



CMAL

Caledonian Maritime Assets Ltd

Hybrid Ferries

An Opportunity for Scotland

Tuesday 06 December 2011
Guy Platten



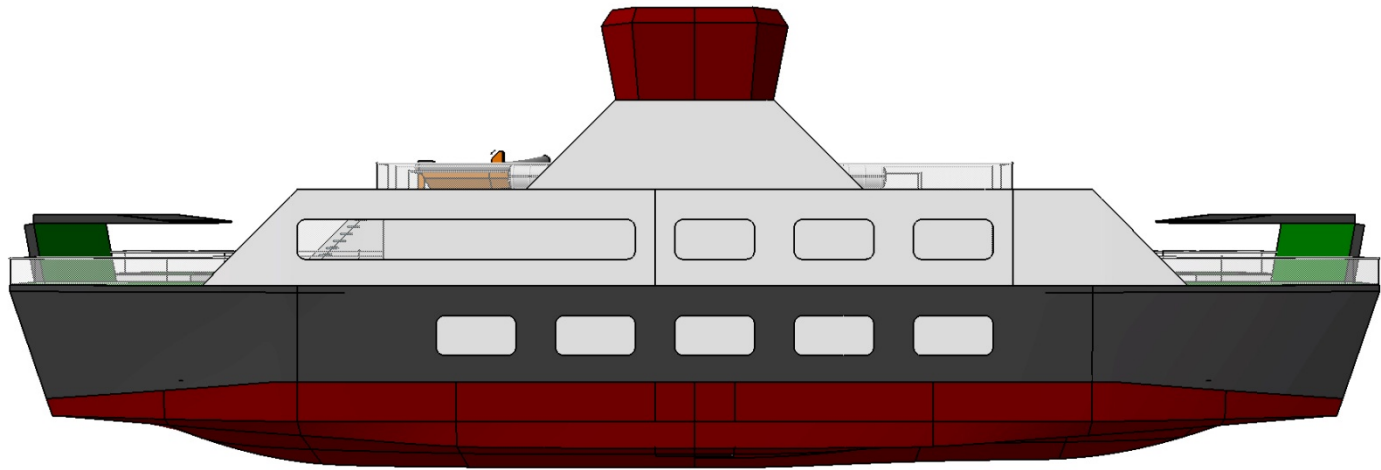


What is CMAL about?

- Asset Management (30 ships, 24 ports, brand, pensions)
- Fully operational for nearly 4 years now
- Small highly skilled team – ‘lean but mean’
- Infrastructure focus NOT operations
- Long term planning and sourcing funds
- Continuity and development of the asset base



Hybrid Passenger/Car Ferry





Media Coverage

DailyRecord

Jobs boost as world's first 'hybrid ferries' to be built by Ferguson Shipbuilders in Port Glasgow

[Nov 3 2011](#) By Paul Ward



Shipbuilder wins hybrid ferry job

Lloyd's List

Ferguson wins first hybrid ferry contract



The Herald

CIVIL shipbuilding is returning to the Clyde, creating around 100 jobs, after a £22 million deal to build the world's first hybrid-powered ferries was clinched.



Innovative hybrid ferry for Scotland

World Service Radio



Shipbuilder and Partners



Ferguson
Shipbuilders

Tec-Source
Electrical Specialists



Electric Propulsion
System and Lithium Ion
Battery Supplier



SeaTec
Ship Design Specialists





Shipbuilding Programme 1st Vessel





Shipbuilding Programme 2nd Vessel





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Scottish Government Climate Change Delivery Plan



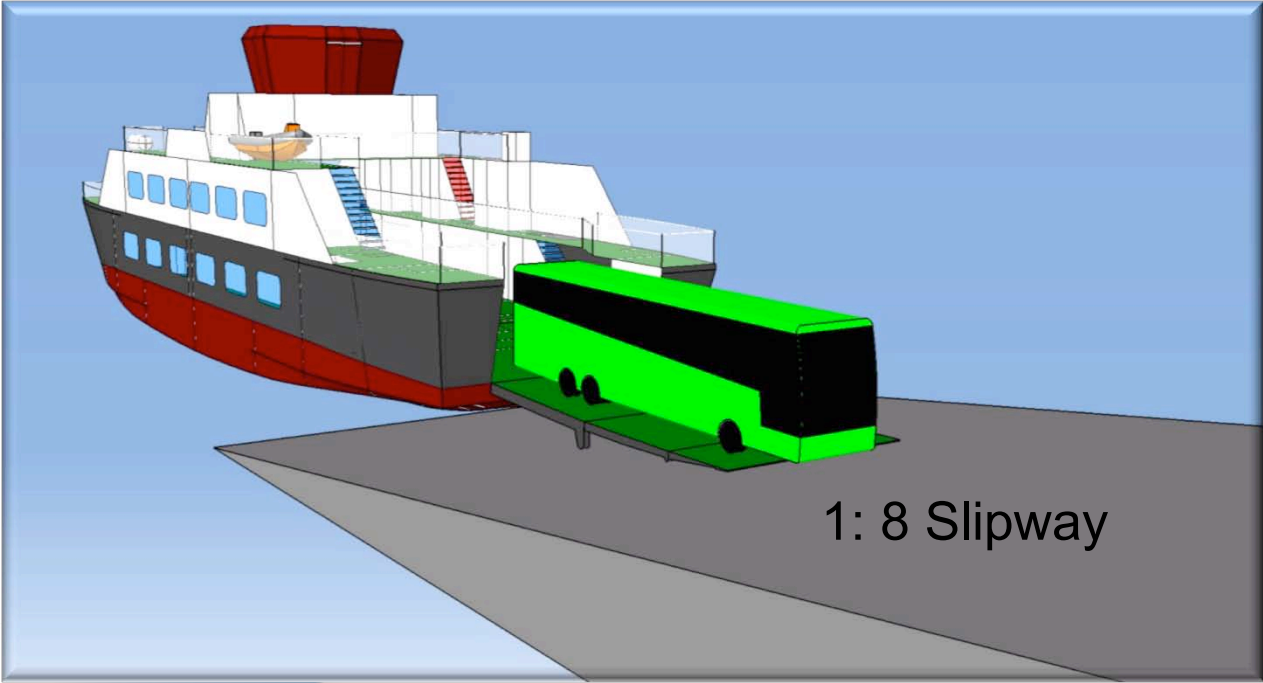
CLIMATE CHANGE DELIVERY PLAN

Chapter 5: Transport Sector

Measures in the transport sector which will contribute to the delivery of the 34% Scottish target in 2020 include:

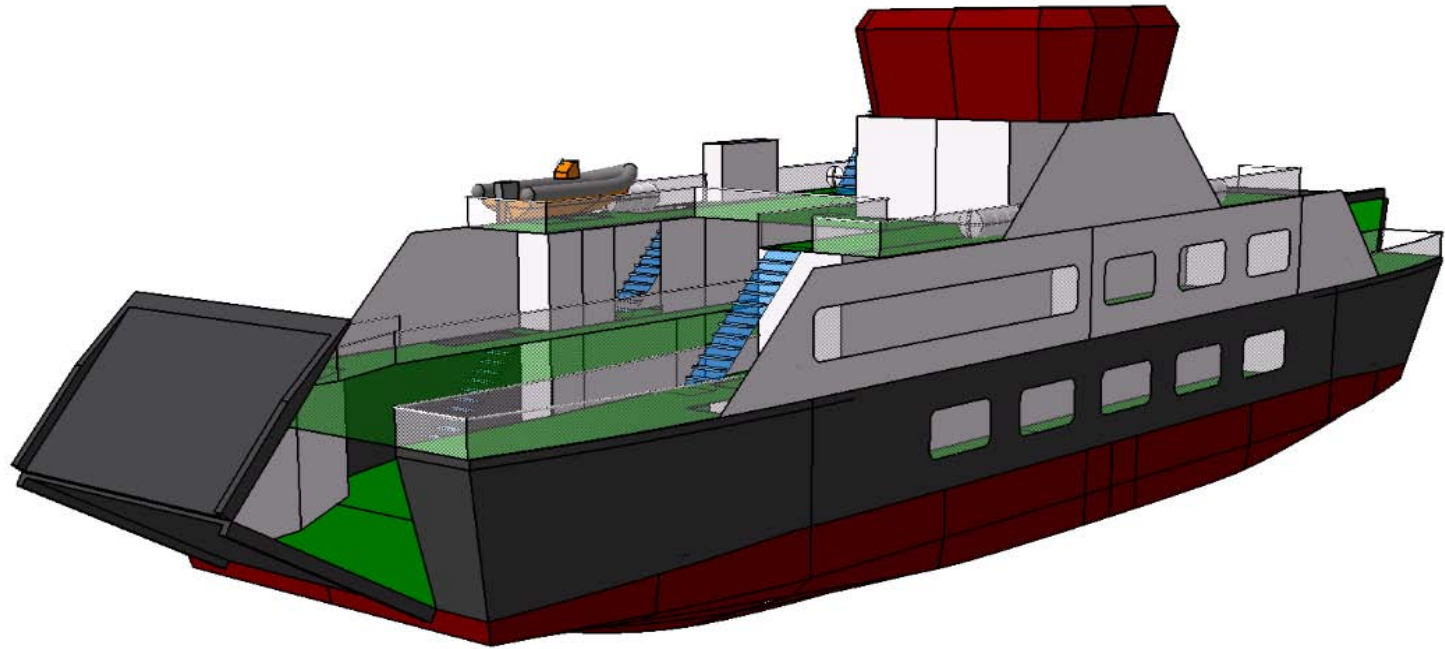
- Improved energy efficiency of new ships
- Public sector investment in new vessels for subsidised lifeline ferry services
- Supporting the development of emissions reduction targets in shipping operations
- By 2020, a 5-10% emissions reduction through technology measures and another 10% reduction through demand and fleet management

Hybrid Passenger/Car Ferry





Hybrid Passenger/Car Ferry





Hybrid Passenger/Car Ferry

Main Dimensions

Length Overall	43.5m
Length between PP	39.99m
Breadth (moulded)	12.2m
Draught	1.73m

Capacities

Deadweight	135 tonnes
Cars	23
HGVs	2
Passengers	150
Crew	3 to 4
Speed	9 kts

Model Tests





Model Tests

**Service Speed 9.0 kts
Required power and Propeller Revolutions at
Design Draught:**

Trial Conditions, BF2

Draught (m)	PD (kW)	N (rpm)
1.73m	267.5	87.2



Propulsion

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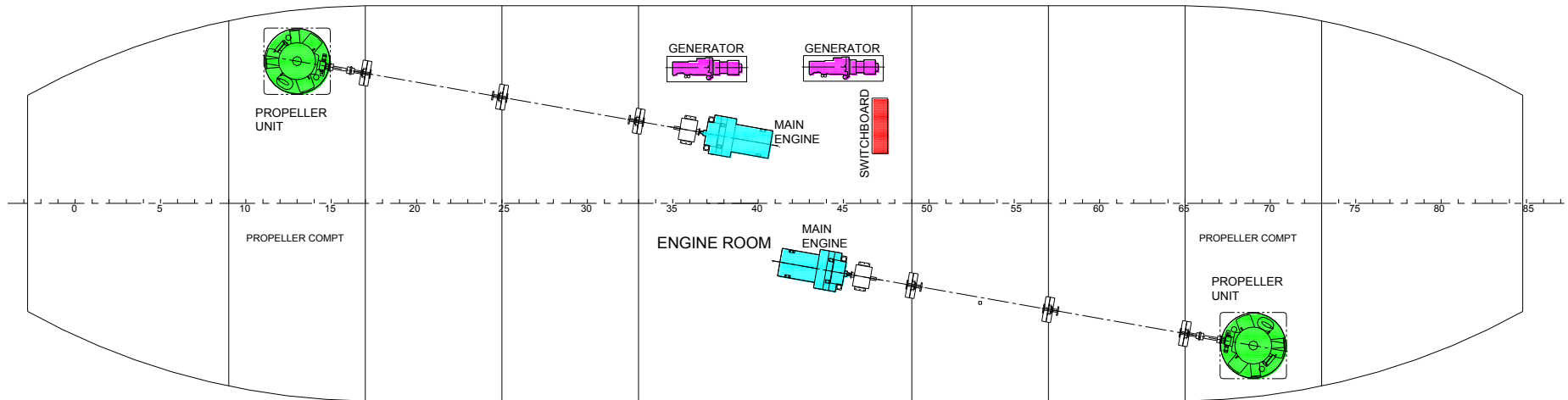


Diesel Mechanical

Diesel Electric

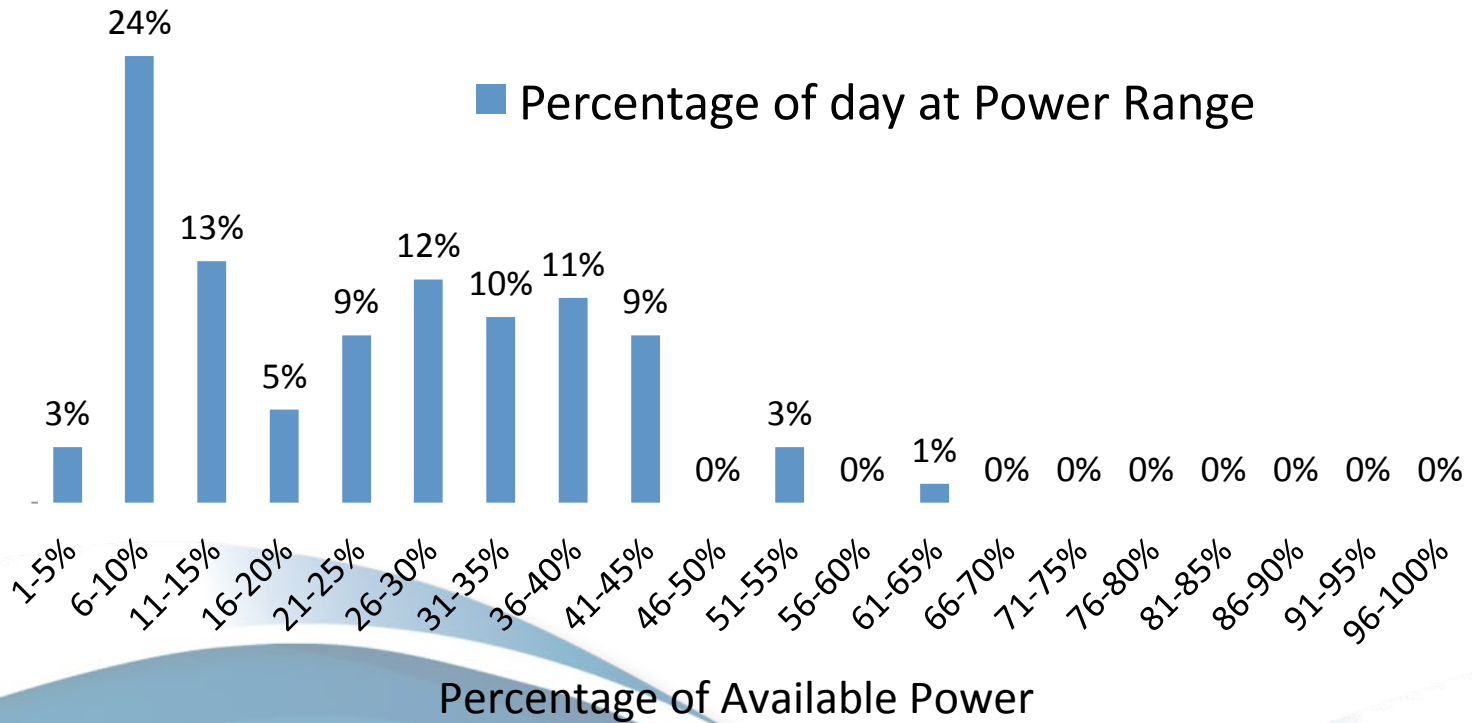
Hybrid

Diesel Mechanical



Diesel Mechanical

Sconser - Raasay Route Daily Average Duty Cycle

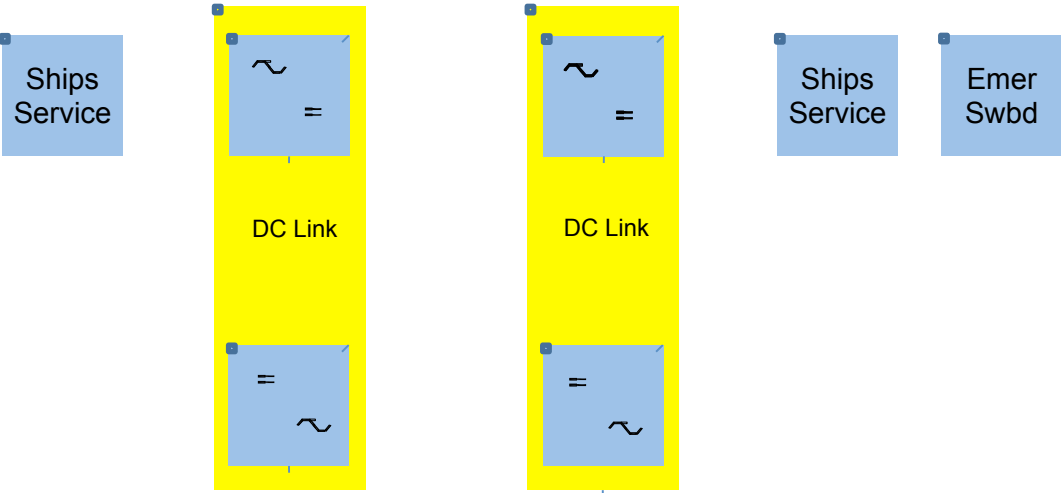




Diesel Electric



3 x 415kVA Generators
400V, 50Hz, 3ph
Cos Ø = 0.9



375 kW
0 – 615 RPM



375 kW
0 – 615 RPM



375 kW



375 kW



Fuel Calculations

Diesel Mechanical 2 x 450kW Engines					
	Max Propulsion Power	9 knots	MAN	PORT	OVERNIGHT
DAILY HOURS		22.50%	0.025%	15%	57%
DAILY HOURS		6.0 h	0.6 h	3.7 h	13.7 h
SHAFT POWER	750 kW	267.5 kW	120 kW	72 kW	
MAIN ENGINE POWER (MCR)	450 kW	450 kW	450 kW	450 kW	
NUMBER CONNECTED	2	2	2	2	
TOTAL INSTALLED ME POWER (MCR)	900 kW	900 kW	900 kW	900 kW	
TOTAL ME POWER DEMAND	840kW	291 kW	130 kW	78 kW	
MAIN ENGINE LOAD	86%	32 %	14 %	9 %	Total
FUEL CONSUMPTION (litres/day)		462 litres/day	23 litres/day	102 litres/day	
Estimated Total Fuel Consumption					587 litres/day

Fuel Calculations

Diesel Electric 3 x 360kW Engines					
	Max Propulsion Power	9 knots	MAN	PORT	OVERNIGHT
DAILY HOURS		22.50%	0.025%	15%	57%
DAILY HOURS		6.0 h	0.6 h	3.7 h	13.7 h
SHAFT POWER	750 kW	267.5 kW	120 kW	72 kW	
MAIN ENGINE POWER (MCR)	360 kW	360 kW	360 kW	360 kW	
NUMBER CONNECTED	3	1	1	1	
TOTAL INSTALLED ME POWER (MCR)	1080 kW	360 kW	360 kW	360 kW	
TOTAL ME POWER DEMAND	848 kW	322 kW	144 kW	87 kW	
MAIN ENGINE LOAD	79%	89 %	40 %	24 %	Total
FUEL CONSUMPTION (litres/day)		434 litres/day	23litres/day	85 litres/day	
				Estimated Total Daily Fuel Consumption	
				542 litres/day	



DM vs DE

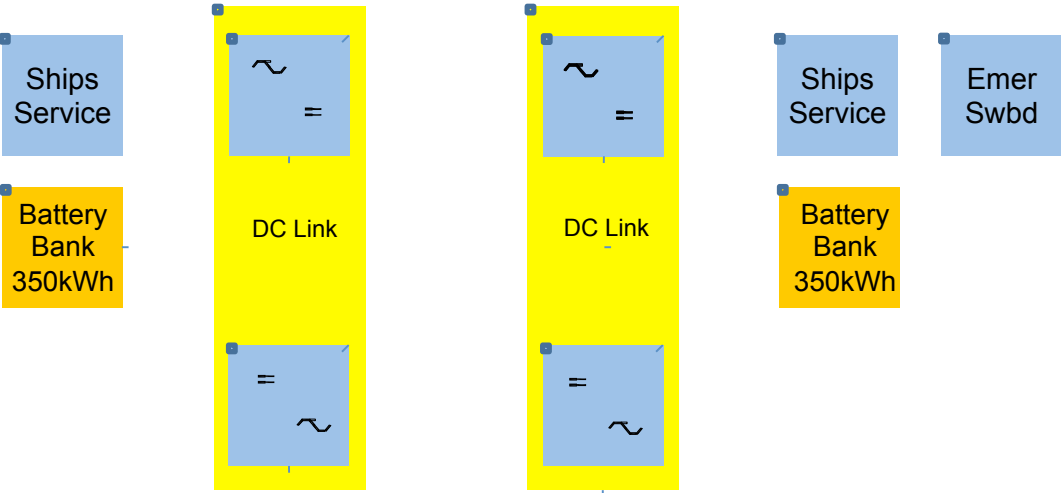
	Diesel Mechanical	Diesel Electric
Daily Fuel Consumption	587 litres/day	542 litres/day
Engine load at 9knots	32%	89%
Engine load during manoeuvring	14%	40%
Engine load at port	9%	24%



Serial Hybrid System



4 x 253kVA Generators
400V, 50Hz, 3ph
Cos Ø = 0.9



375 kW
0 – 615 RPM



375 kW
0 – 615 RPM



375 kW



375 kW

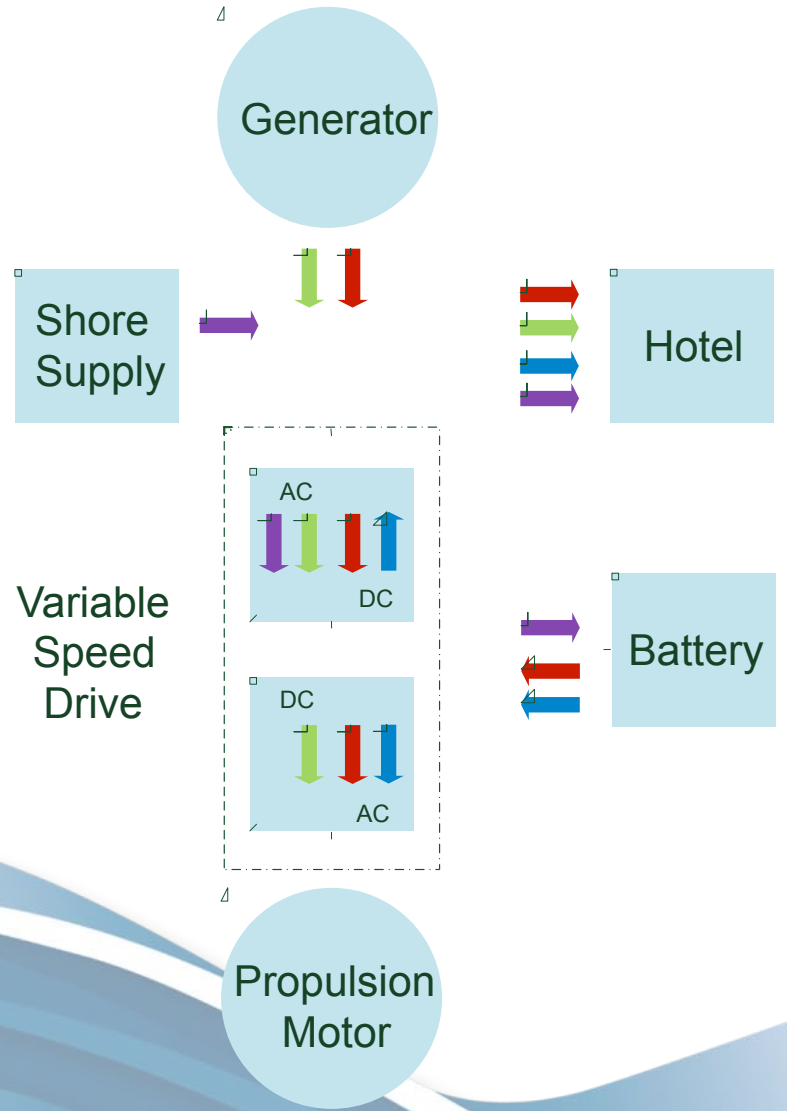


375 kW

Modes of Operation

- Mode 1 - Generator
- Mode 2 - Generator + Battery
- Mode 3 - Battery
- Mode 4 - Battery charging

Rating of Shore Power:
400V 3ph 50Hz, 125A





Reasons for Considering Hybrid Propulsion

Greater redundancy

Reduce fuel consumption

Reduced impact of CO2 emissions and other pollutants

Uncertainty of future fuel costs

Insurance against increasing environmental regulation

Noise reduction

Possibility to operate in zero emission mode when vessel is at port

Lower maintenance



Batteries

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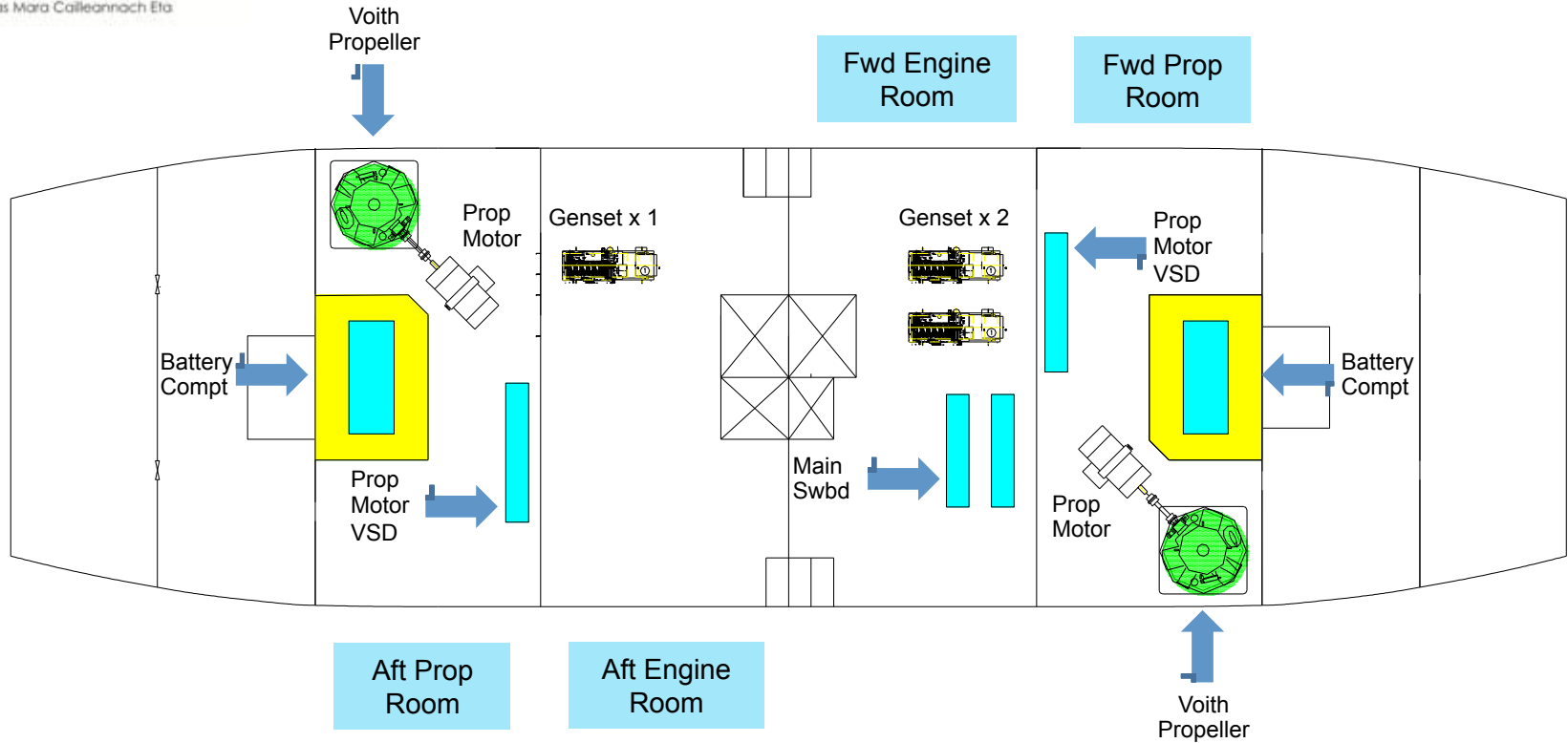




Lead Acid – Lithium Ion Comparison

	Lead Acid	Lithium Ion
Depth of Discharge	50%	80%
Cycle life at 50% Depth of Discharge	1000	8000 >3000 @ 80% DoD
Energy Density	20 Wh/kg	100 Wh/kg
Charge Efficiency	60%	95-99%
Maintenance	Maintenance required	Maintenance Free

Hybrid Machinery Arrangement





Opportunities for Scotland

- World's first seagoing Hybrid ROPAX
- Establishment of Scotland once again as a centre of maritime innovation – renewables and shipbuilding
- Employment
- Supply chain
- Link to island renewables and spin off opportunities
- Regeneration of island communities
- Opportunity to be ahead of the game with worldwide export potential
- Significant media interest – How can we capitalise on this?



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Thank you for your attention

