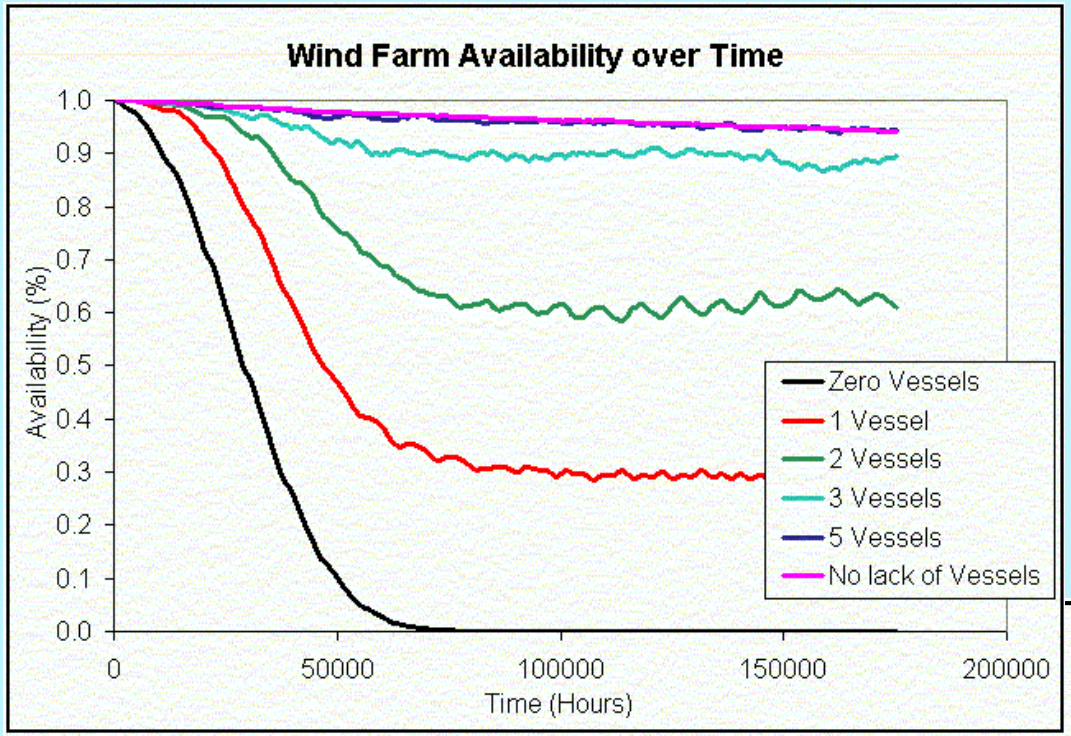


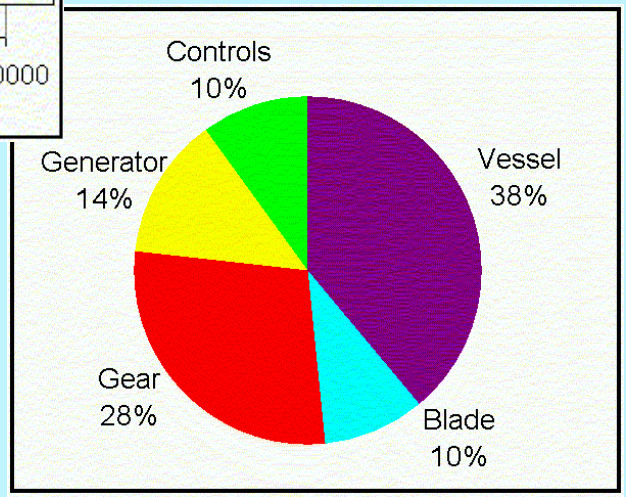
Effect of the weather capability of vessels

No lack of vessels or spare parts

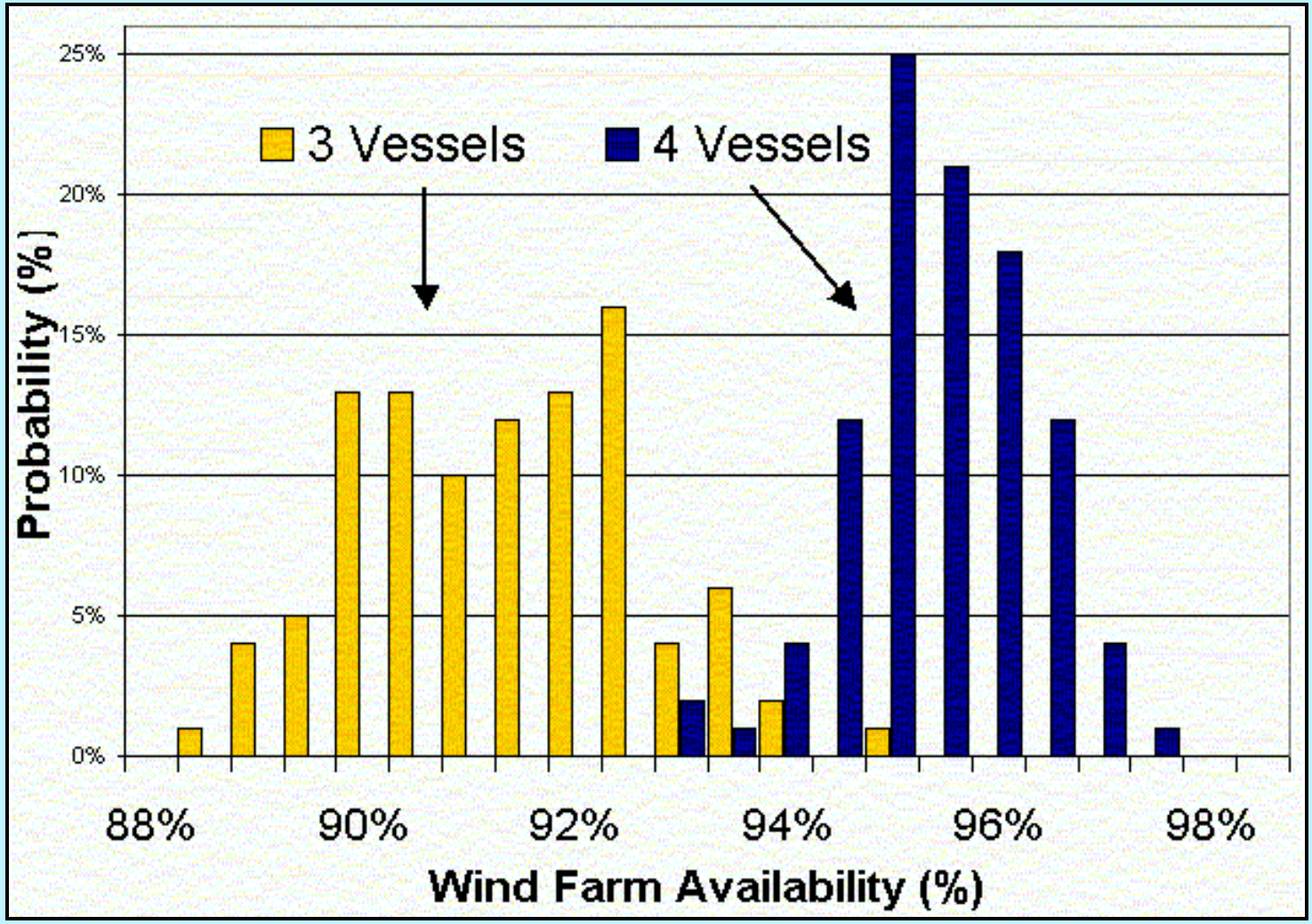


Capability to breakdown results





Statistical nature of results



Conclusion

1. Methods exist to model the financial viability of offshore wind farms
2. Methods tried and tested in oil & gas
3. Methods fully include the effect of the weather
4. Viability can be assessed for any stakeholder

Thank you

Further Information

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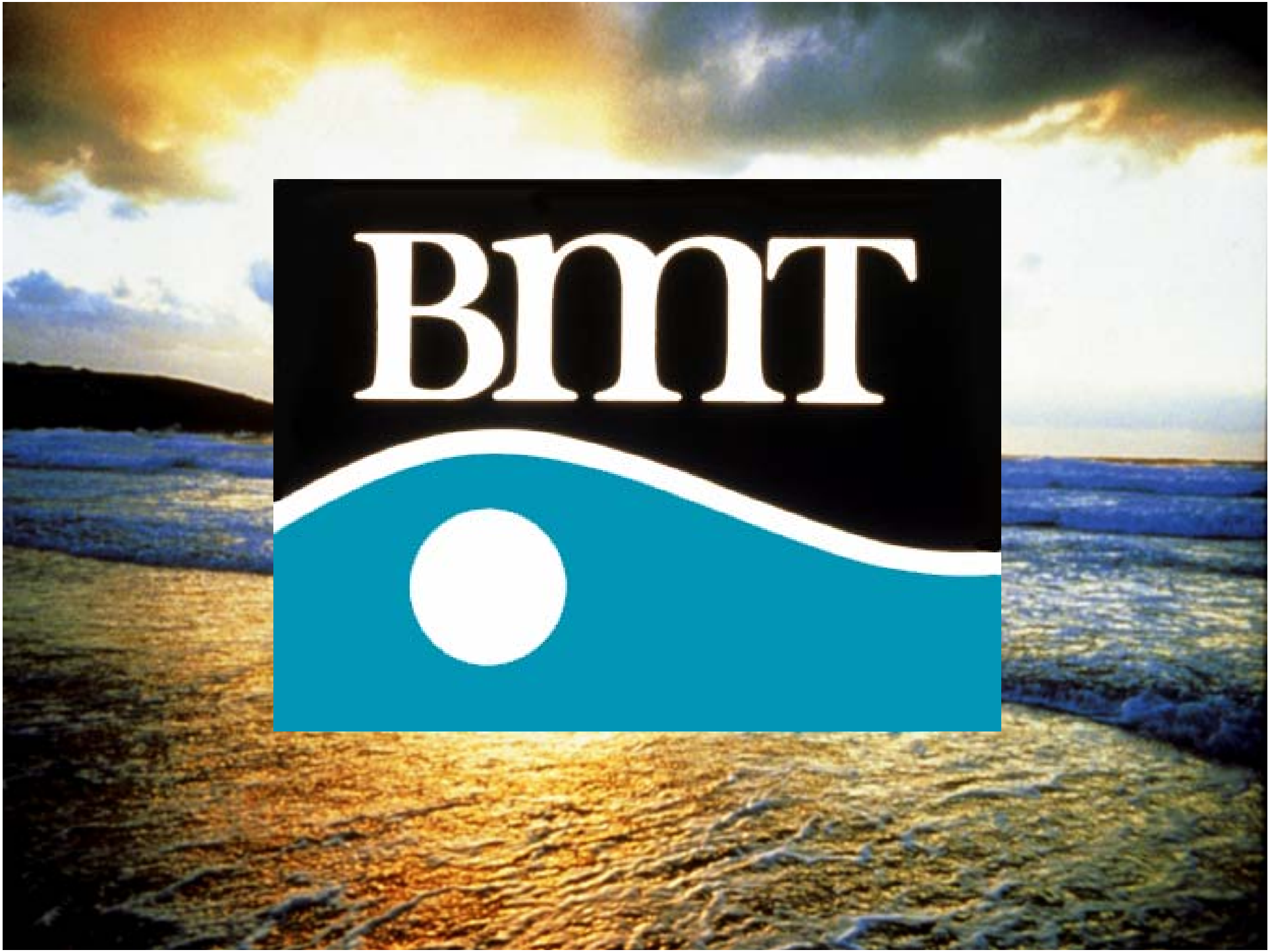
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