Deep Arctic Upgrade

Diving Into The Future: Battery Hybrid DSV

Andrew Manson, OneFleet
50 by 30 Overview
50 by 30 Emissions Reduction

One Fleet Focus

- **Targeting 50% reduction in Scope 1 & 2 emissions by 2030:**
  - Absolute emissions, versus 2017 baseline
  - OneFleet accounts for up to 70% of Group emissions

- **Two fundamental pillars for One Fleet emissions reduction:**

**Energy Efficiency**

Reduce energy consumption by operational & technology advancement:

- Use of digital platforms to provide better operational insight and energy consumption awareness
- Active SEEMP management, to reduce consumption
- Hybrid power plants / energy storage solutions, to enable safer, and more efficient vessel operations
- Fleet renewal, replacing ageing assets with inherently more efficient tonnage

**Alternative Fuels**

Introduce alternative fuels with lower carbon intensity:

- **Today** - *Renewable Diesels, produced from sustainable feedstocks, waste products and biomass, offering greatest CO2 reduction factors*
- **Tomorrow** – Outlook beyond 2030, potential shift to alternative, power-to-X fuels, produced from renewable energy sources
Deep Arctic Upgrades
Energy Efficiency

Generating Energy Onboard

• Problem Statement:
  • The DP Critical Activity Modes for a Saturation Diving Vessel, demand high levels of redundancy for power generation; meaning sufficient spinning reserve, to ensure the safest mode of operation
    • Multiple generating sets online running at relatively low load
    • Increased fuel consumption & emissions, running hours & maintenance
    • Driving up the cost and environmental impact of operations

Typical DP setup:
• 4 Generators online ~ 15 - 20% Load
• Max Operational Redundancy

Ideal DP setup:
• 2 Generators online ~ 30 - 40% Load
• Min Operational Redundancy

Most Energy Efficient Setup:
• 1 Generator online ~ 60 - 80% load
• Zero Redundancy!

Typical Engine
‘Specific Fuel Oil Consumption’ Curve

Generators operate more efficiently @ higher loads

Generator Setup on DP:

A
Typical DP setup:
• 4 Generators online ~ 15 - 20% Load
• Max Operational Redundancy

B
Ideal DP setup:
• 2 Generators online ~ 30 - 40% Load
• Min Operational Redundancy

C
Most Energy Efficient Setup:
• 1 Generator online ~ 60 - 80% load
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Energy Efficiency

Benefits of Energy Storage

• Hybrid Power Solution:
  • Battery arrays have been demonstrated to provide the following benefits

Power Backup:
  • Short-time backup to running generators, replacing engine spinning reserve, whilst satisfying operational redundancy requirements

Peak Shaving & Enhanced Dynamic Performance
  • Providing level power on engines, offsetting the need to start new engines, as well as instant power in support of running engines; safer and more dynamic response during normal operations

Zero Emission Operations
  • Inclusion of shore power connections, allows unrestricted project mobilization activities to be carried out with zero emissions, where port “cold ironing” infrastructure is available
Main Upgrades Overview

**Main Upgrades Overview**

- Installation of new hybrid equipment below main deck, batteries, drives, transformers, distribution boards, HV boards
- New battery rooms in port and starboard DP zones
- Modification to vessels systems, firefighting, lighting, alarms, CCTV, etc. within new battery rooms
- Modifications to PMS, IAS and DP Control systems
- New Cooling & HVAC Systems
  - New Shore Power Connection Plugs
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**TechnipFMC**

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Onboard Upgrades Complete March 2021
Energy Storage System Overview:

- 2 x 420kWh Battery arrays
  - Each array has 7 x 60kWh cubicles
  - Each Cubicle 9 x 6.6kWh Battery Modules

- SOC Usable Range 20 – 70%

- Peak Shaving Allowance 20%

- Max Discharge Power 1,240kW (duration 300sec)

Typical Battery Design Margins:

- Only approx. 50% of the battery capacities are usable!

<table>
<thead>
<tr>
<th>Margin Type</th>
<th>Percentage Range</th>
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</thead>
<tbody>
<tr>
<td>Max Charging Margin</td>
<td>5 - 10%</td>
</tr>
<tr>
<td>Aging / Losses Margin</td>
<td>20%</td>
</tr>
<tr>
<td>Peak Shaving Demand</td>
<td>20 - 30%</td>
</tr>
<tr>
<td>Power Backup Demand</td>
<td>20 - 30%</td>
</tr>
<tr>
<td>Depth of Discharge Margin</td>
<td>20 - 30%</td>
</tr>
</tbody>
</table>
Estimated Benefits

• **Operational Profile 2017-2020:**
  
  - **Transit:** 11%
  - **Port (Mob / Demob):** 9%
  - **Port (Maint / Standby):** 19%
  
  **DP:** 61%

• **Major proportion of time in DP / offshore, when the largest savings can be made**

• **Relative savings per mode:**
  
  - DP 22%, Port 15%, Transit 3%

• **Annual Average Reductions**
  
  - **Up to 20% reduction in Fuel Consumption & Emissions:**
    
    - MGO ~ 1,300 m³
    - CO2 ~ 3,500 Te
    - NOx ~ 57 Te

  - **Over 50% reduction in engine running hours & maintenance**
**Actual Savings**

*Kognifai Remote Monitoring*

Overview of example project campaign, intended to demonstrate approximate fuel savings resulting from Battery Hybrid power plant, when working in DP

<table>
<thead>
<tr>
<th>Mob</th>
<th>Transit</th>
<th>Offshore Campaign</th>
<th>Transit</th>
<th>Demob</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(Working / DP)</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>(WOW / Short Transits)</td>
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</tbody>
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**Dynamic Positioning Zoom**

Typically 2 Gensets Online @ 28% Ave Load

**Overview of example project campaign, intended to demonstrate approximate fuel savings resulting from Battery Hybrid power plant, when working in DP**

<table>
<thead>
<tr>
<th>Gensets Online</th>
<th>Hybrid</th>
<th>Original</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ave Genset Load</td>
<td>28% (960kW)</td>
<td>14% (480kW)</td>
</tr>
<tr>
<td>Ave Fuel Consumption</td>
<td>15 m³ / day</td>
<td>18-19 m³ / day</td>
</tr>
</tbody>
</table>

**Estimated Savings of ~25% in DP**

![Graph showing fuel consumption and savings comparison between Hybrid and Original modes.](image)