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# *ALASKA LOW EMISSION / ELECTRIC FERRY RESEARCH ANALYSIS*

*Cultivating a Systems Approach to Sustainable Transportation by  
Implementing Climate Responsive Ferry Vessel Options*

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# Purpose

- Evaluate current technology for:
  - Reducing fleet emissions
  - Utilize renewable electricity
  - Improve reliability
  - Improve fleet flexibility
  - Increase service capacity
- Apply findings to define a pilot project



*Formerly McDowell Group*



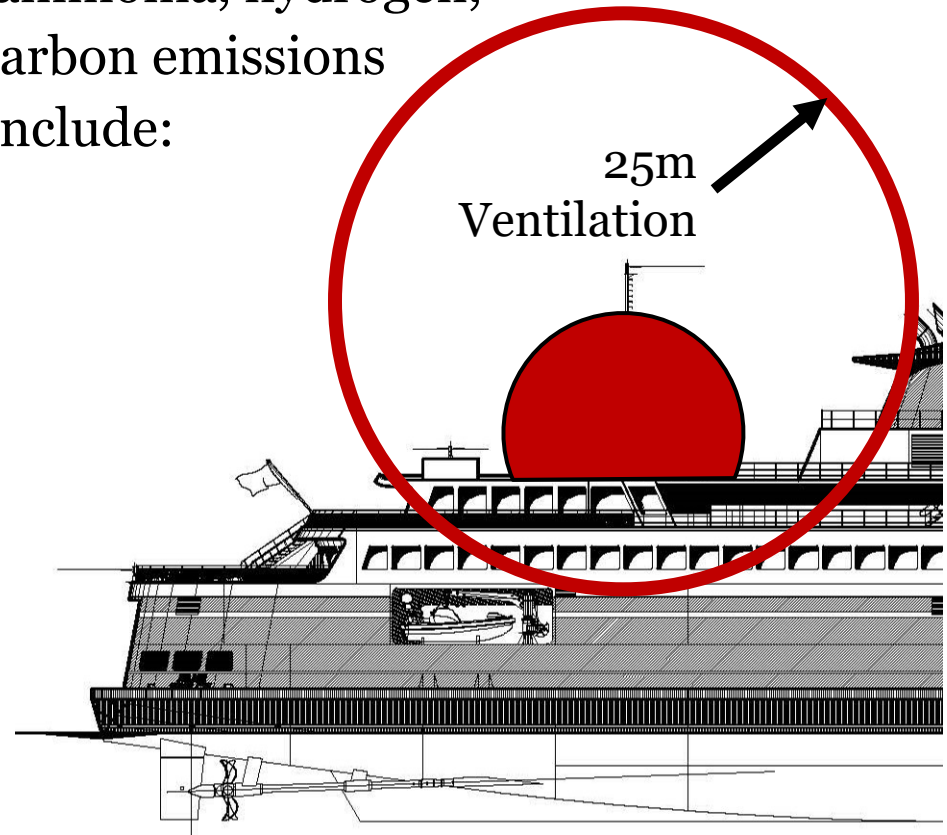
# State of Current Technology

- Arrangements
- Alternative fuels
- All-electric propulsion

	AURORA	COLUMBIA	KENNICOTT	LECONTE	LITUYA	MATANUSKA	TAZLINA	TUSTUMENA	HUBBARD
Build Date	1977	1974	1998	1974	2004	1963	2019	1964	2019
Length (ft)	235	418	382	235	181	408	280	296	280
Beam (ft)	57	85	85	57	50	74	67	59	67
Dispalcement (LT)	2132	7684	7504	2132	647	5569	3016	3081	3016
Gross Tonnage (ITC)	3124	13009	12635	3124	758	9214	5304	4529	5304
Gross Tonnage (Domestic)	1280	3946	9978	1328	97	3029	3217	2174	3217
Installed Horsepower	4300	10800	13200	4300	2000	7200	6000	5100	6000
Service Speed (kt)	14.5	17.3	16.8	14.5	11.5	16.5	16.5	13.3	16.5
Fuel Use (gal/hr)	190	397	354	188	55	234	250	151	250
Normal Crew Count	24	63	55	24	5	48	14	38	14
Passenger Capacity	250	499	450	225	125	450	290	160	290
Vehicle Capacity (lane ft)	660	2660	1560	660	300	1675	1060	680	1060

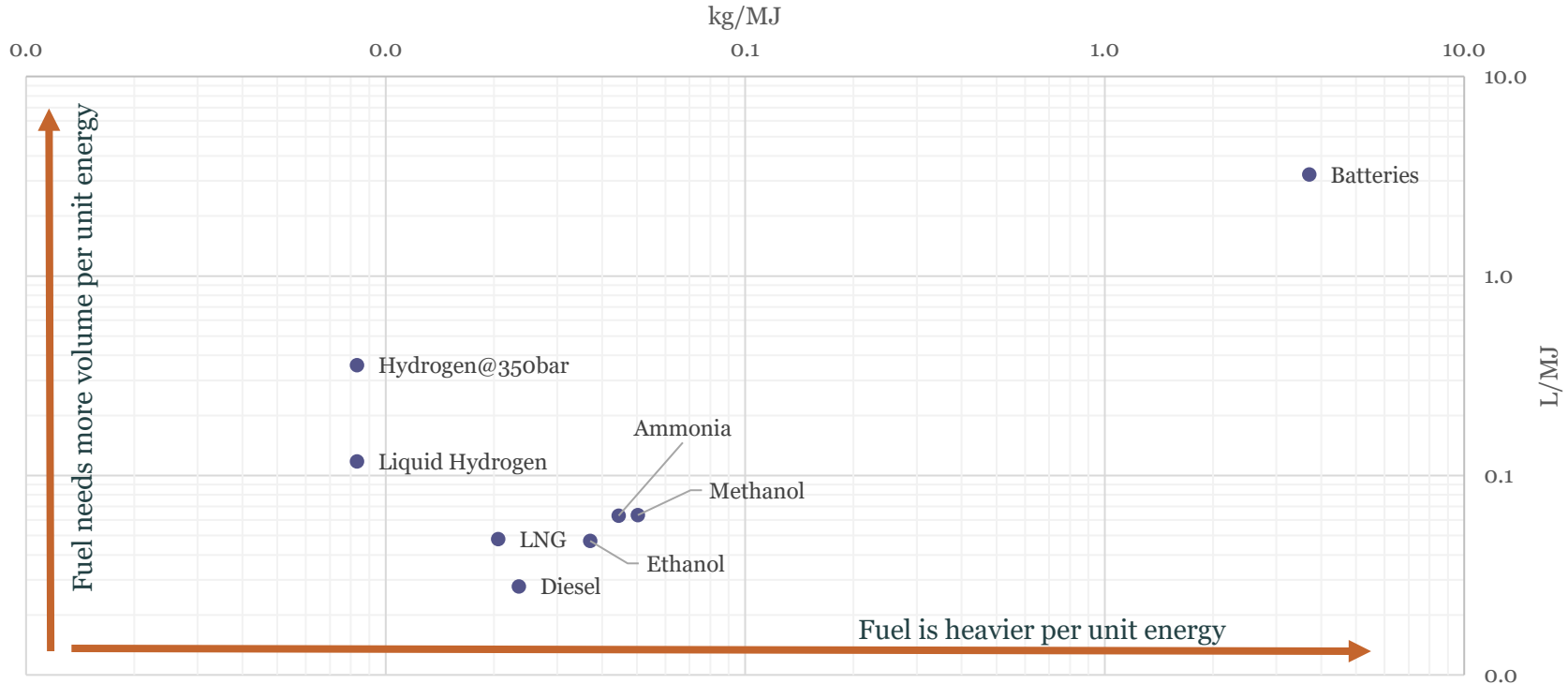
# Alternative fuels

- Biodiesel, LNG, methanol, ammonia, hydrogen,
- Essential step to lowering carbon emissions
- Challenges (not biodiesel) include:
  - Availability
  - Fuel price
  - Hazardous zones
  - Low flashpoint
  - Crew training
  - Automation
  - Increased parasitic loads
  - More weight and volume



# Alternative fuels

Volume and mass per unit energy



# Example Hybrid/All-Electric Vessels

- Domestic Vessels:

- Casco Bay
- New Governors Island Ferry
- Cameron Parish Ferry
- TxDOT Galveston Ferry



- International Vessels (year entered service):

- AMPERE (2015)
- COLOR HYBRID (2019)
- ELEKTRA (2017)
- BASTØ ELECTRIC (2021)



# Charging Systems



# Pilot Routes



- Short route <math>< 16\text{nm}</math> (suitable for batteries)
- Availability of sustainable electricity





# Pilot Project Vessel Particulars

- Sized for current and future expected passenger and car demand:
  - Length ~198 ft
  - Passenger capacity >150
  - Car capacity >20
  - Propulsion Arrangement Hybrid
  - Installed propulsive power 3000 hp
  - Battery capacity >4000 kWh
  - Gross registered tonnage <100 tons
  - Cruise speed 10-14 kt
  - Car deck enclosed
  - Cost ~\$50 million ea.



# System Sizing

Route	Distance nm	Charging	"95% MCR" Operation (Cruise Speed = 13.2kt)				Slow Operation (Cruise Speed = 9.7kt)		
			Crossing Energy kWh	Battery Size kWh	Crossing Time min	CO2 saved MT	Crossing Energy kWh	Battery Size kWh	Crossing Time min
Skagway - Haines	12.6	One Port	4262	5730	62	3.0	3274	4402	80
		Both Ports	2131	2865			1637	2201	
Ketch. - Met.	7.0	One Port	2285	3073	36	1.7	1783	2398	46
		Both Ports	1143	1536			892	1199	
Homer - Seldovia	15.6	One Port	5321	7153	76	3.7	4073	5476	99
		Both Ports	2660	3577			2037	2738	

Representative Emissions from Conventional Diesel Mechanical Vessel (kg per round trip)

Route	NO <sub>x</sub>	CO	PM
Skagway - Haines	27	8	0.9
Ketch. - Met.	14	4	0.5
Homer - Seldovia	33	11	1.1

- Charging requires shoreside battery

# Conclusions

- Pilot project provides AMHS opportunity to test latest technology
- Small electric shuttle could:
  - improve reliability
  - expand service
  - reduce emissions

