Block Island Wind Farm CVA

Status of verification activities at FDR and FIR submittal milestone
Overview

Last Update – March 10

- Site Assessment
- Design Basis
- Loads Simulation
- Manufacturing Surveillance to Date

Current Update – April 23

- Completion of Loads simulation
- Facilities Design Report
- 2015 Fabrication and Installation Report
- Update on Manufacturing Surveillance
Load Simulation

Bladed (turbine + tower design)

Mean Wind + Turbulence

Wave train

Interface Loads

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ULS Tower Loads Comparison – Combined Shear Force

\[ F_{\text{ly}} = F_{\text{ly}} / \bar{F}_{\text{ly}}, \text{22m} \uparrow \text{ABS} \]
ULS Tower Loads Comparison
Combined Overturning Moments

\[ M_{\downarrow xy} = \frac{M_{\downarrow xy}}{M_{\downarrow xy, 22m \uparrow ABS}} \]

![Graph showing combined overturning moments for different tower heights and normalized Mxy values. The graph compares ABS_Tower, Alstom_Tower Loop 2, and Alstom_Tower Loop 1.](image-url)
DEL↓Mx = \frac{DEL↓Mx}{DEL↓Mx,22m↑ABS}

![Graph showing normalized DEL of Mx vs tower height for different models (ABS, ALSTOM_Bladed_4.6, ALSTOM_Bladed_4.3).]
$\text{DEL}_F \downarrow F_x = \text{DEL}_F \downarrow F_x \, /\, \text{DEL}_F \downarrow F_x$, 22m ↑ABS

FLS Tower Load Comparison
Fore-Aft Shear Forces

Normalized DEL of Fx

ABS
ALSTOM_Bladed_4.6
ALSTOM_Bladed_4.3

Tower Height (m)

Normalized DEL of Fx

0.6 0.7 0.8 0.9 1.0 1.1

0 20 40 60 80 100 120
FLS Tower Load Comparison
Fore-Aft Overturning Moments

\[ \text{DELM}_y = \frac{\text{DELM}_y}{\text{DELM}_y;22\text{m}^{\uparrow}\text{ABS}} \]

![Graph showing normalized DEL of My for different tower heights and normalized DEL of My for different models.](chart)
$DELF_y = \frac{DELF_y}{DELF_y, 22m \uparrow ABS}$
Bladed 4.3 wind was found to be non IEC Compliant
ULS Jacket Load Comparison
Utilization Ratios – Pile Safety Factors – DLC 6.2a

Mem Result: Combined UC

KEI Joint
103X
UC=0.77

ABS Joint
100X
UC=0.845

KEI: 0.53
10A1

KEI Pile
10A1 SF=2.06

ABS Pile
10B2 SF=1.71

10A2

10B1

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FLS Jacket Load Comparison
Minimum Fatigue Lifetimes

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<tr>
<th>JOINT</th>
<th>JOINT DESC.</th>
<th>LIFE</th>
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<tr>
<td>WP1A</td>
<td>Transition Piece Flange</td>
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<tr>
<td>0047</td>
<td>Racetrack at TP</td>
<td>33</td>
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<tr>
<td>0047 (0046)</td>
<td>Deck Leg Upper Can at Racetrack</td>
<td>2,834 (1815)</td>
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<td>41A1</td>
<td>Deck Leg Upper Can at Brace Conn.</td>
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<tr>
<td>32B2</td>
<td>Top of Deck Leg Lower Can</td>
<td>99</td>
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<tr>
<td>34B2</td>
<td>Bottom of Deck Leg Upper Can</td>
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<tr>
<td>302X</td>
<td>Deck X Brace</td>
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<td>31B1</td>
<td>Deck Leg Lower Can at Brace Conn.</td>
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<td>30B2</td>
<td>Pile to Deck Leg Connection</td>
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<td>21B1 (21B2)</td>
<td>Jacket Leg Upper Can</td>
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<td>202X (203X)</td>
<td>Jacket Upper X Brace</td>
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<td>20A2</td>
<td>Jacket Leg Int. Can</td>
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<td>100X</td>
<td>Jacket Lower X Brace</td>
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<td>Jacket Leg Lower Can</td>
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<td>Alstom, Keystone</td>
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<td>Substructure FEA</td>
<td>Keystone</td>
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<td>Keystone</td>
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<td>Alstom Tower Reports</td>
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<td>Detailed Design Substructure</td>
<td>Keystone</td>
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<td>32</td>
<td>Substructure Electrical Drawings</td>
<td>Keystone</td>
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<td>Installation Plan Substructure</td>
<td>Weeks Manson</td>
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## Open DCSs

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<tr>
<th>DCS Number</th>
<th>Subject</th>
<th>Issued to</th>
<th>Issue Date</th>
<th>Engineer</th>
<th>Current Rev</th>
<th>Status</th>
<th>Action</th>
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<td>Keystone</td>
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<td>Keystone</td>
<td>20-Feb-15</td>
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<td>Detailed Design Substructure</td>
<td>Keystone</td>
<td>2-Apr-15</td>
<td>JM</td>
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<td>OPEN</td>
<td>KS to send results of new secondary steel strength analysis, DWW to send cable info, ABS to review crane and fall arrest documents</td>
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<td>Substructure Electrical Drawings</td>
<td>Keystone</td>
<td>2-Apr-15</td>
<td>TH</td>
<td>0</td>
<td>OPEN</td>
<td>DWW to reply, provide arc-flash analysis</td>
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<td>51</td>
<td>Installation Plan Substructure</td>
<td>Weeks Manson</td>
<td>7-Apr-15</td>
<td>RB</td>
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<td>OPEN</td>
<td>DWW to provide additional documentation</td>
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</table>
Exceptions to Verification of Facilities Design Report (FDR)

- Secondary Steel Strength Calculations (J-tubes, internal platforms, upper access platform)
- Design changes ongoing (piles, secondary steel)
- Vessel Impact Analysis
- Cable Details for evaluation of J-tube design
- Final Platform Electrical Drawings
- Arc Flash Analysis
- Limitation of Scope
- Closing out DCSs
Fabrication Plan – Gulf Island Fabricators

- Delivered and Commented
  - Fabrication Plan

Transportation and Installation Plan – Weeks Manson

- Delivered and Commented
  - Fabrication and Installation Plan
- Delivered, Comments being prepared
  - Health and Safety Plan
  - Emergency Response Plan
Transportation and Installation Plan – Weeks Manson

- To be Delivered
  - Sea Fastening Plans – Apr 22
  - Interface Management Plan – May 1
  - Welding Procedure – May 1
  - Coating Procedure – May 1
  - Loadout Plans – May 15
  - Grouting Procedure – May 15
  - Quality Control Procedures – (final) May 21
  - Environmental Requirements DWW
Deck Dimension Check
Gulf Island Marine, Houma, LA
Deck Fabrication Process
- Fabricate row A w/ rows 1 & 2 Braces
- Fabricate row B
- Install 2 racetrack braces & TP on row A
- Install 2 racetrack braces on row B
- Roll row A onto row B
- Roll deck into vertical position
- Install upper access platform

Jacket Fabrication Process
- Fabricate row A w/ rows 1 & 2 braces and top elevation
- Fabricate row B
- Stand up row A with Braces
- Stand up row B
- Install row B to row A
Project completion
• Man-hours to date: 28,853
• Project completion to date: 23%
• Safety incidents to date: None
Start of rolling of 2-1/2” plate

Welding of the 2-1/2” thick can

UT performed on deck X-braces

MT performed on the deck X-Braces
36" X-Braces installed to leg A1 and A2

Race track braces being prepared to be welded

Dimensional inspector surveying deck legs A1 and A2 for site 1

Brace being installed to first two deck legs for site 1
Deck Leg Rework

TYPICAL DECK VERTICAL FRAMING
MODIFICATION STEP 3

Brace to Leg

Deck Leg
Deck Leg Rework
Flame straightening to correct flange deformation
Manufacturing Surveillance - Substructure

TP loadout, Rostock, Germany
Manufacturing Surveillance - Substructure

Jacket Piles – EEW, Korea

Roundness

UT Check

MT Check
Inspection Criteria
1. Quality control procedures and implementation
2. Manufacturing instructions
3. Material quality and identification systems
4. Manufacturing record keeping systems
5. Serial production test procedures and results
6. Defects identified and corrective actions
7. Repair procedures
8. Post manufacturing inspection procedures
9. NDT procedures
10. Production and Quality documentation after final acceptance by manufacturer QA department
11. Component storage requirements
Wind Turbine Component Casting - China

Cast hub rendering

Hub during pour

Hub for first set
Wind Turbine Component Casting - China

Front Frame rendering

Coupling Arm rendering

Front Frame casting

Coupling Arm casting

BIWF CVA Status - presented to CRMC 2015-Apr-23
Status of Activities

Load Simulation
• Complete – Report to be released

Verification of Facilities Design Report (FDR)
• Complete with Exceptions

Verification of Fabrication and Installation Report (FIR)
• 2015 FIR Review and Comments Ongoing

Manufacturing Verification
• Jacket Fabrication – in process, load-out June 27
• Wind Turbine Manufacturing – in process Q1 2015 – Q2 2016

Transportation and Installation Verification
• In planning stages for load-out June, start of installation July
May
- Close Exceptions to FDR
- Continue Review and Comment of FIR
- Continue Manufacturing Verification of Jacket
  – additional shifts
- Continue Manufacturing Verification of WTG

June
- Complete Manufacturing Verification of Jacket
- Loadout and Transportation of Jacket
- Continue Manufacturing Verification of WTG

July
- Start Installation of Jacket
- Continue Manufacturing Verification of WTG…