



Woods Hole, Martha's Vineyard and Nantucket Steamship Authority

Posted June 2, 2022 4:25 PM

WOODS HOLE, MARTHA'S VINEYARD & NANTUCKET
STEAMSHIP AUTHORITY

PORT COUNCIL
Tuesday, June 7, 2022
9:00 AM

First Floor Meeting Room (Room #103), SSA Administrative Offices
228 Palmer Avenue, Falmouth, MA 02540

NOTE: Pursuant to Section 20 of Chapter 20 of the Acts of 2021, this meeting will be held virtually. The public may participate in the meeting, including Public Comment, by going to zoom.us and using meeting ID 851 3455 6877 . Participants can also use the same meeting ID and join telephonically by calling one of the following numbers: 669-900-6833, 346-248-7799, 929-436-2866, 253-215-8782, 301-715-8592, or 312-626-6799.

1. Minutes
 - a) Approval of the Minutes of the May 3, 2022, Meeting
2. Management Report
 - a) Updates on Current Projects including:
 1. Website Update/Redesign
 2. SQMS Update
 - b) Hybrid Propulsion Study Report
 - c) General Manager Review
3. Treasurer's Report
 - a) Business Summary for the Month of April 2022
4. Old/New Business
5. Public Comment

These agenda items are those that the Chairman reasonably anticipates will be discussed at the meeting. Not all items listed may in fact be discussed, and other items not listed because they are not anticipated by the Chairman to be discussed may also be brought up for discussion to the extent permitted by law. The Port Council's practice is to reserve time under New Business for topics that the Chairman does not anticipate will be discussed at the meeting. Other topics not listed but discussed by the Port Council during previous meetings might also be brought up for discussion by other Port Council Members under Old Business even though the Chairman does not anticipate a discussion about any such topics.

Our mission is to operate a safe, efficient, and reliable transportation system for the islands of Martha's Vineyard and Nantucket with a commitment to sustainability, accessibility, our port communities, and public engagement.

228 Palmer Avenue
Falmouth, MA 02540
(508) 548-5011

Agenda Item

2a)i)-Website Redesign

To Be Presented By:

Sean Driscoll

Agenda Item

2a)ii)-SQMS

To Be Presented By:

Angela
Sampson

STAFF SUMMARY

Date: May 25, 2022

File# GM-773



TO:		FOR:		FROM:
	General Manager		Vote	Dept.: General Manager
				Author: Robert B. Davis
X	Board Members	X	Information	Subject: Hybrid Propulsion Study

PURPOSE:

To present to the Members the Hybrid Propulsion Study conducted by Elliott Bay Design Group.

BACKGROUND:

In early summer 2021, the Steamship Authority engaged the services of Elliott Bay Design Group (EBDG) to conduct a feasibility study for alternative vessel propulsion as part of the Steamship Authority's vessel replacement program. EBDG has worked with a number of ferry operator on the feasibility of electric propulsion, including for new vessels that are under design or existing vessels due for repowering. Washington State Ferries and Casco Bay Lines are among the clients EBDG has worked with.

Since EBDG designed the Authority's most recent vessel, the M/V Woods Hole, the study was conducted using that vessel characteristics as the baseline for the study.

The scope of EBDG's objective under the project included:

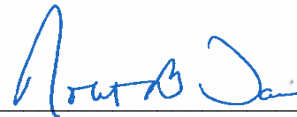
- Gather data on the daily energy profiles for both the Martha's Vineyard and Nantucket routes.
- Energy profiles to include hotel loads for both summer and winter service.
- Identifying propulsion loads for various weather conditions.
- Gather data on existing electric grid and utility rate structures.
- Establish evaluation criteria within three (3) defined categories (vessel emission reductions; operating costs; and capital costs).
- Examine five (5) different scenarios including the baseline:
 1. Geared diesel propulsion with diesel generators (current)
 2. Diesel-Electric plant with small battery bank to allow all-electric operation when in the berth (no shore charging)

3. Diesel-Electric plant with battery bank sized for brief increases in power demand should a generator fail (no shore charging)
 4. Diesel-Electric with large battery bank sized to handle 50% of operational time as all-electric
 5. All-Electric operation with rapid charging on both sides of route (only applies to Martha's Vineyard route)
- Identify, for each scenario, the size of battery bank and associated electrical generation and calculate the associated operating costs, fuel savings and emission reductions.
 - Estimate the capital costs for each scenario compared to baseline, including modifications to terminals and utility supply lines.

Elliott Bay Design Group has completed this phase of the study and is prepared to provide the Members with their findings.

RECOMMENDATION:

This study is being presented for informational purposes only and no vote is required.



Robert B. Davis
General Manager



NEW VEHICLE FERRY M/V WOODS HOLE EQUIVALENT

Hybrid Propulsion Study

Prepared for: Steamship Authority | Falmouth, MA

Ref: 21051-894-7

Rev. A

May 13, 2022

Steamship Authority

New Vehicle Ferry

5/13/22

PREPARED BY

ELLIOTT BAY DESIGN GROUP
5305 SHILSHOLE AVE. NW, STE. 100
SEATTLE, WA 98107

REVISIONS

REV	DESCRIPTION	DATE	APPROVED
-	Initial Issue	4/14/22	LGB 51201
A	Revised to align shore power electricity costs with KPFF memo.	5/13/22	LGB 51201

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Steamship Authority

New Vehicle Ferry

5/13/22

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1. PURPOSE

This study presents a comparison of alternative propulsion options for a New Vehicle Ferry. The vessel considered in this study is an equivalent of the M/V WOODS HOLE with alterations for alternative propulsion configurations. This equivalent vessel is 235 ft. x 64 ft. x 18.5 ft. passenger ferry intended for service on two routes operated by the Steamship Authority (SSA): Woods Hole to Martha's Vineyard and Hyannis to Nantucket.

2. PROCEDURE

2.1 OVERVIEW

SSA provided operational vessel data from the M/V WOODS HOLE from the past five years while operating on the two routes. This data was reviewed and sorted to construct propulsion and hotel load profiles for each route. Five different propulsion configurations were identified as options for this vessel and each configuration was evaluated in terms of three evaluation criteria: capital cost, operating cost, and emissions.

2.2 CANDIDATE PROPULSION SYSTEMS

Preliminary discussions between EBDG and SSA led to the selection of five different propulsion arrangements for evaluation over two different routes. See Appendix C for system arrangement sketches.

2.2.1 OPTION 1: DIESEL MECHANICAL

The diesel mechanical option is meant to represent an updated version of the M/V WOODS HOLE installation and act as the baseline for all the other options. The configuration is a standard diesel mechanical propulsion system with two independent propulsion trains each with a high-speed diesel engine driving a single controllable pitch propeller (CPP) via a reduction gear and conventional shaft line. Electrical ship service power is provided by three diesel generators.

For this option the following equipment was considered:

- Two MTU 16V4000 M65L EPA Tier IV propulsion engines, rated for 2560 kW
- Two Hundested CPP Systems, including marine gear boxes and propeller units
- Three John Deere 6135 AFM85 diesel generators, rated for 310 ekW

2.2.2 OPTION 2: BERTH BATTERY

The second configuration is a diesel hybrid propulsion system with electric propulsion motors, generators, and battery banks. Three high-speed diesel propulsion generators are provided to charge batteries, provide hotel power, or power electric propulsion motors. Two variable speed propulsion motors would then drive fixed pitch propellers. Electrical ship service power is provided by the battery bank and the propulsion generators. Note that the third propulsion generator is included in this option, and all other hybrid options, in order to provide operational redundancy similar to the M/V WOODS HOLE configuration with three ship service generators.

This configuration is sized such that the diesel generators provide for propulsion and hotel loads during the crossing while charging batteries. In berth at either end of the crossing all diesel generators are shut down and hotel loads are provided by the battery banks.

For this option the following equipment was considered:

- Three MTU 16V4000 M65L EPA Tier IV generators, rated for 2450 ekW
- Two fixed pitch propellers
- Two 1,000 kW electric propulsion motors
- A DC propulsion switchboard, AC distribution switchboard and all interfacing equipment
- 180 – 190 kWh batteries

2.2.3 OPTION 3: PEAK SHAVE

The third configuration is a diesel hybrid propulsion system similar to Option 2 with an increased battery capacity. This configuration is optimized to level load the generators throughout the route, removing any peak demands from the generators operational profile and increasing the overall efficiency of the generator. Batteries are charged and discharged to support the level loading of the generators. The generators operate while in the berth.

For this option the following equipment was considered:

- Three MTU 16V4000 M65L EPA Tier IV generators, rated for 2450 ekW
- Two fixed pitch propellers
- Two 1,000 kW electric propulsion motors
- A DC propulsion switchboard, AC distribution switchboard and all interfacing equipment
- 1500 – 1900 kWh Batteries

2.2.4 OPTION 4: 50% BATTERY (MANUEVERING AND BERTH BATTERY)

The fourth configuration is yet another diesel hybrid propulsion system with additional batteries beyond those provided in Option 2 and Option 3. In this configuration diesel generators provide for propulsion and hotel loads and charge batteries during the transit portion of the crossing. The batteries are then used to provide for propulsion and hotel loads when the vessel is maneuvering in and out of the terminals. Additionally, batteries are used for hotel loads while in the terminal. The diesel generators will not operate while in berth.

For this option the following equipment was considered:

- Three MTU 16V4000 M65L EPA Tier IV generators, rated for 2450 ekW
- Two fixed pitch propellers
- Two 1,000 kW electric propulsion motors
- A DC propulsion switchboard, AC distribution switchboard and all interfacing equipment
- 1800 – 2500 kWh Batteries

2.2.5 OPTION 5: ALL ELECTRIC

The fifth propulsion option is an all-electric arrangement sized to provide all propulsion and hotel loads for the entire crossing. Batteries are sized assuming they are charged to their full capacity after each one-way crossing. The batteries would be charged at both the Woods Hole and Martha's Vineyard docks. The Hyannis to Nantucket route is not being considered for all-electric propulsion at this time. A high-speed diesel generator is provided to charge batteries or drive electric motors should shore power be unavailable.

For this option the following equipment was considered:

- One MTU 16V4000 M65L EPA Tier IV generators, rated for 2450 ekW
- Two fixed pitch propellers
- Two 1,000 kW electric propulsion motors
- One DC propulsion switchboard, one AC distribution switchboard, and interfacing equipment
- One shore power terminal and interfacing equipment
- 5380 kWh Batteries

2.3 EVALUATION CRITERIA

2.3.1 CAPITAL COST

Capital costs consist of the purchase price of all major equipment for each propulsion option. Budgetary estimates from vendors along with cost data from prior studies were used to develop the capital cost estimates, with all costs presented in 2022 dollars.

Installation, shipyard, and engineering labor costs are not included. Installation materials such as structural steel, cables, system piping, and shafting are not included. These costs are expected to be similar across all options. The diesel hybrid options do require additional systems as compared to diesel mechanical, but in the scope of a new vessel construction these additional systems are not large enough to make a significant cost difference. The relevant costs for the hybrid systems are accounted for in the overall cost of the propulsion package.

2.3.2 OPERATING COST

The operating costs consist of a 10-year life cycle maintenance and energy costs.

The maintenance cost includes the parts, consumables and labor for the recommended maintenance practices provided by the major equipment vendors. Maintenance activities were determined based upon engine and gear operating hours. For the hybrid options, battery replacement is included and based upon a 10-year battery life. Minimal maintenance costs for standby equipment is also included; annual time to verify the functionality of equipment and maintenance materials is estimated.

The energy cost is based upon an estimated annual fuel consumption and annual shoreside electricity consumption. Energy consumption is based upon the route profiles described in Section 3.1. Shoreside electricity consumption is considered for the all-electric Option 5 with rapid charging connections available at the Martha's Vineyard terminal and the Woods Hole terminal.

2.3.3 EMISSIONS

Once annual fuel consumption and operating hours for each arrangement is calculated the estimated annual Carbon Dioxide (CO₂), Nitrous Oxide (NO_x), Carbon Monoxide (CO), and Particulate Matter (PM) emissions can be calculated. This study only considered the vessel emissions and does not account for offsite emissions such as those associated with electrical power generation. Emission rates at various engine/generator loadings were used along with the calculated vessel power demand to generate a total amount of emissions per cycle.

3. GIVEN AND ASSUMED PARAMETERS

3.1 VESSEL ROUTE AND POWER REQUIREMENTS

Two routes were studied to determine propulsion system configurations and sizing. Operational engine data from the Woods Hole to Martha's Vineyard and Hyannis to Nantucket routes was analyzed to determine powering requirements for each route. The M/V WOODS HOLE operated on three distinct routes for the time frame analyzed: Woods Hole to Martha's Vineyard, Hyannis to Nantucket, and Woods Hole to Oak Bluff. The Woods Hole to Oak Bluff route was omitted from the analysis, as it is similar in powering to the Martha's Vineyard route and was not within the scope of study.

Port and starboard main engine data was submitted by MTU as a percentage of the engine's Maximum Continuous Rating (MCR). Figure 1 is an example of the data provided; this figure shows a single engine load as a percent MCR over a single run on the Martha's Vineyard Route.

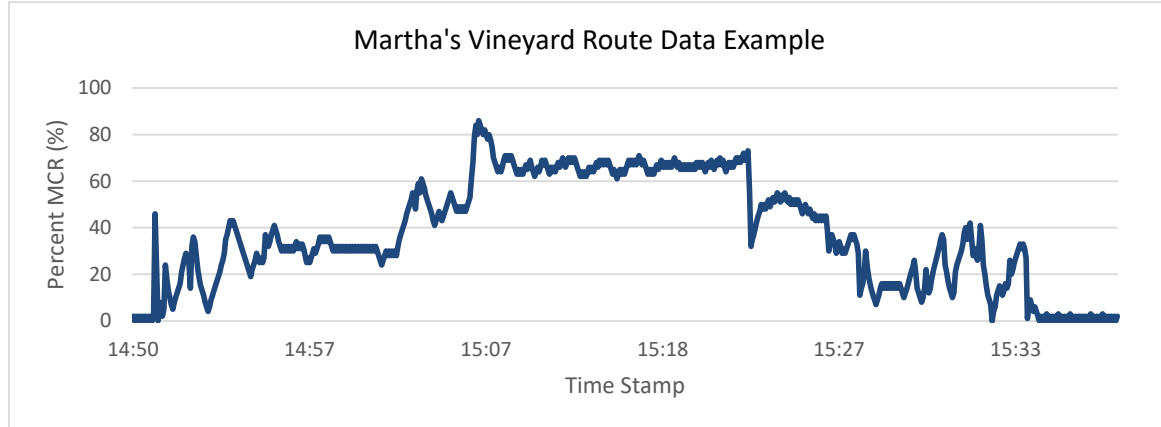


Figure 1: Example Propulsion Engine Data

The propulsion engine data was filtered to a representative day per month for each engine to account for differences in wind, wave, and loading conditions. SSA provided the approved vessel schedule as well as out of service dates for the vessel which was used to align the vessel activity with the data provided.

The values of the percentage load were averaged together as a piecewise function highlighting the different maneuvering and transiting conditions of the vessel during a typical voyage. The results of the data analysis were an average time and power spent at each operating condition for both the Woods Hole to Martha's Vineyard route and the Hyannis to Nantucket route.

3.1.1 WOODS HOLE TO MARTHA'S VINEYARD

The Woods Hole to Martha's Vineyard route has three distinct operating conditions: maneuvering out of the terminal, transit speed, and maneuvering into the new terminal. For annual calculations the vessel is assumed to operate on this route about 285 days per year with an average of 7 round trips per day. Figure 2 and Table 1 summarize the nominal Woods Hole to Martha's Vineyard route profile.

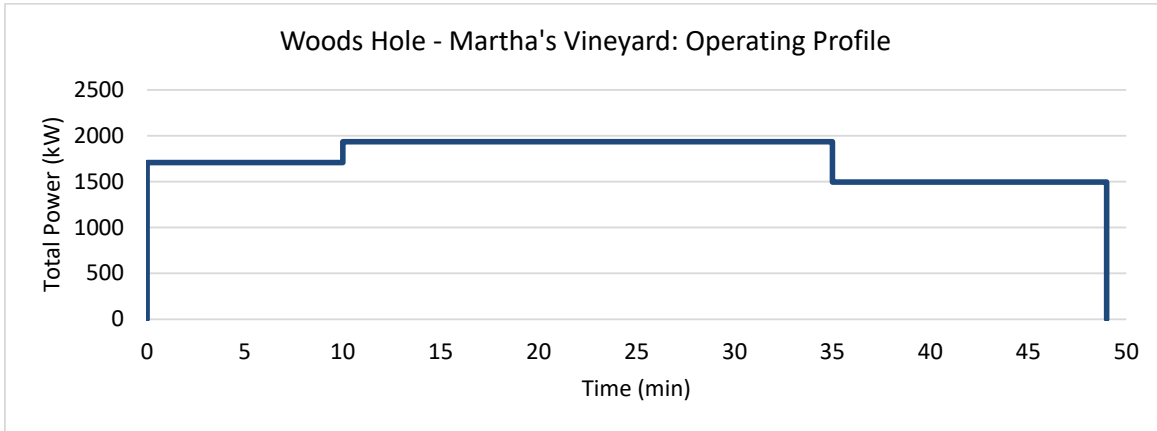


Figure 2: Woods Hole to Martha's Vineyard Profile

Table 1: Operational Profile - Woods Hole to Martha's Vineyard

OPERATING CONDITION	TIME (MIN)	COMBINED ENGINE POWER (KW)
Maneuvering 1	10	1707
Transit 1	25	1935
Maneuvering 2	13	1494

3.1.2 HYANNIS TO NANTUCKET

The Hyannis to Nantucket route has a secondary transit loading where additional power is required to maintain the transit speed. For annual calculations the vessel is assumed to operate on this route 200 days per year, 3 round trips per day. Figure 3 and Table 2 summarize the Hyannis to Nantucket nominal route profile.

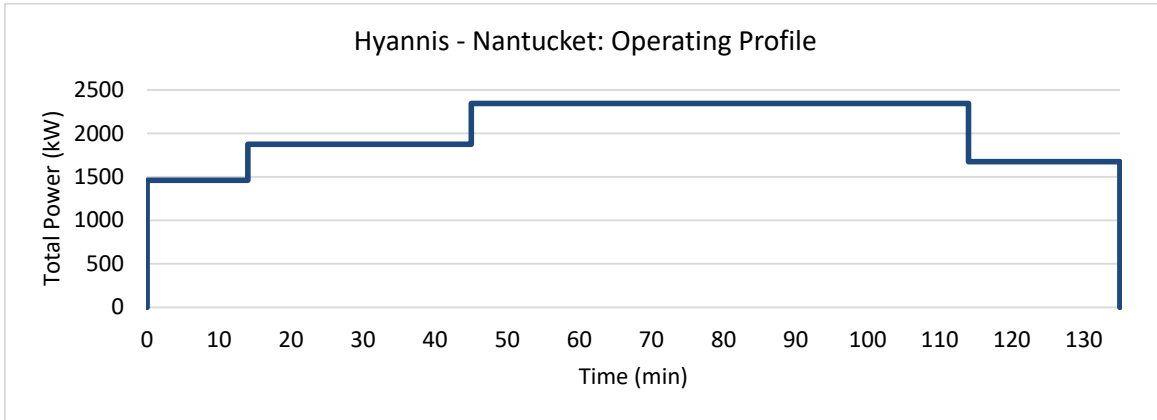


Figure 3: Hyannis to Nantucket Profile

Table 2: Operational Profile - Hyannis to Nantucket

OPERATING CONDITION	TIME (MIN)	COMBINED ENGINE POWER (KW)
Maneuvering 1	14	1460
Transit 1	31	1875
Transit 2	69	2344
Maneuvering 2	20	1674

3.2 SHIPS SERVICE ELECTRICAL AND HVAC REQUIREMENTS

Hotel loads of the existing vessel were analyzed in a similar fashion to the propulsion engine loads. After reviewing a collection of generator load data across a variety of dates for each route analyzed a conservative estimate was made.

For the purpose of this study, the assumed ships service electrical load is route dependent, with the Woods Hole to Martha's Vineyard route requiring 95 kW and the Hyannis to Nantucket route requiring 120 kW. These hotel loads account for lighting, ventilation, fluid pumping, and other normal operation loads.

All arrangements assume heat is supplied by a hot water boiler system and the propulsion arrangement will not affect the heat required by the vessel. Boiler fuel consumption is not included in the calculations.

3.3 FINANCIAL ASSUMPTIONS

For the capital and operating cost estimates, the following assumptions were used:

- Major equipment costs are based on quotes and costs derived from equipment vendors.
- Where current quotes were not obtained, equipment costs were estimated using a parametric approach, using that system's main design driver as the scaling factor.
- For the life cycle cost estimation, all costs were estimated as annual costs and inflation is accounted for using an annual 3% inflation rate.
- Electricity Rates were obtained from a study performed by KPFF, an engineering firm specializing in shoreside infrastructure. See Reference [1]. A single electric vessel was assumed to be charging directly from the grid.
- The consumables in Table 3 were assumed for the life cycle and fuel cost comparisons.

Table 3: Cost of Consumables

ITEM	COST	UNITS
Fuel (ULSD)	2.15	\$/gal
Lube Oil	8.00	\$/gal
Batteries	750	\$/kWh
Urea	3.23	\$/gal

Ultra-Low Sulfur Diesel (ULSD) price was sourced from the 2021 actual expenses for the M/V WOODS HOLE. While this may not be reflective of the current spike in fuel costs, it is reflective of the highest cost per gallon since 2016. The cost per kWh for batteries was confirmed with a battery vendor.

4. DISCUSSION

4.1 CAPITAL COST

The capital cost estimates for each different propulsion configuration are provided in Table 4 and Table 5. Additional details of the Capital Cost Calculations are shown in Appendix A.

Only the high-level costs related specifically to the propulsion system were addressed. In the diesel mechanical configuration, the capital costs accounted for the engines, the CPP system and reduction gears, and the ship service generator. Each of the diesel hybrid options had similar cost estimating, with the main differences in the costs being quantity of batteries required.

Of the diesel hybrid options, the 50% battery option required the most batteries and as such was the highest cost of the hybrid options. The all-electric configuration was the most expensive of all the configurations. This can be attributed to its large battery storage requirements, its shore power charging connections, and the general powering redundancy necessary for regulatory approval.

The costs for the Martha's Vineyard route configurations are more expensive than the Nantucket configurations for Peak Shave and 50% Battery, as the number of annual cycles affects battery aging and increases the required battery capacity.

Table 4: Martha's Vineyard Capital Cost Summary

OPTION	DESCRIPTION	COST
1	Diesel Mechanical	\$ 4,467,000
2	Berth Battery	\$ 8,691,000
3	Peak Shave	\$ 10,236,000
4	50% Battery	\$ 10,786,000
5	All Electric	\$ 12,237,000

Table 5: Nantucket Capital Cost Summary

OPTION	DESCRIPTION	COST
1	Diesel Mechanical	\$ 4,467,000
2	Berth Battery	\$ 8,737,000
3	Peak Shave	\$ 9,924,000
4	50% Battery	\$ 10,209,000

4.2 OPERATING COST

Each propulsion configuration was projected out to a 10-year span, with estimates for the major costs incurred during that 10-year period. The major drivers of the operating costs were diesel consumption, shore power, urea consumption, battery replacement, and engine/generator maintenance. A 3% inflation rate in line with the maritime industry's inflation trends was assumed and used to calculate the future costs incurred for each recurring operating expense. The operating costs over a 10-year period, in 2022 dollars, are shown in Table 6 and Table 7. Additional details of the operating cost calculation are provided in Appendix B.

Table 6: Martha's Vineyard Operating Cost Summary

OPTION	DESCRIPTION	COST
1	Diesel Mechanical	\$ 12,533,000
2	Berth Battery	\$ 11,488,000
3	Peak Shave	\$ 12,928,000
4	50% Battery	\$ 13,332,000
5	All Electric	\$ 17,728,000

Table 7: Nantucket Operating Cost Summary

OPTION	DESCRIPTION	COST
1	Diesel Mechanical	\$ 11,662,000
2	Berth Battery	\$ 10,766,000
3	Peak Shave	\$ 11,698,000
4	50% Battery	\$ 12,136,000

4.3 EMISSIONS

Utilizing the power profiles presented in Section 3.1 and ship service electrical requirements presented in Section 3.2, each route's emission generation was calculated.

It is standard practice to measure emissions in metric units. CO₂ generation is a function of the diesel fuel burned; one metric ton of CO₂ is generated for every 99.4 gallons of diesel burned. All other emissions (NOx, CO, and PM) were calculated based upon load-weighted EPA emissions certification data provided by the engine manufacturers. NOx, CO, and PM emissions from marine engines are already controlled by EPA regulations and all engine manufacturers are required to provide documentation of their engines meeting the EPA regulations. Table 8 and Table 9 show the total annual emissions produced by each configuration option.

The all-electric configuration was assumed to produce approximately 5% of the emissions of the diesel mechanical arrangement. This was to account for occasional operation of the installed diesel generator. It is expected that the generator may be required for vessel propulsion, and it is good marine practice to ensure the generator is operable.

Table 8: Martha's Vineyard Emissions Summary

OPTION	DESCRIPTION	CO ₂ (MT/YR)	NOX (MT/YR)	CO (KG/YR)	PM (KG/YR)
1	Diesel Mechanical	3849	22	909	175
2	Berth Battery	3565	14	258	87
3	Peak Shave	3538	13	467	82
4	50% Battery	3544	11	2118	101
5	All Electric	187	1.1	45	8.7

Table 9: Nantucket Emissions Summary

OPTION	DESCRIPTION	CO ₂ (MT/YR)	NOX (MT/YR)	CO (KG/YR)	PM (KG/YR)
1	Diesel Mechanical	3619	20	936	155
2	Berth Battery	3355	13	364	79
3	Peak Shave	3317	11	1782	92
4	50% Battery	3336	12	968	81

5. CONCLUSIONS

Of the five options considered, Option 1 (diesel mechanical) produced the most emissions and was the cheapest propulsion configuration. Option 5 was the closest to zero emission (wake-side) configuration and was also the most expensive to procure. The diesel hybrid options (Options 2-4) produced emissions similar to, but less than the diesel mechanical option with CO₂ emission reductions ranging from 7% - 8% depending on the load conditions of the propulsion generators.

Capital costs for the propulsion systems were higher the more emissions were reduced. The increase in cost amongst the hybrid and all electric options was largely related to the quantity of batteries needed in each powering scenario.

Future studies and analyses could be performed to better define a vessel optimized for an all-electric or hybrid option. There is likely a sweet-spot design that would work well on both routes. An all-electric configuration for the Hyannis – Nantucket route was not considered in this study, and the quantity of batteries for that application would likely be prohibitive. An evaluation of the existing M/V WOODS HOLE hold space for fit of a diesel hybrid propulsion configuration is recommended.

This study did not consider any alternate fuels such as methanol, hydrogen, or ammonia as potential vehicles for emissions reduction relative to diesel. To do so would require an in-depth analysis of the supply chain of such fuels.

Steamship Authority

New Vehicle Ferry

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6. REFERENCES

- [1] KPFF, "2100492.001 Martha's Vineyard and Nantucket Steamship Authority Shoreside Electrification Feasibility Study".

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APPENDIX A

Capital Cost

Steamship Authority

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5/13/22

MARTHA'S VINEYARD

Diesel Mechanical

Item	Cost Per Unit		Unit	Total
Engines	\$ 401	per kW	5120	\$ 2,050,865
CPP System & Gears	\$ 398	per kW	5120	\$ 2,035,319
Ship Service Generator	\$ 423	per kW	900	\$ 381,000
Total Investment Cost				\$ 4,467,184

Battery Power at Berths

Item	Cost Per Unit		Unit	Total
Batteries	\$ 750	Qty	181	\$ 135,731
DC Grid / Drive System	\$ 2,899,004	Qty	1	\$ 2,899,004
Motors, Propulsion	\$ 155,811	Qty	1	\$ 155,811
Switchgear and Transformer	\$ 248,685	Qty	1	\$ 248,685
Integrator Execution, Commissioning, Engineering	20%	% of Ele. Equip.	\$ 3,439,231	\$ 687,846
Generators	\$ 1,304,698	Qty	3	\$ 3,914,093
Propellers	\$ 50,000	Qty	2	\$ 100,000
Reduction Gear	\$ 200,000	Qty	2	\$ 400,000
Systems, etc.	\$ 150,000	per room	1	\$ 150,000
Total Investment Cost				\$ 8,691,169

Peak Shaving

Item	Cost Per Unit		Unit	Total
Batteries	\$ 750	Qty	1897	\$ 1,423,011
DC Grid / Drive System	\$ 2,899,004	Qty	1	\$ 2,899,004
Motors, Propulsion	\$ 155,811	Qty	1	\$ 155,811
Switchgear and Transformer	\$ 248,685	Qty	1	\$ 248,685
Integrator Execution, Commissioning, Engineering	20%	% of Ele. Equip.	\$ 4,726,511	\$ 945,302
Generators	\$ 1,304,698	Qty	3	\$ 3,914,093
Propellers	\$ 50,000	Qty	2	\$ 100,000
Reduction Gear	\$ 200,000	Qty	2	\$ 400,000
Systems, etc.	\$ 150,000	per room	1	\$ 150,000
Total Investment Cost				\$ 10,235,906

Steamship Authority

New Vehicle Ferry

5/13/22

50 Percent Battery Operation

Item	Cost Per Unit		Unit	Total
Batteries	\$ 750	Qty	2509	\$ 1,881,559
DC Grid / Drive System	\$ 2,899,004	Qty	1	\$ 2,899,004
Motors, Propulsion	\$ 155,811	Qty	1	\$ 155,811
Switchgear and Transformer	\$ 248,685	Qty	1	\$ 248,685
Integrator Execution, Commissioning, Engineering	20%	% of Ele. Equip.	\$ 5,185,059	\$ 1,037,012
Generators	\$ 1,304,698	Qty	3	\$ 3,914,093
Propellers	\$ 50,000	Qty	2	\$ 100,000
Reduction Gear	\$ 200,000	Qty	2	\$ 400,000
Systems, etc.	\$ 150,000	per room	1	\$ 150,000
Total Investment Cost				\$ 10,786,163

All Battery with Shore Charging

Item	Cost Per Unit		Unit	Total
Batteries	\$ 750	Qty	5380	\$ 4,035,319
DC Grid / Drive System	\$ 2,899,004	Qty	1	\$ 2,899,004
Shore charging modifications	\$ 1,105,128	Qty	1	\$ 1,105,128
Motors, Propulsion	\$ 155,811	Qty	1	\$ 155,811
Switchgear and Transformer	\$ 248,685	Qty	1	\$ 248,685
Integrator Execution, Commissioning, Engineering	20%	% of Ele. Equip.	\$ 8,443,947	\$ 1,688,789
Generators	\$ 1,304,698	Qty	1	\$ 1,304,698
Propellers	\$ 50,000	Qty	2	\$ 100,000
Reduction Gear	\$ 200,000	Qty	2	\$ 400,000
Systems, etc.	\$ 150,000	per room	2	\$ 300,000
Total Investment Cost				\$ 12,237,434

NANTUCKET**Diesel Mechanical**

Item	Cost Per Unit		Unit	Total
Engines	\$ 401	per kW	5120	\$ 2,050,865
CPP System & Gears	\$ 398	per kW	5120	\$ 2,035,319
Ship Service Generator	\$ 423	per kW	900	\$ 381,000
Total Investment Cost				\$ 4,467,184

Steamship Authority

New Vehicle Ferry

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Battery Power at Berths

Item	Cost Per Unit		Unit	Total
Batteries	\$ 750	Qty	191	\$ 143,386
DC Grid / Drive System	\$ 2,899,004	Qty	1	\$ 2,899,004
Motors, Propulsion	\$ 187,048	Qty	1	\$ 187,048
Switchgear and Transformer	\$ 248,685	Qty	1	\$ 248,685
Integrator Execution, Commissioning, Engineering	20%	% of Ele. Equip.	\$ 3,478,123	\$ 695,625
Generators	\$ 1,304,698	Qty	3	\$ 3,914,093
Propellers	\$ 50,000	Qty	2	\$ 100,000
Reduction Gear	\$ 200,000	Qty	2	\$ 400,000
Systems, etc.	\$ 150,000	per room	1	\$ 150,000
Total Investment Cost				\$ 8,737,841

Peak Shaving

Item	Cost Per Unit		Unit	Total
Batteries	\$ 750	Qty	1509	\$ 1,131,855
DC Grid / Drive System	\$ 2,899,004	Qty	1	\$ 2,899,004
Motors, Propulsion	\$ 187,048	Qty	1	\$ 187,048
Switchgear and Transformer	\$ 248,685	Qty	1	\$ 248,685
Integrator Execution, Commissioning, Engineering	20%	% of Ele. Equip.	\$ 4,466,592	\$ 893,318
Generators	\$ 1,304,698	Qty	3	\$ 3,914,093
Propellers	\$ 50,000	Qty	2	\$ 100,000
Reduction Gear	\$ 200,000	Qty	2	\$ 400,000
Systems, etc.	\$ 150,000	per room	1	\$ 150,000
Total Investment Cost				\$ 9,924,003

50 Percent Battery Operation

Item	Cost Per Unit		Unit	Total
Batteries	\$ 750	Qty	1826	\$ 1,369,142
DC Grid / Drive System	\$ 2,899,004	Qty	1	\$ 2,899,004
Motors, Propulsion	\$ 187,048	Qty	1	\$ 187,048
Switchgear and Transformer	\$ 248,685	Qty	1	\$ 248,685
Integrator Execution, Commissioning, Engineering	20%	% of Ele. Equip.	\$ 4,703,879	\$ 940,776
Generators	\$ 1,304,698	Qty	3	\$ 3,914,093
Propellers	\$ 50,000	Qty	2	\$ 100,000
Reduction Gear	\$ 200,000	Qty	2	\$ 400,000
Systems, etc.	\$ 150,000	per room	1	\$ 150,000
Total Investment Cost				\$ 10,208,747

Steamship Authority

New Vehicle Ferry

5/13/22

APPENDIX B

Operating Cost

Steamship Authority

New Vehicle Ferry

5/13/22

MARTHA'S VINEYARD

System Properties

System Property	Unit	Diesel Mechanical	Battery Power at Berths	Peak Shaving	50 Percent Battery Operation	All Battery with Shorepower
Engine Size	kW	2560.00	0.00	0.00	0.00	0.00
No. Engines	-	2	0	0	0	0
Engines Operating	-	2	0	0	0	0
Vessel Operating Hours	hr	5187	0	0	0	0
Annual Engine Hours (ea.)	hr	3192	0	0	0	0
Generator Size	kW	300	2450	2450	2450	0
No. Generators	-	3	3	3	3	0
Generators Operating	-	1	2	1	2	0
Annual Generator Hours (ea.)	hr	1729	2128	1729	1108	0
Battery Bank	kWh	n/a	181	1897	2509	5380
Cycle Life	yr	n/a	10.00	10.00	10.00	10.00
Fuel Consumption	gal/trip	95.87	88.78	88.11	88.26	0.00
Shore Power Consumption	kWh/trip	0.00	0.00	0.00	0.00	1533.08

Annual Fluid / Shore Power Consumption

Fluid	Unit	Diesel Mechanical	Battery Power at Berths	Peak Shaving	50 Percent Battery Operation	All Battery with Shorepower
Diesel	gal	382506	354237	351571	352164	0
Urea	gal	19125	17712	17579	17608	0
Lube Oil (Consumption)	gal	593	354	352	352	0
Shore Power	kWh	0	0	0	0	6116979

Annual Costs

Annual Cost Item	\$/unit	Diesel Mechanical	Battery Power at Berths	Peak Shaving	50 Percent Battery Operation	All Battery with Shorepower
Diesel	\$ 2.15	\$822,388	\$761,609	\$755,878	\$757,152	\$0
Shore Power	\$ 0.16	\$0	\$0	\$0	\$0	\$972,600
Urea	\$ 3.23	\$61,775	\$57,209	\$56,779	\$56,874	\$0
Lube Oil	\$ 8.00	\$4,745	\$2,834	\$2,813	\$2,817	\$0
Batteries	\$ 750.00	\$0	\$13,573	\$142,301	\$188,156	\$403,532
Engine Maintenance		\$80,539	\$0	\$0	\$0	\$0
Reduction Gear Maint.		\$4,000	\$4,000	\$4,000	\$4,000	\$4,000
Generator Maint.		\$5,112	\$53,693	\$43,625	\$27,965	\$0
Motor Maint.		\$0	\$4,000	\$4,000	\$4,000	\$4,000
Total Annual Cost		\$978,559	\$896,917	\$1,009,395	\$1,040,965	\$1,384,132

Steamship Authority

New Vehicle Ferry

5/13/22

Net Present Value of Annual Costs

Annual Cost Item	Inflation Rate	Diesel Mechanical	Battery Power at Berths	Peak Shaving	50 Percent Battery Operation	All Battery with Shorepower
Diesel	3.00%	\$10,532,978	\$9,754,528	\$9,681,125	\$9,697,450	\$0
Shore Power	3.00%	\$0	\$0	\$0	\$0	\$12,456,858
Urea	3.00%	\$791,198	\$732,724	\$727,210	\$728,436	\$0
Lube Oil	3.00%	\$60,778	\$36,296	\$36,023	\$36,084	\$0
Batteries	3.00%	\$0	\$173,841	\$1,822,564	\$2,409,862	\$5,168,354
Engine Maintenance	3.00%	\$1,031,525	\$0	\$0	\$0	\$0
Reduction Gear Maint.	3.00%	\$51,231	\$51,231	\$51,231	\$51,231	\$51,231
Generator Maint.	3.00%	\$65,478	\$687,683	\$558,743	\$358,168	\$0
Motor Maint.	3.00%	\$0	\$51,231	\$51,231	\$51,231	\$51,231
Total Annual Cost		\$12,533,188	\$11,487,534	\$12,928,127	\$13,332,463	\$17,727,674

NANTUCKET**System Properties**

System Property	Unit	Diesel Mechanical	Battery Power at Berths	Peak Shaving	50 Percent Battery Operation
Engine Size	kW	2560.00	0.00	0.00	0.00
No. Engines	-	2	0	0	0
Engines Operating	-	2	0	0	0
Vessel Operating Hours	hr	3280	0	0	0
Annual Engine Hours (ea.)	hr	2680	0	0	0
Generator Size	kW	300	2450	2450	2450
No. Generators	-	3	3	3	3
Generators Operating	-	1	2	1	2
Annual Generator Hours (ea.)	hr	1093	1787	1093	1333
Battery Bank	kWh	n/a	191	1509	1826
Cycle Life	yr	n/a	10.00	10.00	10.00
Fuel Consumption	gal/trip	299.72	277.78	274.70	276.28
Shore Power Consumption	kWh/trip	0.00	0.00	0.00	0.00

Annual Fluid / Shore Power Consumption

Fluid	Unit	Diesel Mechanical	Battery Power at Berths	Peak Shaving	50 Percent Battery Operation
Diesel	gal	359663	333340	329642	331540
Urea	gal	17983	16667	16482	16577
Lube Oil (Consumption)	gal	537	333	330	332
Shore Power	kWh	0	0	0	0

Steamship Authority

New Vehicle Ferry

5/13/22

Annual Costs

Annual Cost Item	\$/unit	Diesel Mechanical	Battery Power at Berths	Peak Shaving	50 Percent Battery Operation
Diesel	\$ 2.15	\$773,275	\$716,682	\$708,731	\$712,810
Shore Power	\$ 0.12	\$0	\$0	\$0	\$0
Urea	\$ 3.23	\$58,086	\$53,834	\$53,237	\$53,544
Lube Oil	\$ 8.00	\$4,292	\$2,667	\$2,637	\$2,652
Batteries	\$ 750.00	\$0	\$14,339	\$113,186	\$136,914
Engine Maintenance		\$67,620	\$0	\$0	\$0
Reduction Gear Maint.		\$4,000	\$4,000	\$4,000	\$4,000
Generator Maint.		\$3,233	\$45,080	\$27,586	\$33,642
Motor Maint.		\$0	\$4,000	\$4,000	\$4,000
Total Annual Cost		\$910,506	\$840,602	\$913,377	\$947,563

Net Present Value of Annual Costs

Annual Cost Item	Inflation Rate	Diesel Mechanical	Battery Power at Berths	Peak Shaving	50 Percent Battery Operation
Diesel	3.00%	\$9,903,947	\$9,179,113	\$9,077,278	\$9,129,531
Shore Power	3.00%	\$0	\$0	\$0	\$0
Urea	3.00%	\$743,948	\$689,501	\$681,851	\$685,776
Lube Oil	3.00%	\$54,975	\$34,155	\$33,776	\$33,970
Batteries	3.00%	\$0	\$183,646	\$1,449,657	\$1,753,569
Engine Maintenance	3.00%	\$866,067	\$0	\$0	\$0
Reduction Gear Maint.	3.00%	\$51,231	\$51,231	\$51,231	\$51,231
Generator Maint.	3.00%	\$41,405	\$577,378	\$353,321	\$430,879
Motor Maint.	3.00%	\$0	\$51,231	\$51,231	\$51,231
Total Annual Cost		\$11,661,573	\$10,766,255	\$11,698,345	\$12,136,188

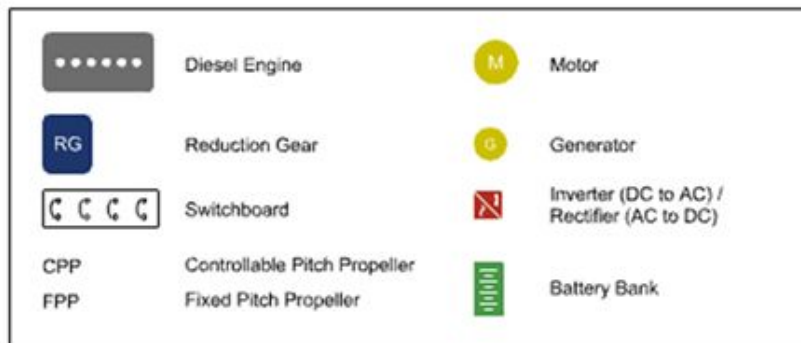
Steamship Authority

New Vehicle Ferry

5/13/22

APPENDIX C

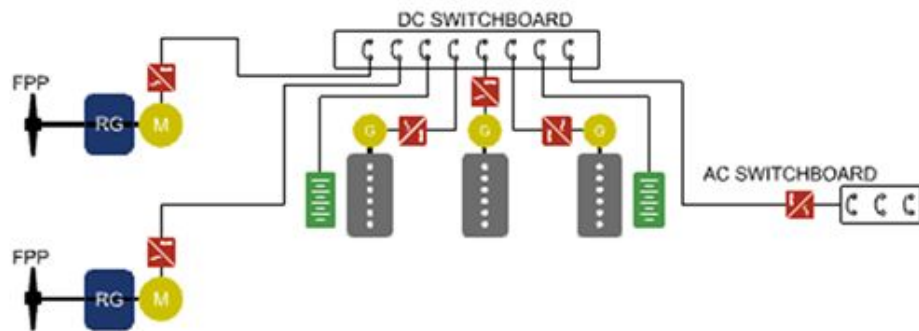
System Sketches



DIESEL MECHANICAL, CPP



DIESEL HYBRID, FPP



Note that Options 2-5 are each a variation of the Diesel Hybrid arrangement with the quantity of batteries, generators and a shore power connection as variables.



better to build · better to operate

NEW VEHICLE FERRY M/V WOODS HOLE EQUIVALENT HYBRID PROPULSION STUDY

May 26, 2022



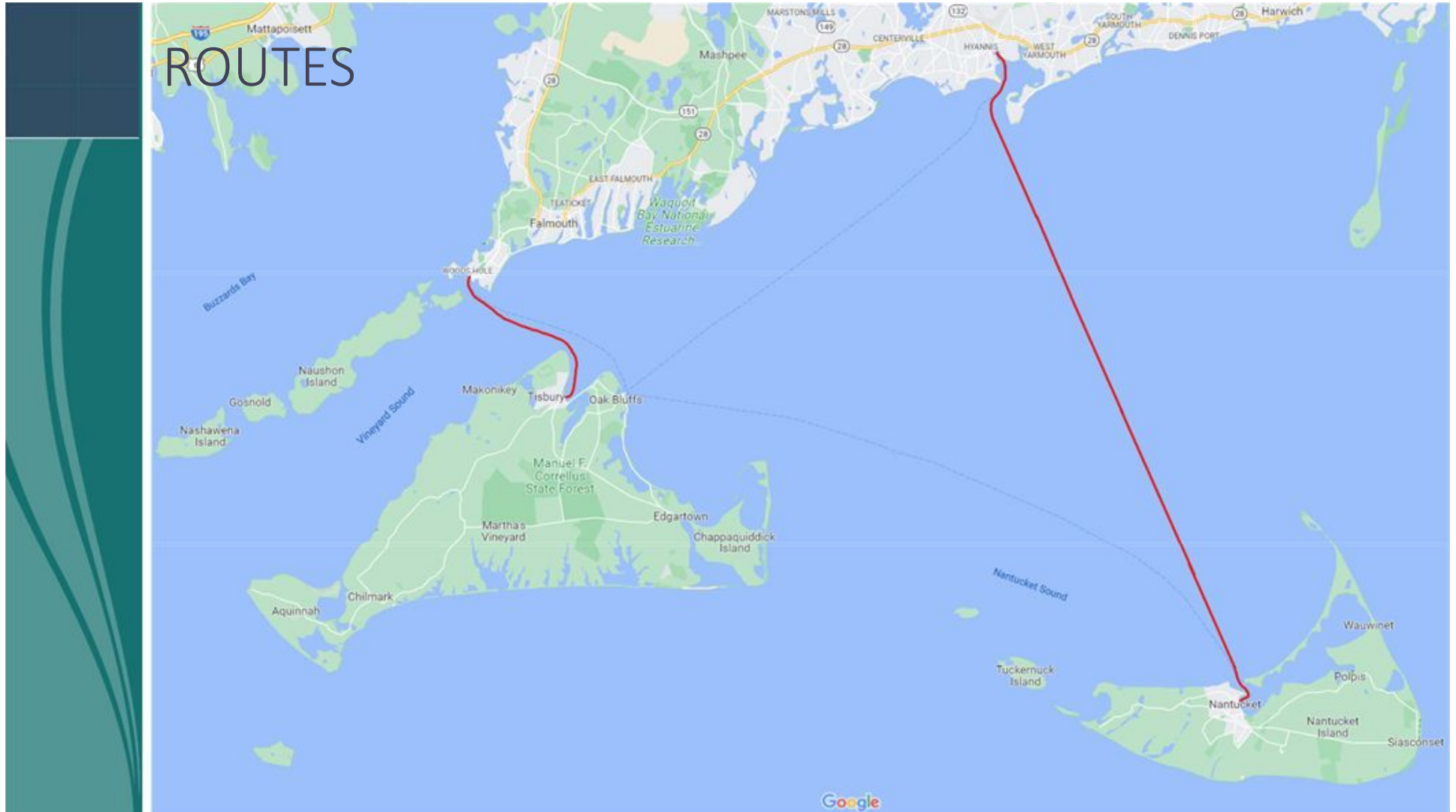
OUR TEAM IS YOUR TEAM

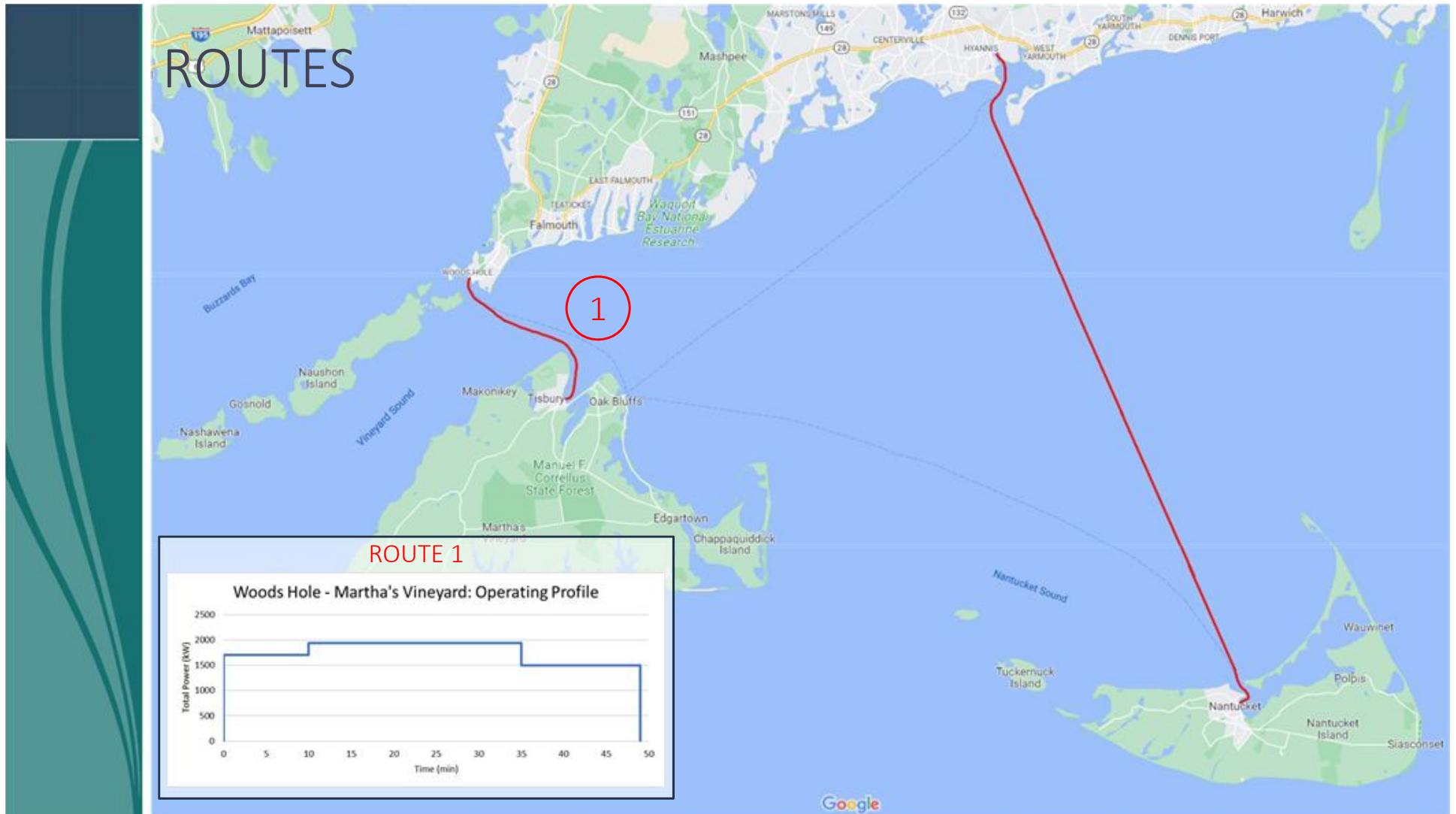


AGENDA

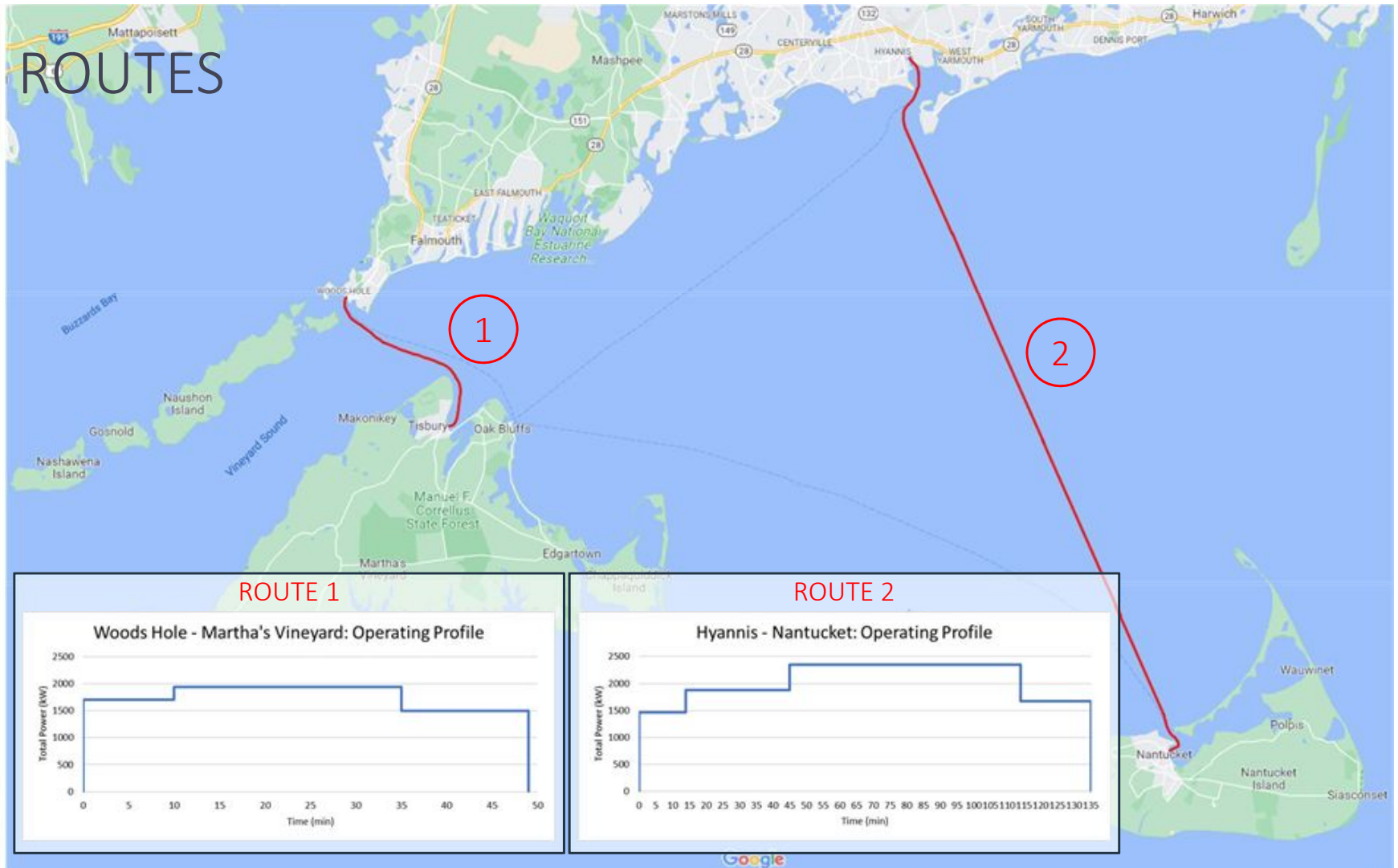
- Overview
- Route and Power Requirements
- Ships Service Electrical and HVAC Loads
- Financial Assumptions
- Candidate Propulsion Systems
- Capital Cost
- Operating Cost
- Emissions
- Conclusions







ROUTES



CANDIDATE PROPULSION CONFIGURATIONS

1

OPTION 1
Diesel Mechanical

2

OPTION 2
Berth Battery

3

OPTION 3
Peak Shave

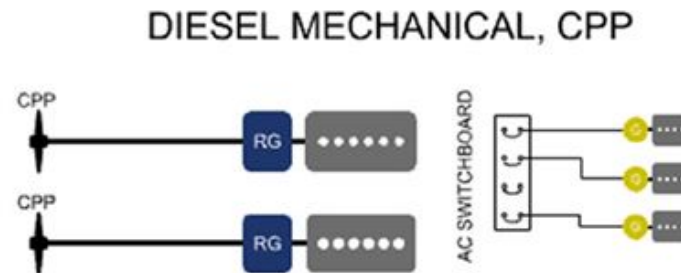
4

OPTION 4
50% Battery

5

OPTION 5
All Electric
(only considered for
Martha's Vineyard route)

OPTION 1 | DIESEL MECHANICAL

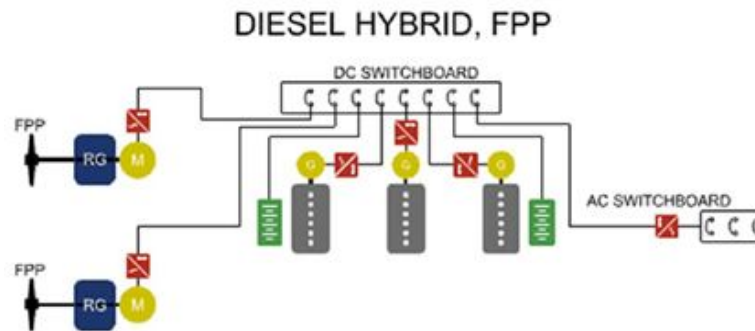


1

DIESEL MECHANICAL

- (2) 2560 kW Engines
- (2) Controllable Pitch Propellers
- (3) 310 eKW Generators

OPTIONS 2-5



2

BERTH BATTERY

(3) 2450 eKW Generators
(2) Fixed Pitch Propellers
(2) 1000 kW Electric Motors
180-190 kWh Batteries

3

PEAK SHAVE

(3) 2450 eKW Generators
(2) Fixed Pitch Propellers
(2) 1000 kW Electric Motors
1500-1900 kWh Batteries

4

50% BATTERY

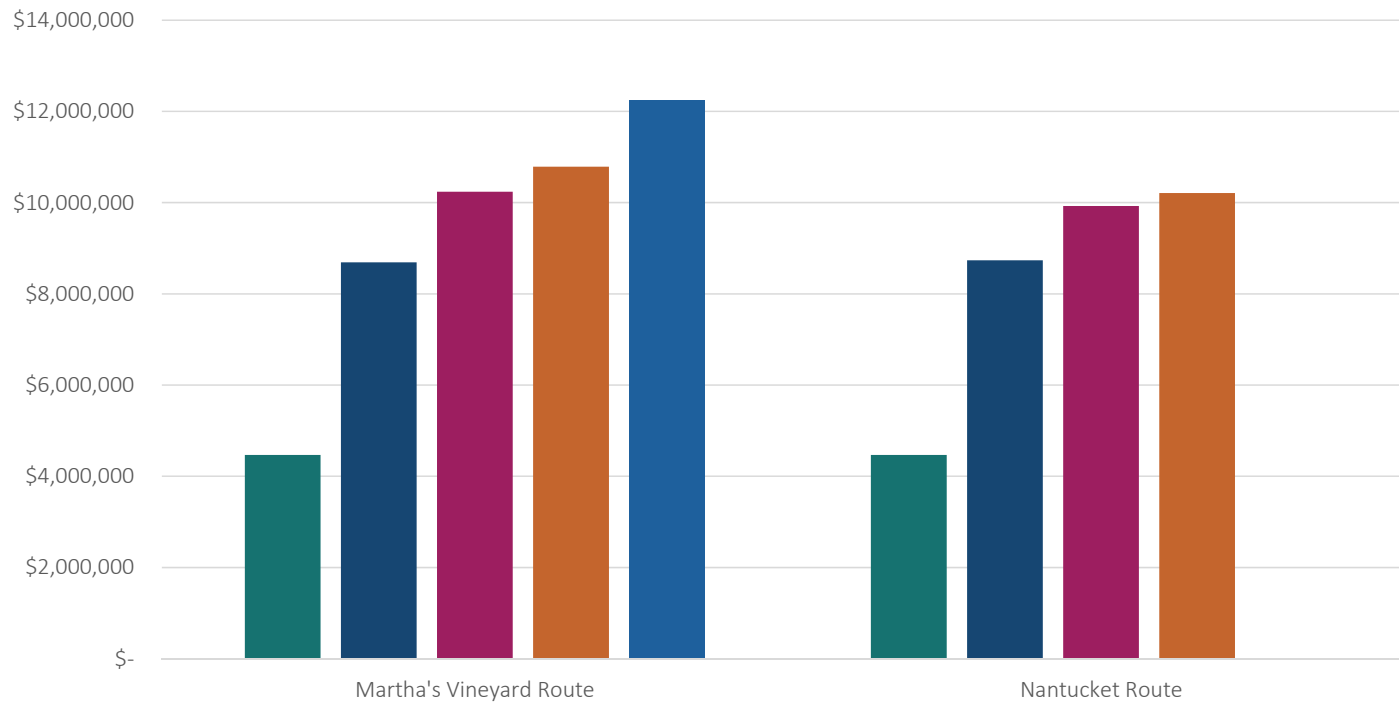
(3) 2450 eKW Generators
(2) Fixed Pitch Propellers
(2) 1000 kW Electric Motors
1800-2500 kWh Batteries

5

ALL ELECTRIC

(1) 2450 eKW Generators
(2) Fixed Pitch Propellers
(2) 1000 kW Electric Motors
5380 kWh Batteries

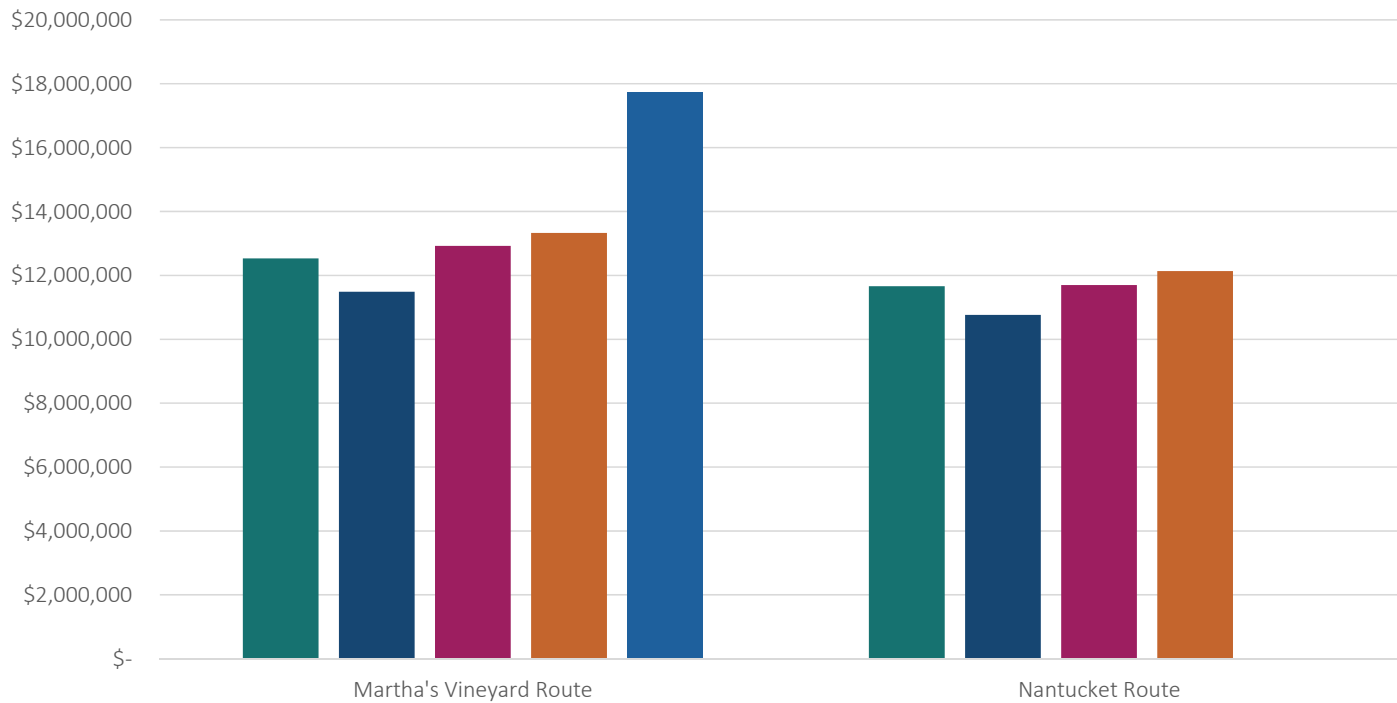
CAPITAL COST



- 1 Diesel Mechanical 2 Berth Battery 3 Peak Shave 4 50% Battery 5 All Electric

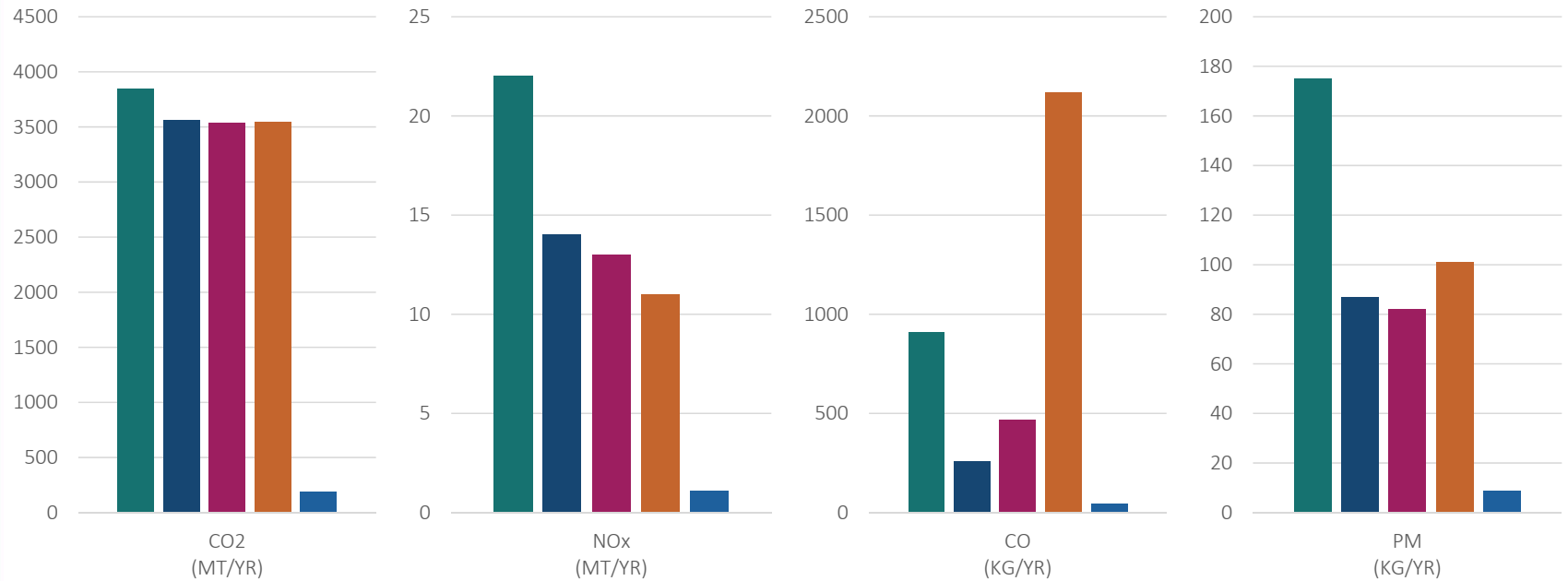


OPERATING COST



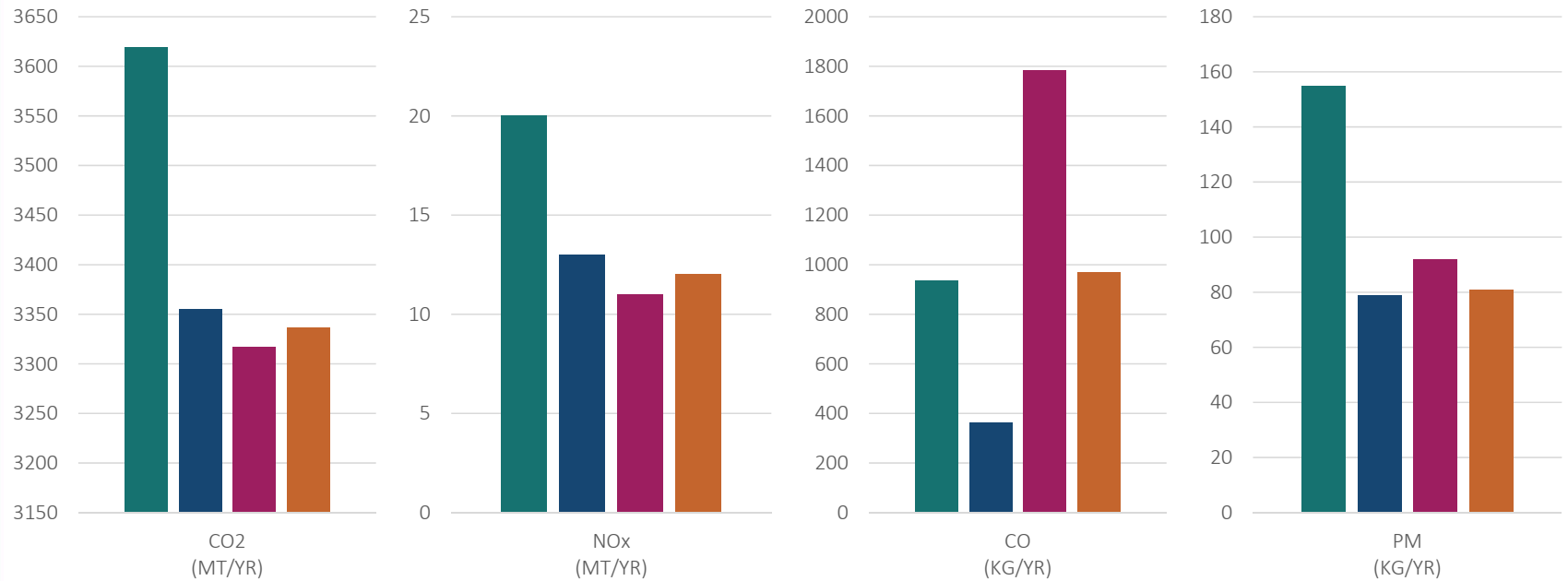
- 1 Diesel Mechanical 2 Berth Battery 3 Peak Shave 4 50% Battery 5 All Electric

EMISSIONS – MARTHA'S VINEYARD



- 1 Diesel Mechanical
2 Berth Battery
3 Peak Shave
4 50% Battery
5 All Electric

EMISSIONS – NANTUCKET ROUTE



- 1 Diesel Mechanical
2 Berth Battery
3 Peak Shave
4 50% Battery
5 All Electric

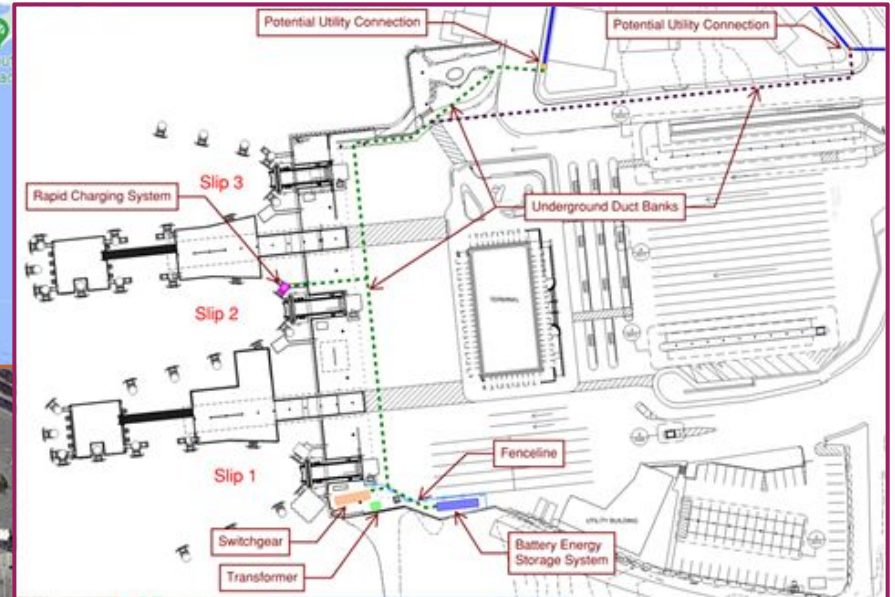
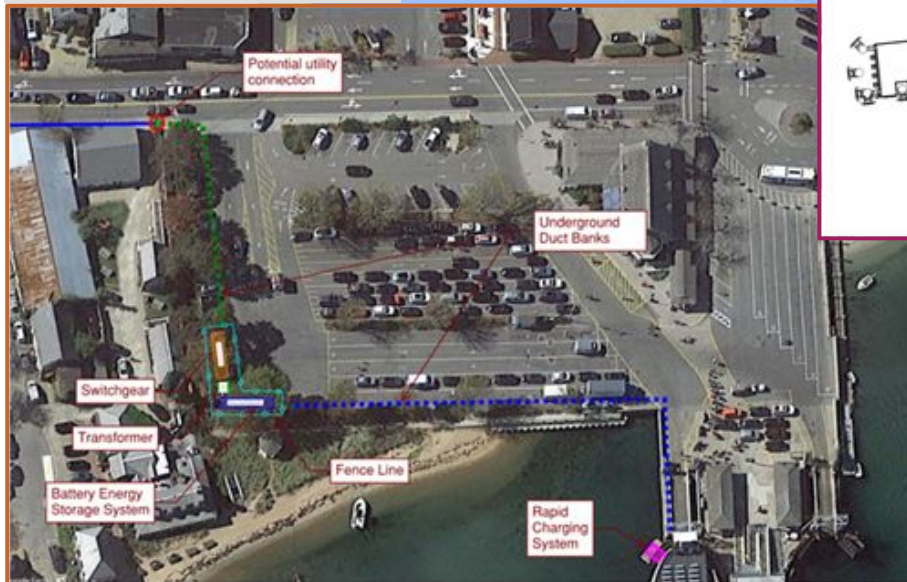
SHORESIDE ELECTRIFICATION



SHORESIDE ELECTRIFICATION



Vineyard Haven Terminal



Woods Hole Terminal



SHORESIDE ELECTRIFICATION COST

ENERGY SYSTEM CAPITAL COST	WOODS HOLE TERMINAL	VINEYARD HAVEN TERMINAL
Battery Energy Storage	\$14,440,000	\$14,440,000
Direct Charging	\$5,520,000	\$5,520,000

SINGLE HYBRID VESSEL SERVICE	WOODS HOLE TERMINAL	VINEYARD HAVEN TERMINAL
Total Annual Power Cost – Direct Charging	\$487,000	\$486,000
Total Annual Power Cost – Battery Energy Storage	\$460,000	\$460,000

TWO HYBRID VESSEL SERVICE	WOODS HOLE TERMINAL	VINEYARD HAVEN TERMINAL
Total Annual Power Cost – Direct Charging	\$938,000	\$938,000
Total Annual Power Cost – Battery Energy Storage	\$918,000	\$918,000

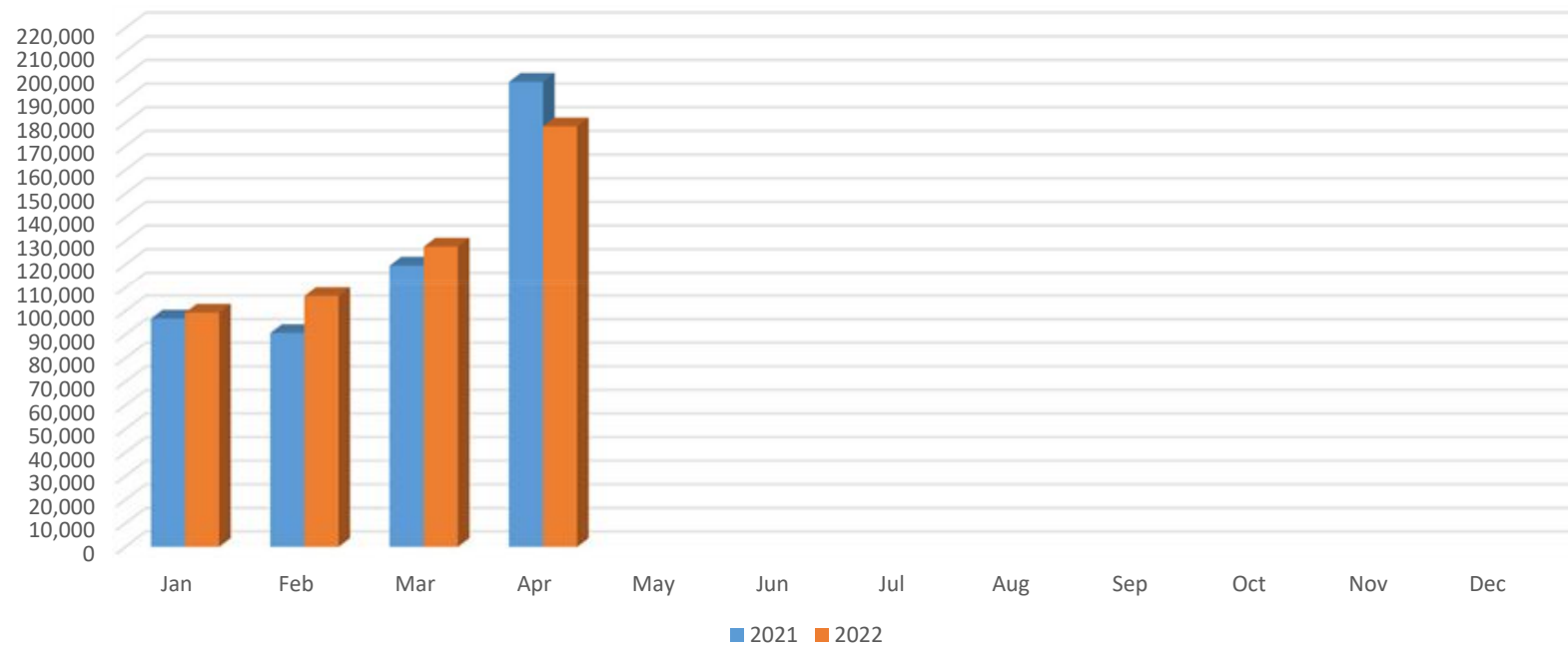
Business Summary – April 2022

Port Council Meeting 06-07-2022

Passengers Carried – April 2022 vs. 2021

		Monthly Variance vs. 2021	Monthly % Difference vs. 2021			Y-T-D Variance vs. 2021	Y-T-D % Difference vs. 2021
Martha's Vineyard Route	↑	11,230	7.8%		↑	37,441	9.1%
Nantucket Regular Ferry	↓	- 329	- 1.8%		↓	- 1,710	- 3.0%
Nantucket Fast Ferry	↑	7,885	50.6%		↑	9,275	57.0%
Nantucket Route Subtotal	↑	7,556	22.3%		↑	7,565	10.4%
Total Passengers	↑	18,786	10.5%		↑	45,006	9.3%

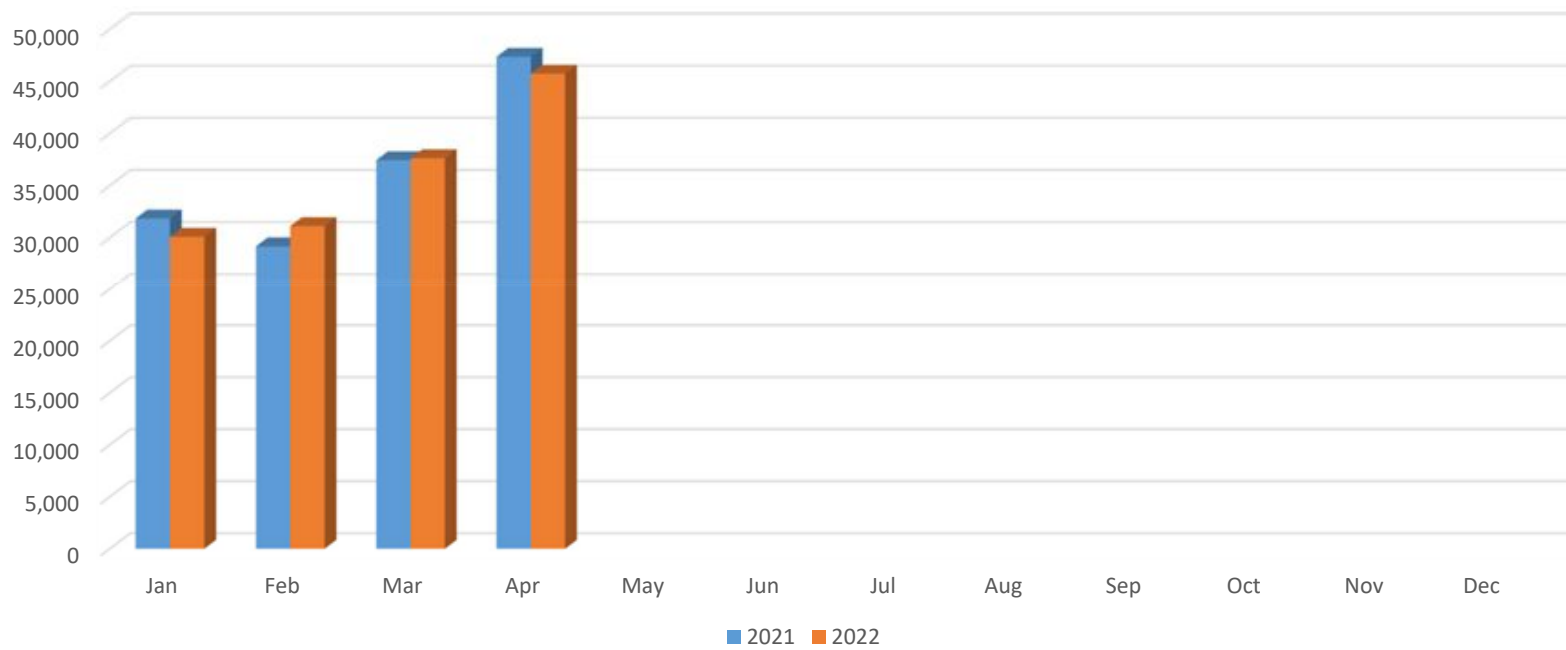
Passengers Carried 2021 - 2022



Vehicles Less than 20 ft. Carried – April 2022 vs. 2021

		Monthly Variance vs. 2021	Monthly % Difference vs. 2021		Y-T-D Variance vs. 2021	Y-T-D % Difference vs. 2021
Martha's Vineyard Route						
Standard Fare Autos	↓	- 2,192	- 11.9%	↓	- 5,973	- 11.7%
Standard Fare Trucks	↓	- 22	- 0.5%	↓	- 562	- 3.7%
Excursion Fare Autos	↑	692	5.1%	↑	4,368	9.6%
Excursion Fare Trucks	↓	- 55	- 1.4%	↑	540	4.1%
Total – Martha's Vineyard	↓	- 1,577	- 3.9%	↓	- 1,627	- 1.3%
Nantucket Route						
Standard Fare Autos	↓	- 185	- 6.0%	↓	- 476	- 6.2%
Standard Fare Trucks	↑	32	3.0%	↑	22	0.7%
Excursion Fare Autos	↑	101	5.4%	↑	679	9.9%
Excursion Fare Trucks	↑	18	2.2%	↑	166	5.2%
Total – Nantucket	↓	- 34	- 0.5%	↑	391	1.9%
Total Vehicles Less Than 20'	↓	- 1,611	- 3.4%	↓	- 1,236	- 0.8%

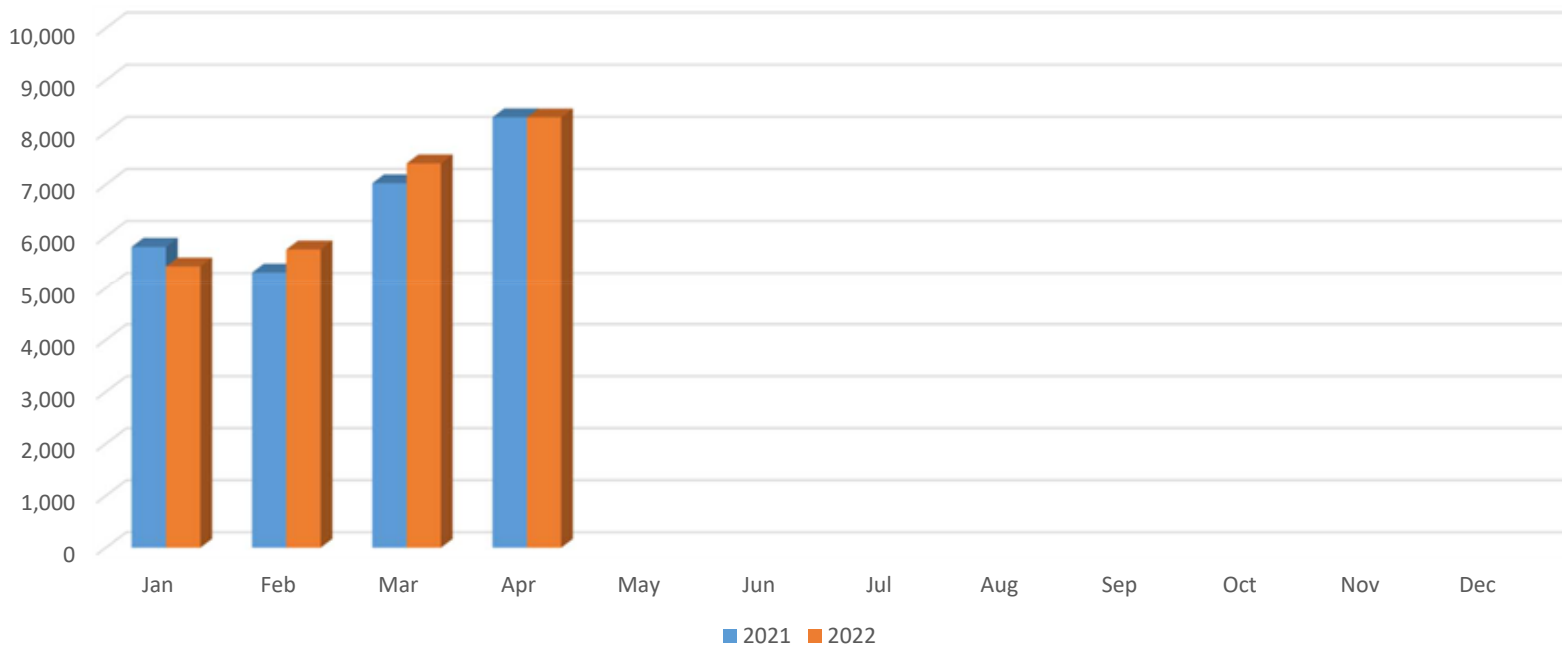
Vehicles Less than 20 Feet Carried 2021 - 2022



Freight Trucks (Trucks 20 ft and over) Carried April 2022 vs. 2021

		Monthly Variance vs. 2021	Monthly % Difference vs. 2021			Y-T-D Variance vs. 2021	Y-T-D % Difference vs. 2021
Martha's Vineyard Route	↑	14	0.3%		↑	177	1.1%
Nantucket Route	↓	- 17	- 0.5%		↑	266	2.6%
Total Trucks	↓	- 3	0.0%		↑	443	1.7%

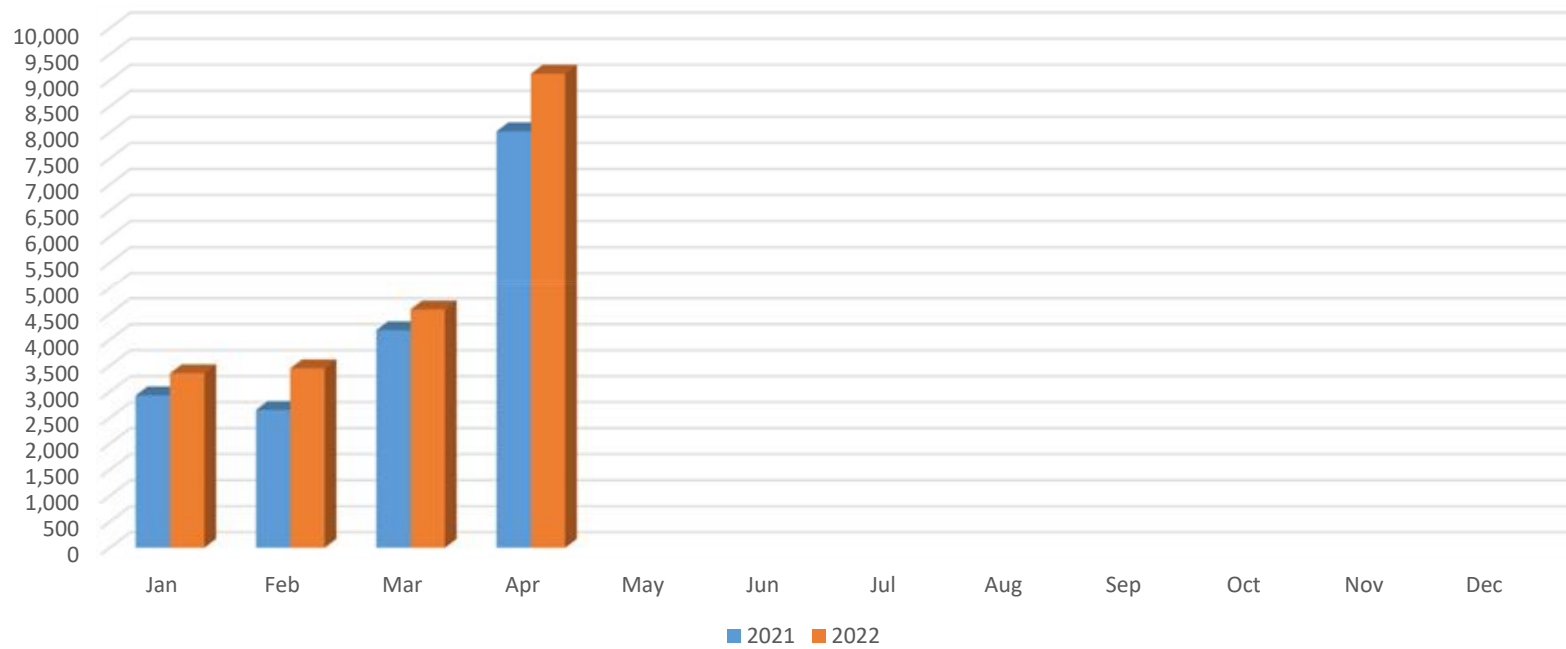
Trucks (20 Feet & Over) Carried 2021 - 2022



Cars Parked— April 2022 vs. 2021

		Monthly Variance vs. 2021	Monthly % Difference vs. 2021			Y-T-D Variance vs. 2021	Y-T-D % Difference vs. 2021
Martha's Vineyard Route	↑	1,063	17.5%		↑	2,503	17.1%
Nantucket Route	↑	42	2.1%		↑	230	7.3%
Total Cars Parked	↑	1,105	13.8%		↑	2,733	15.4%

Cars Parked 2021 - 2022



Trip Summary Report

	Scheduled		Cancelled for				
MV Route	Budgeted	Available	Mechanical	Weather	Traffic	Unscheduled	Total
April	1,210	6	0	- 10	- 7	0	1,199
YTD	4,772	19	- 15	- 107	- 93	4	4,580
NT Route	Budgeted	Available	Mechanical	Weather	Traffic	Unscheduled	Total
April	762	4	- 8	- 28	0	2	732
YTD	1,852	16	- 8	- 69	- 36	13	1,762
Total	Budgeted	Available	Mechanical	Weather	Traffic	Unscheduled	Total
April	1,972	10	- 8	- 38	- 7	2	1,931
YTD	6,624	35	- 23	- 176	- 129	17	6,342

Financial Snapshot



April

- Operating Revenue of **\$9,236,722** was **higher** than budget by **\$48,286**
- Other Income of **\$83,983** was **higher** than budget by **\$21,546**
- Operating Expenses of **\$9,271,895** was **lower** than budget by **\$36,111**
- Income Deductions of **\$141,047** was **lower** than budget by **\$4,615**
- Net Operating Loss of **\$92,237** was **lower** than budget by **\$110,558**

January – April

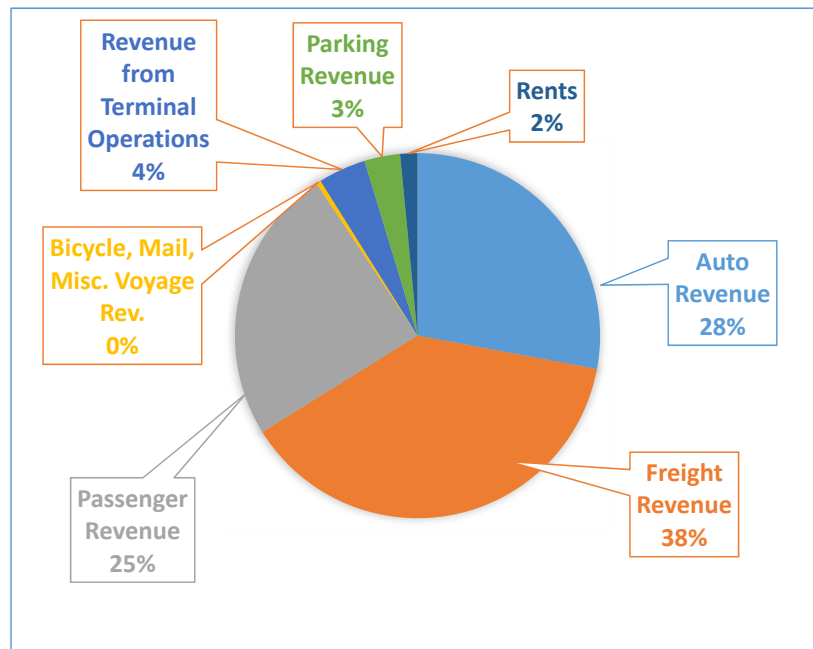
- Operating Revenue of **\$24,856,134** was **higher** than budget by **\$538,086**
- Other Income of **\$1,188,163** was **lower** than budget by **\$514,290**
- Operating Expenses of **\$36,878,822** was **lower** than budget by **\$689,871**
- Income Deductions of **\$637,087** was **lower** than budget by **\$13,537**
- Net Operating Loss of **\$11,471,612** was **lower** than budget by **\$727,204**

Operating Revenues – April 2022 vs. Budget

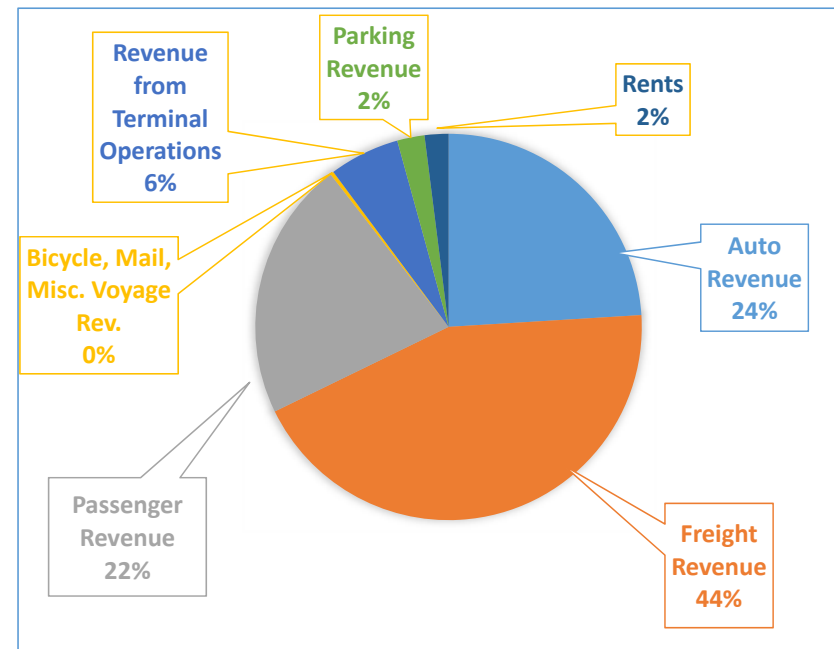
		Monthly Variance vs. Budget	Monthly % Difference vs. Budget		Y-T-D Variance vs. Budget	Y-T-D % Difference vs. Budget
Waterline Revenues						
Automobile Revenue	↓	\$ - 318,125	- 11.0%	↓	\$ - 531,251	- 8.2%
Freight Revenue	↓	- 39,934	- 1.1%	↓	- 2,335	0.0%
Passenger Revenue	↑	250,135	12.4%	↑	243,122	4.7%
Misc. Voyage Revenue	↑	6,165	19.3%	↑	2,745	3.8%
Term. Oper. Revenue	↑	64,620	19.8%	↑	602,487	69.7%
Parking Revenue	↑	47,897	19.6%	↑	86,907	18.0%
Rent Revenue	↑	37,528	36.5%	↑	136,411	38.2%
Total Operating Revenue	↑	\$ 48,286	0.5%	↑	\$ 538,086	2.2%
Total Other Income	↑	\$ 21,546	34.5%	↓	\$ - 514,290	- 30.2%
Total Operating & Other	↑	\$ 69,832	0.8%	↑	\$ 23,796	0.1%

Operating Revenues - 2022

April



January - April

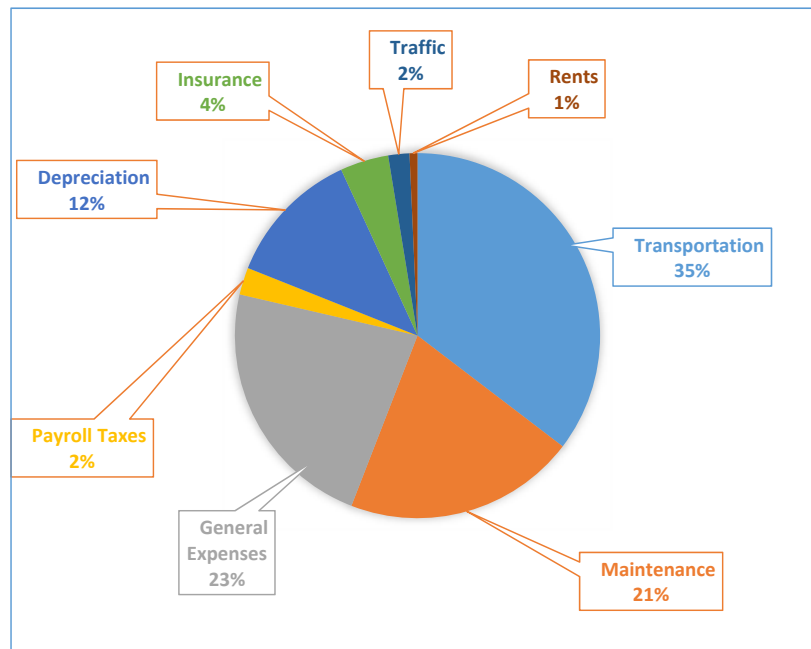


Operating Expenses – April 2022 vs. Budget

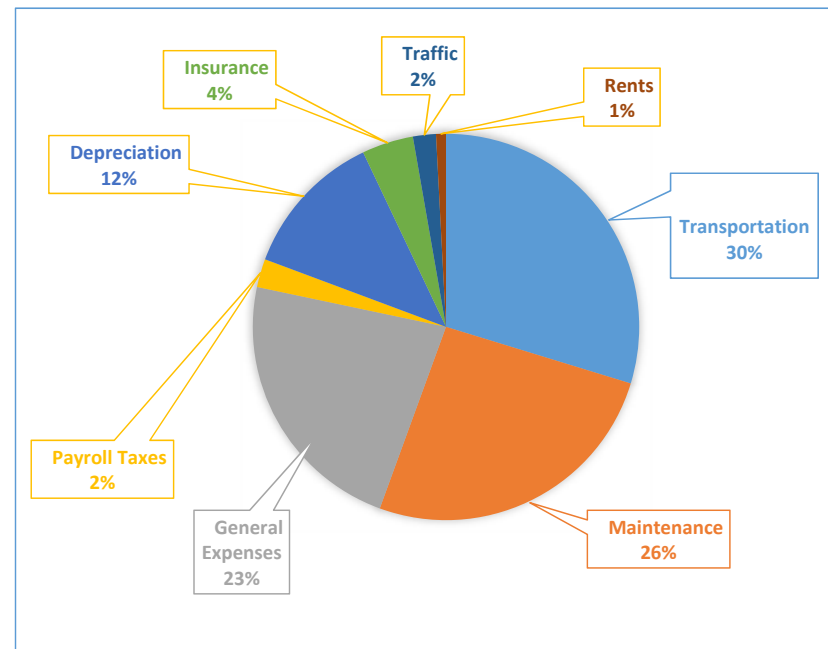
		Monthly Variance vs. Budget	Monthly % Difference vs. Budget		Y-T-D Variance vs. Budget	Y-T-D % Difference vs. Budget
Waterline Expenses						
Maintenance	↑	394,174	26.1%	↑	140,773	1.5%
Depreciation	↓	- 36,358	- 3.1%	↓	- 145,250	- 3.1%
Vessel Operations	↑	7,283	0.3%	↑	42,817	0.6%
Terminal Operations	↑	42,546	27.5%	↑	372,424	10.5%
Traffic Expense	↓	- 59,095	- 25.3%	↓	- 75,278	- 9.6%
General Expense	↓	- 387,742	- 15.5%	↓	- 1,052,986	- 11.2%
Insurance	↑	2,708	0.7%	↑	9,908	0.6%
Rents	↑	6,604	11.4%	↑	4,378	1.5%
Payroll Taxes	↓	- 6,232	- 2.7%	↑	13,342	1.5%
Total Operating Expenses	↓	\$ - 36,111	- 0.4%	↓	\$ - 689,871	- 1.8%
Total Other Expenses	↓	\$ - 4,615	- 2.2%	↓	\$ - 13,537	- 2.1%
Total Operating & Other	↓	\$ - 40,726	- 0.4%	↓	\$ - 703,408	- 1.8%

Operating Expenses - 2022

April



























January – April



Passengers Carried – May 1-21, 2022 vs. 2021

		Monthly Variance	Monthly % Difference			Y-T-D Variance	Y-T-D % Difference
Martha's Vineyard Route	↑	7,187	5.8%		↑	44,628	8.3%
Nantucket Regular Ferry	↑	1,692	13.1%	↓		- 18	- 0.0%
Nantucket Fast Ferry	↓	- 1,716	- 9.4%	↑		7,559	21.8%
Nantucket Route Subtotal	↓	- 24	- 0.1%		↑	7,541	7.3%
Total Passengers	↑	7,163	4.6%		↑	52,169	8.1%

Vehicles Carried – May 1-21, 2022 vs. 2021

		Monthly Variance	Monthly % Difference			Y-T-D Variance	Y-T-D % Difference
Martha's Vineyard Route							
Automobiles - Regular		- 1,710	- 11.1%			- 7,683	- 11.6%
Automobiles – Excursion		347	3.9%			4,715	8.6%
Pickup Trucks – Regular		- 81	- 2.4%			- 643	- 3.5%
Pickup Trucks – Excursion		155	6.2%			695	4.4%
20 Feet & Over Trucks		181	4.9%			358	1.8%
Total – Martha's Vineyard		- 1,108	- 3.3 %			- 2,558	- 1.5%
Nantucket Route							
Automobiles – Regular		- 339	- 11.7%			- 815	- 7.7%
Automobiles – Excursion		- 59	- 5.0%			620	7.7%
Pickup Trucks – Regular		- 97	- 12.3%			- 75	- 1.8%
Pickup Trucks – Excursion		27	5.5%			193	5.3%
20 Feet & Over Trucks		18	0.7%			284	2.2%
Total - Nantucket		- 468	- 5.8%			207	0.5%