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Deep Arctic Upgrade

Diving Into The Future: Battery Hybrid DSV

50 by 30

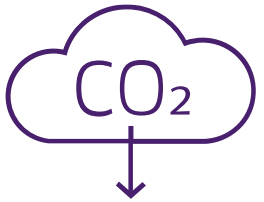
Andrew Manson, OneFleet

11/15/2021

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:

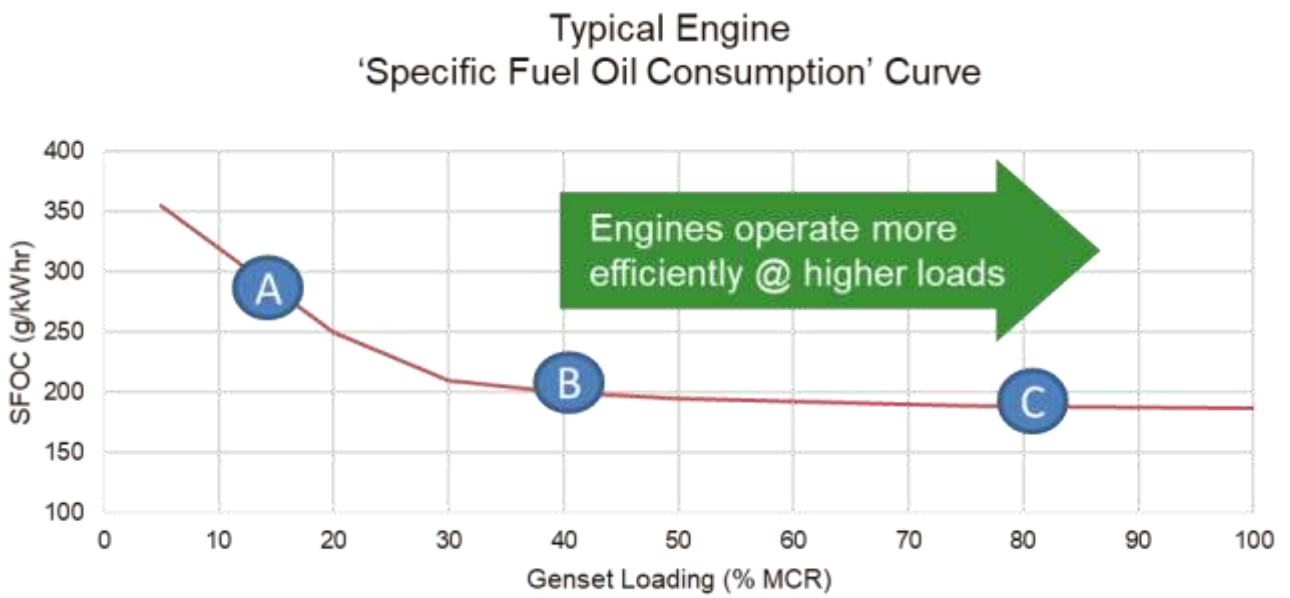
- *Today -* ***Renewable Diesels, produced from sustainable feedstocks, waste products and biomass, offering greatest C02 reduction factors***
- *Tomorrow – Outlook beyond 2030, potential shift to alternative, power-to-X fuels, produced from renewable energy sources*

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*



Generator Setup on DP:

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

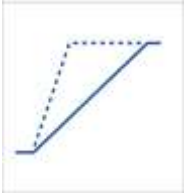
B Ideal DP setup:
- *2 Generators online ~ 30 - 40% Load*
- *Min Operational Redundancy*

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

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*

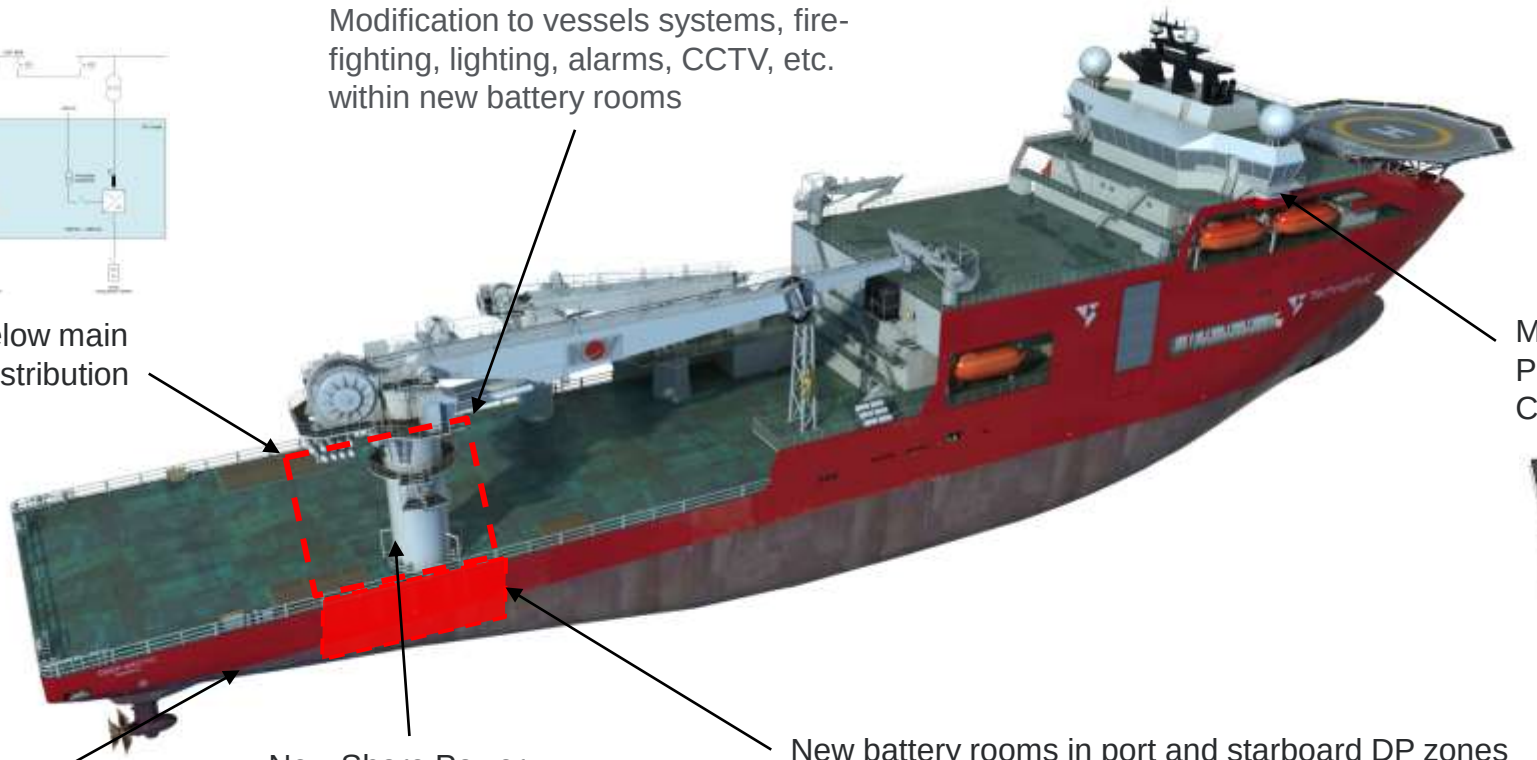
Zero Emission Operations

- *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

Modification to vessels systems, fire-fighting, lighting, alarms, CCTV, etc. within new battery rooms

Installation of new hybrid equipment below main deck, batteries, drives, transformers, distribution boards, HV boards

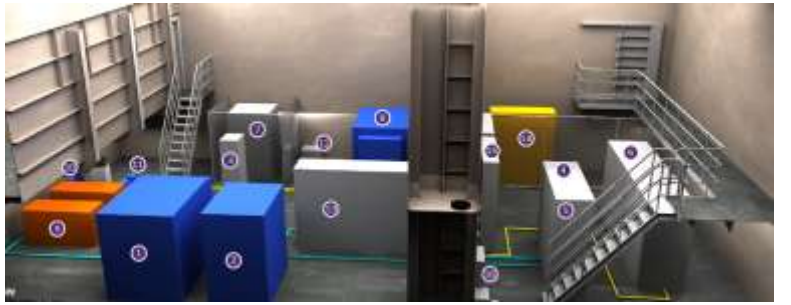


Modifications to PMS, IAS and DP Control systems

New Cooling & HVAC Systems

New Shore Power Connection Plugs

New battery rooms in port and starboard DP zones



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Onboard Upgrades Complete March 2021

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Energy Storage System

SIEMENS

50 by 30

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)*

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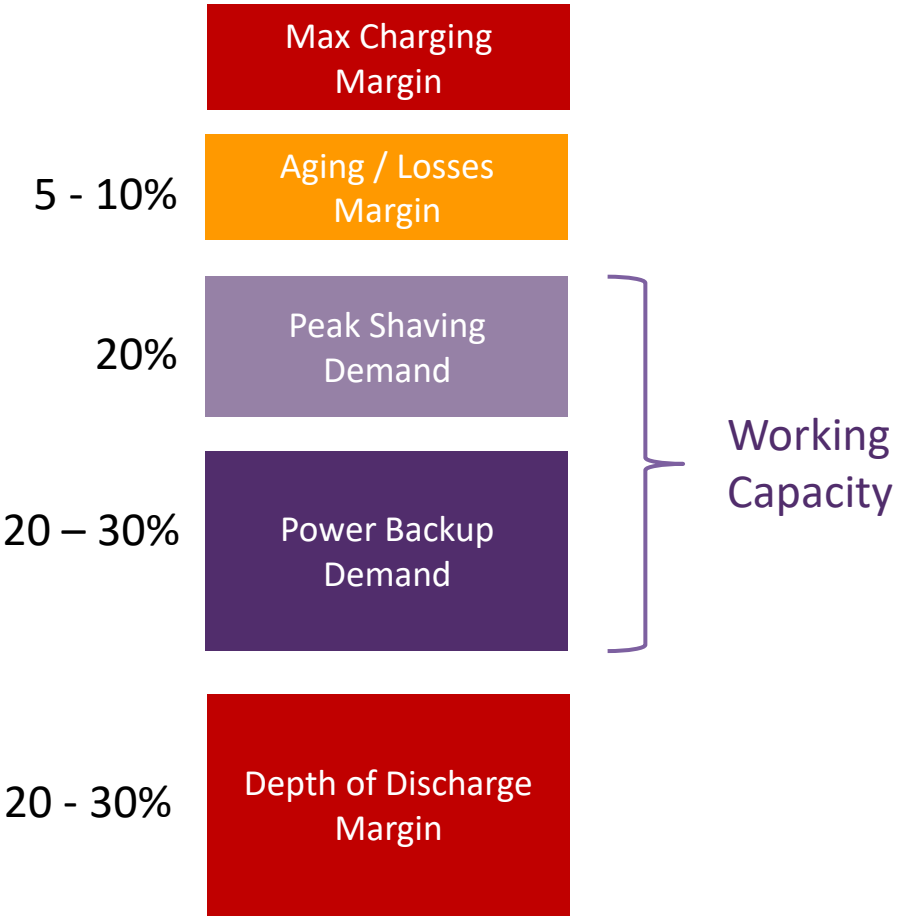
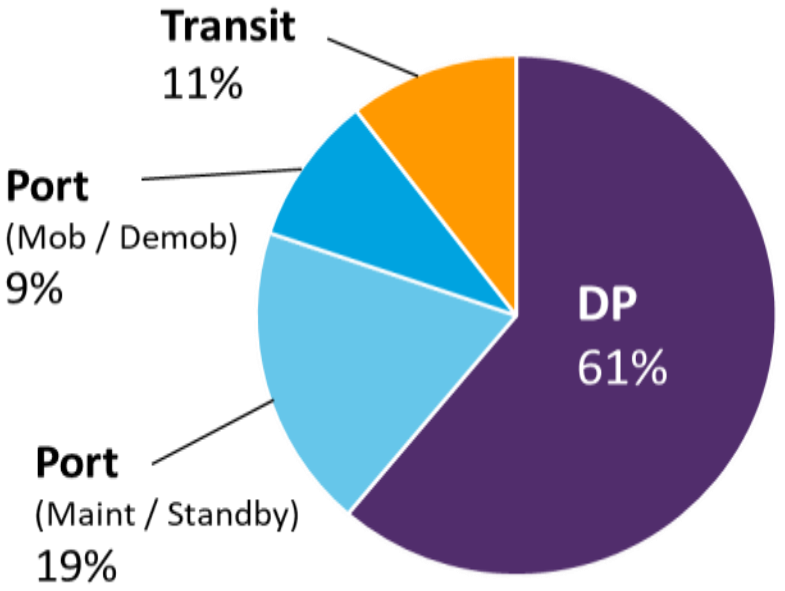
Typical Battery Design Margins:

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

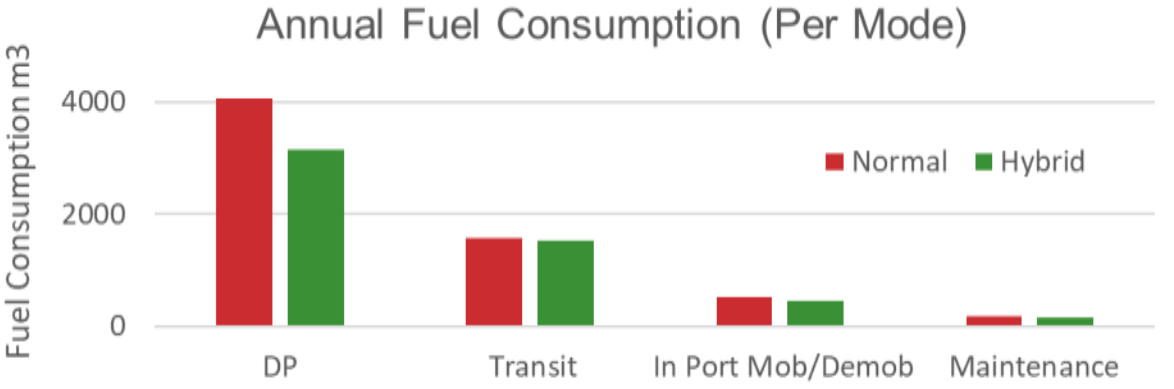


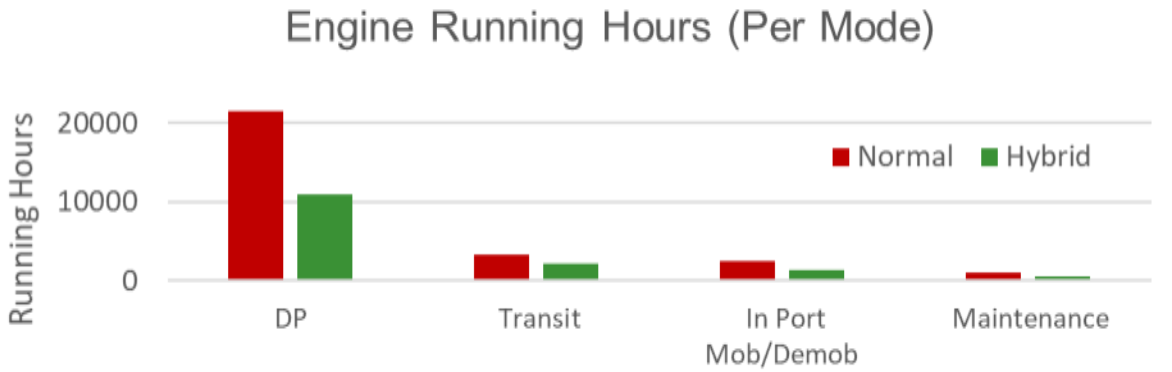
Estimated Benefits

- **Operational Profile 2017-2020:**



- *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*

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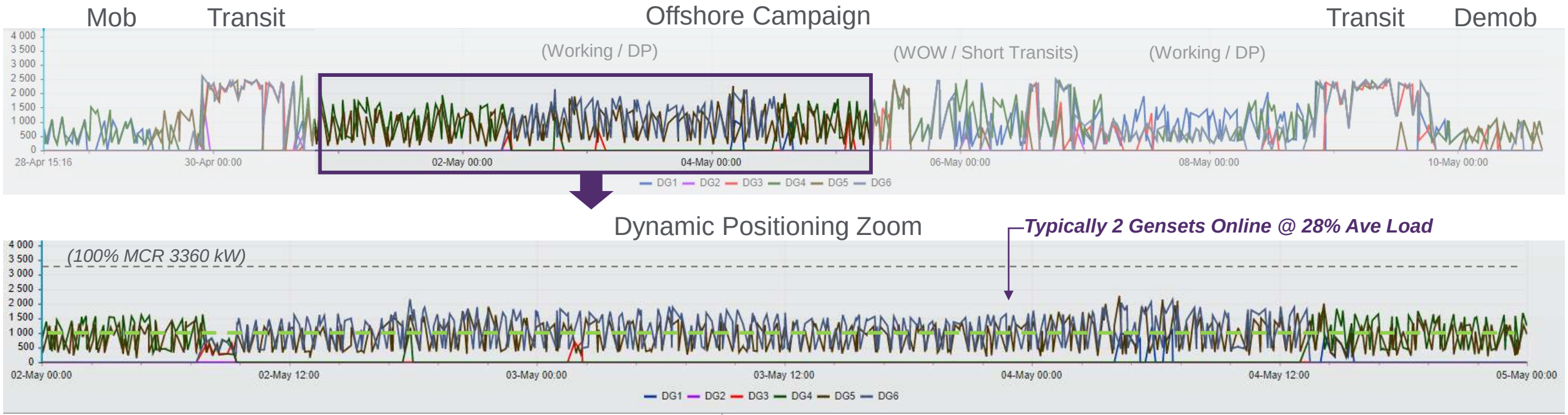
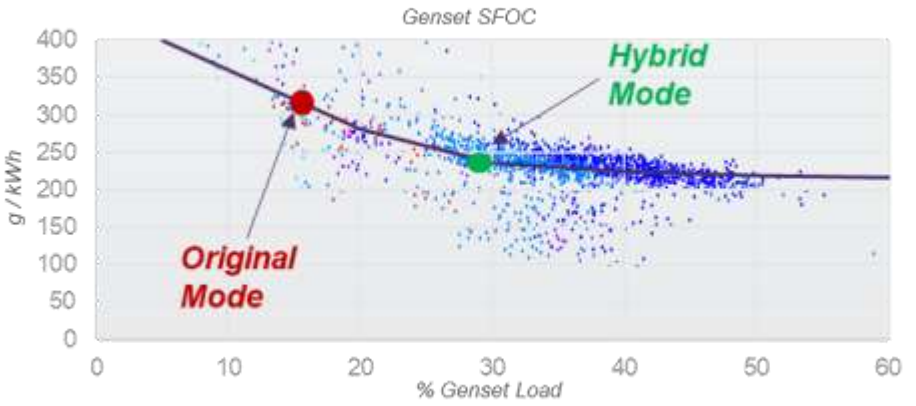
Actual Savings

Kognifai Remote Monitoring

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



	Hybrid	Original
Gensets Online	2	4
Ave Genset Load	28% (960kW)	14% (480kW)
Ave Fuel Consumption	15 m^3 / day	18-19 m^3 / day



Estimated Savings of ~25% in DP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