

# The Issues Facing CMAL

- old ferries, some over 40 years
- ageing infrastructure
- economic challenges

Owns 30 ferries – average age 22yrs

Port Ellen - Islay

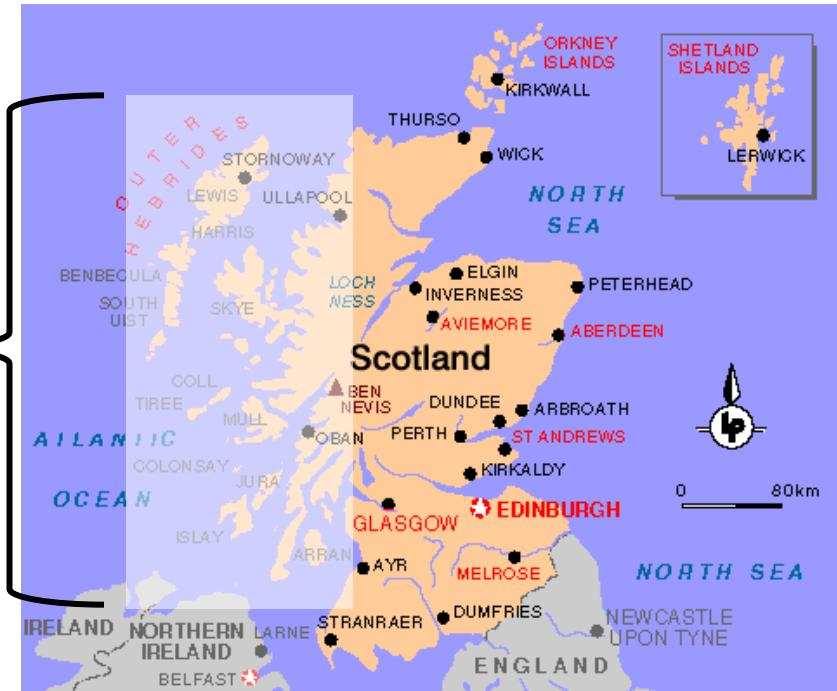
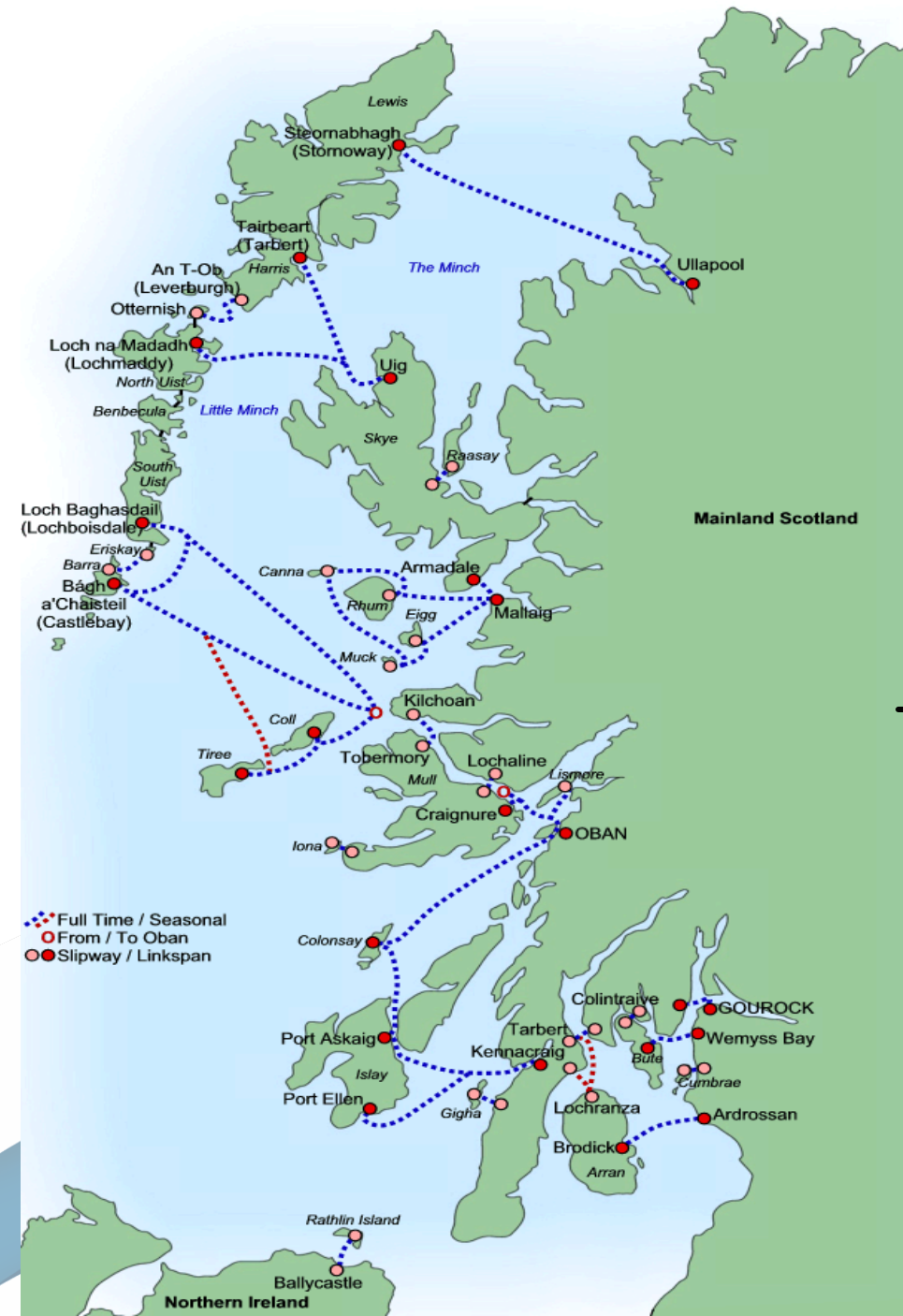


Owns or operates 24 harbours

MV Jupiter built in 1973



# Where CMAL operates - Routes and Ports



## Reasons for Considering Hybrid Propulsion

Greater redundancy

Reduce fuel consumption

Reduced impact of CO<sub>2</sub> 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

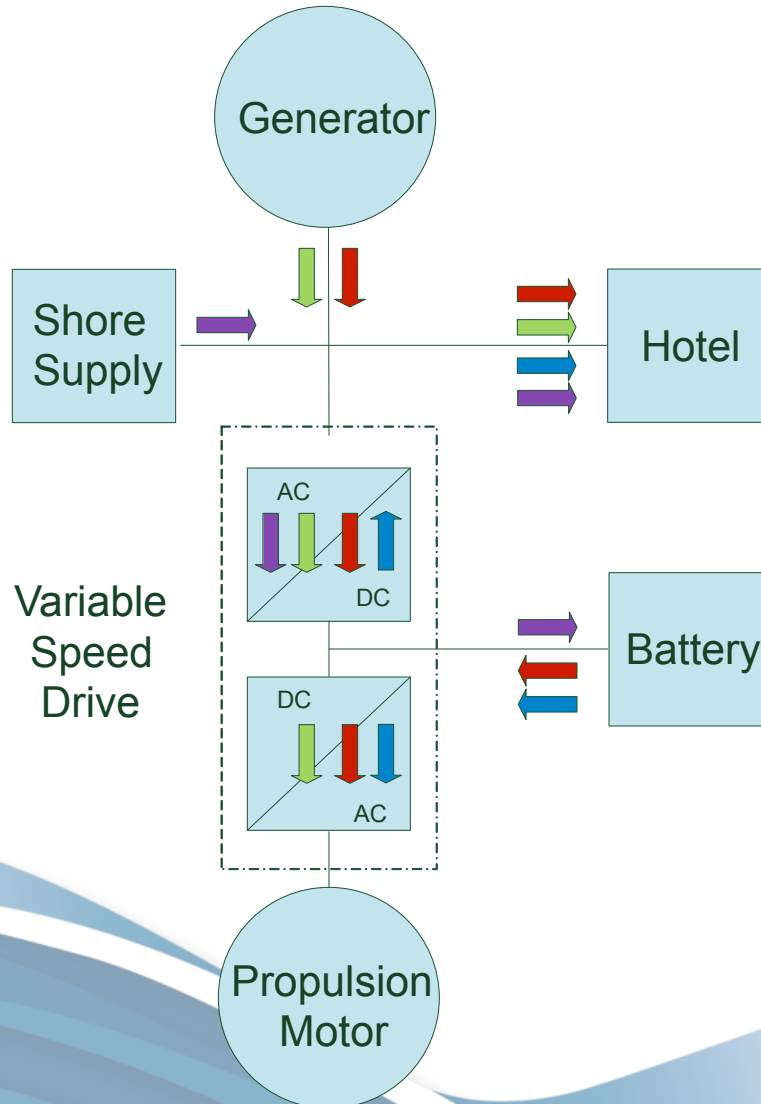
Lower maintenance

# Lead Acid – Lithium Comparison

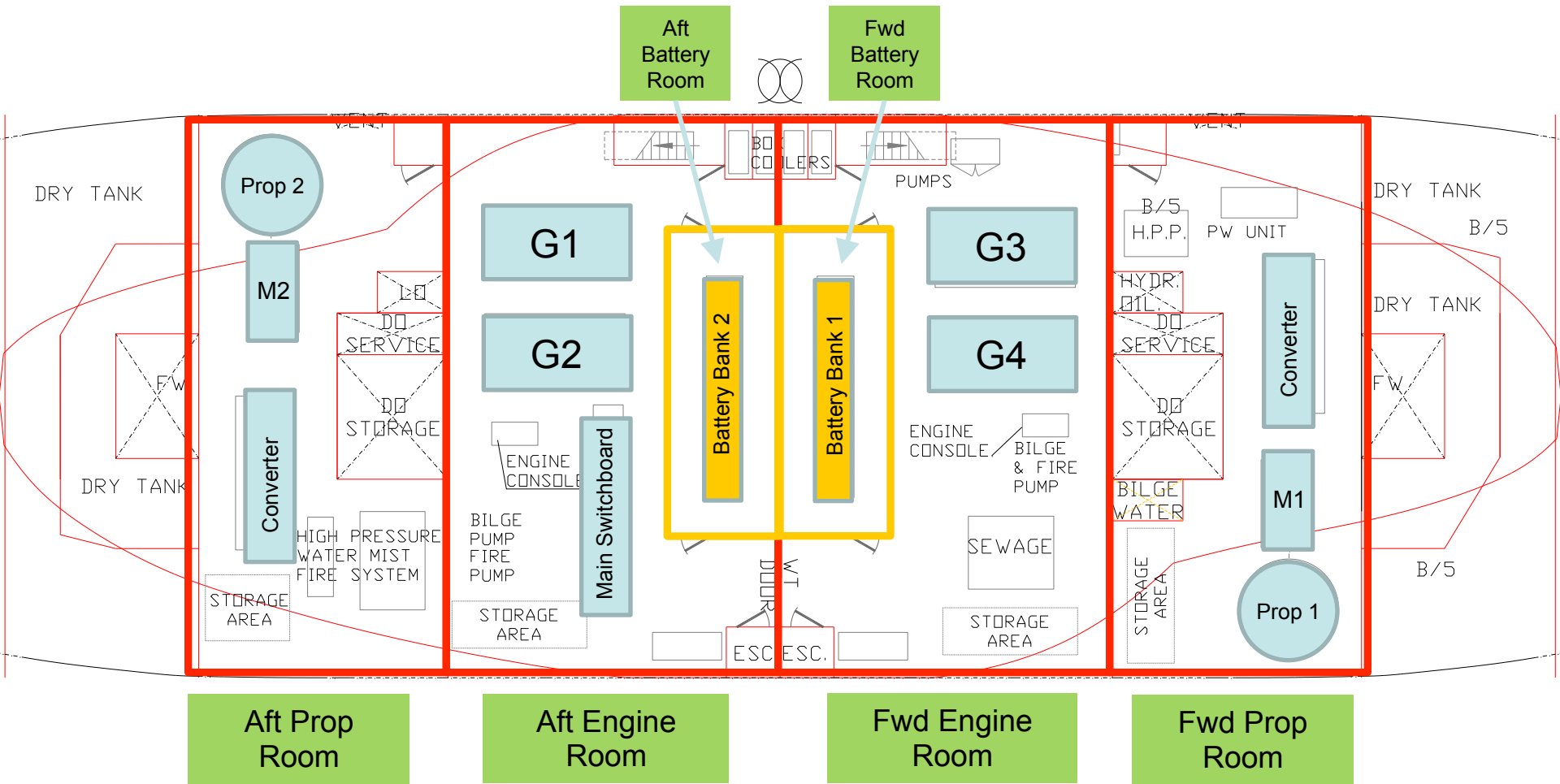
	Lead Acid	Lithium Ion
Depth of Discharge	50%	80%
Cycle life at 50% Depth of Discharge	1000	8000 >3000 @ 80% DoD
Energy Density	20 Wh/kg	100 Wh/kg
Charge Efficiency	60%	95-99%
Maintenance	Maintenance required	Maintenance Free

# Modes of Operation

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



# Machinery Arrangement



## The Future - Hybrid Ferries

### Reasons for Hybrid Propulsion System

- Reducing Emissions >20%
- Possibly zero emissions in harbour as vessel will be powered by batteries or shore supply while in harbour mode
- Energy Savings
- Fuel Savings, on existing vessels there are periods of low load running, which can increase SFOC by 5-10%
- Reduced Operating Costs
- Reduced noise when operating on batteries
- Flexible and efficient operation, excellent redundancy
- Less Installed Power by optimising machinery selection
- The batteries onboard the vessel could be charged overnight from a shore supply, could be a wind turbine or from a source of renewable power (Hydro or Wind Farm).

