Principles of Certification of Offshore Energy Converters

OTEQ conference - Porto

Benson Waldron
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The Presentation

- About DNV
- DNV Involvement in Marine Renewables
- Background to certification scheme development
- DNV risk based certification approach
- Why a risk based approach makes sense
- Expectations from stakeholders
- Summary
Introduction to DNV

Independent foundation established 1864

PURPOSE
To Safeguard Life, Property, and the Environment

VALUES
We build trust and confidence
We never compromise on quality or integrity
We care for our customers and each other
We are committed to teamwork and innovation

VISION
Global impact for a safe and sustainable future

RESEARCH AND INNOVATION
We use profits to continuously develop our people and our research and innovation
Highly skilled people across the world

 HEAD OFFICE – Oslo, Norway

300 offices

100 countries

10,400 employees
A trusted player in shipping

- Authorised by 130 national maritime authorities
- DNV classed 22% of the world fleet orderbook in 2011 (in Gross Tonnes)
- 14% of the world’s sailing fleet is to DNV Class (in Gross Tonnes)
Expert role in the oil and gas industry

65% of the world's offshore pipelines are designed and installed to DNV's pipeline standard.

1 in 3 of all classed Floating Production, Storage and Offloading vessels and 38% of drill ships are to DNV class.

30% DNV is involved in 30% of the world's LNG terminal projects.
Impacting climate change issues

25% of Clean Development Mechanism (CDM) projects are validated by DNV

75% of the world’s offshore wind projects are certified and verified by DNV

1st
Released the world’s first standard for qualification of carbon capture and storage technologies
What is DNV doing in the Marine renewable sector?

- Contracted by the Carbon Trust in the UK to create ‘Guidelines on design and operation of wave energy converters’ issued in 2005
- Saw a market need for third party services to de-risk the large investments in novel technology
- Right mix of skills and expertise within DNV
- Created first dedicated certification standard for the Wave and Tidal industry ‘DNV OSS-312’

Question: ‘How to certify unique novel technology where no standards exist?’
Certification is…

“Confirmation that the [component/system] is designed, documented and manufactured in conformity with design assumptions, specific standards and other technical requirements.”


In order for there to be large scale deployment there needs to be a high level of confidence – We need to manage risk clearly and transparently to inspire CONFIDENCE
What are the main areas of risk?

- Survivability of technology in the harsh marine environment
- Reliability / Maintainability / Availability
- Deployment of technology (marine ops)
- Unproven novel technology
- Quality of power
- Development of supply chain
- Development of workforce and infrastructure to support deployment and maintenance
- Inclusion into financial and insurance market
- Meeting environmental impact targets
- Health and safety
The DNV certification process

DNV aim to provide the following

- A systematic approach to identify and manage risks so informed decisions can be properly taken and resources properly allocated.
- Support existing knowledge (within the industry or company) regarding the frequency of events, their consequences and risk tolerance / acceptance.
Certification Process – Wave and Tidal

- Project Initiation
  - DNV Statement of Feasibility
- Design Assessment
  - DNV Prototype Certificate
  - DNV Conditioned Type Certificate
  - DNV Type Certificate
  - DNV Project Certificate

Product Certificates for Components and Assemblies

Survey Reports

Traditional Certification Process
Define Certification Basis

Technology Assessment

Failure Mode Identification and Risk Ranking

Concept Improvement

Selection of Qualification Methods

Certification Plan

Design Assessment (Data Collection / Analysis and Testing / Surveillance)

Make Decisions

Use of Codes and Standards

Class?

Failure Mode Identification + Recommendations from Guidelines + Specific Recommendations for Tidal

Any unconventional failure modes identified?

Yes

No Class 1 & 2

Statement of Feasibility

Application area

<table>
<thead>
<tr>
<th>Technology</th>
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</thead>
<tbody>
<tr>
<td>Proven</td>
</tr>
<tr>
<td>Limited field history</td>
</tr>
<tr>
<td>New or unproven</td>
</tr>
<tr>
<td>Known</td>
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<tr>
<td>New</td>
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Risk Management Marine Renewable Technology

**Tank testing** *(Low level of investment – Low risk)*
- Results are important for future certification stages. Important for calibration of analytical models, mooring configurations, definition of hydrodynamic parameters
- Stage revisited as needed during the next technology development stages.

**Sea trials** *(Medium level of investment – High business & technology risk )*
- Small scale / Full Scale
- Technology deployment
- Confirmation of scaleability
- Initial Assessment of Power Generation
- Control Strategies
- Survivability
- Initial indication of Availability / Reliability
- Evolution of Analytical Model (extrapolation of results)

**Arrays** *(High level of investment – High business risk & lower technology risk)*
- Interference / Interaction between devices
- In-field infrastructure deployment (including mooring arrangements for farm configuration)
- Power Quality
- Building up reliability data
- Production optimisation
Handling Novelty and Uncertainty

![Graph showing probability distributions for different stages of a project: concept, design, testing, optimisation, commercialisation.](image)

- **Target**
- **Service Life**
- **Probability**
- **Investment**

- £ = acceptance percentile

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Getting from early prototype to industry standard

- No Design Standards exist for design of wave and tidal energy systems, although these are being created.
- Even when issued any standard will have to deal with a wide variety of technology and approaches.
- How to achieve success varies from technology to technology.
- DNV have promoted a Risk Based Approach based on the established Qualification of New Technology RP.
- Demonstrate feasibility then analyse technical risk and mitigate as necessary.
Certification Scheme for Marine Renewables Sector

Under Development:

IEC Technical Specifications

- 62600-1 - Terminology
- 62600-2 - Design Requirements
- 62600-10 - Assessment of Mooring
- 62600-100 - Power Performance – Wave Energy Converter
- 62600-200 - Power Performance – Tidal Energy Converter
- 62600-101 - Resource Assessment – Wave
- 62600-201 - Resource Assessment – Tidal

- NWIP - Tank Testing
- NWIP - Methodology for Power Assessment in different locations and limited data
- NWIP - Power Quality
Certification Framework – Available now

- OSS-312
  - DNV Offshore Standards
  - Other DNV Standards
  - International Codes and Standards
  - Guidelines on Design and Operation of WECs
- DNV Recommended Practices
- DNV Guidelines and Notes
Benefits of a standardised certification approach

- Establishes a common language
- Certification follows risk-based processes
- Systematic adaptation of technology from offshore and maritime and existing standards
- Plan of actions to mitigate risks and reduce uncertainties
- Use of traditional surveillance procedures
- The process provides demonstrable risk management
- DNV experience in offshore industries accessed
- Scheme can be integrated to project schedule
Summary

- Funding Agencies, Investors, Authorities, Brokers, Energy Utility Companies and the public expect that marine renewables will be cost effective, reliable and meet generating cost targets!
- For Portugal to develop marine renewable ambitions these expectations need to be fulfilled
- The DNV certification is based on the following cornerstones:
  - Risk Based Certification Process
  - Adaptation of standards and recommended practices from Offshore Oil & Gas, Maritime and Wind Industries
- Third party certification provides a robust level of assurance and demonstrates that the key risks have been managed increasing probability of success
- For the industry to grow and attract investment it must be perceived as mature and low risk
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