# Cruise Ships Analysis (Components, Vessel and Voyage)

## Assumptions:

1. **Aggregation:** Mean is considered for Power and Fuel flow rate for different time window aggregation.
2. **Total Power Consumption**: Total power consumption are from Power Galley 1 and 2, Power Service, HVAC Chiller 1, 2 and 3 Power, Scrubber Power, Propulsion Power, Port Side Propulsion Power, Starboard Side Propulsion Power, Bow Thruster 2 and 3 Power, Stern Thruster 1 and 2 Power.
3. **Total Power Generation:** Total power generation is from the Diesel Generator 1, 2, 3 and 4 Power.
4. **Voyage/Trip**: Voyage distance and duration might play a key role in multiple vessel performance attributes. Here voyage is identified based on positional changes of the cruises

# Power Analysis:

| | Total Power Generated (MW) | Total Power Consumed (MW) | Power Difference |
|---|---|---|---|
| Total Power Generated (MW) | 1.000 | 0.999 | 0.997 |
| Total Power Consumed (MW) | 0.999 | 1.000 | 0.999 |
| Power Difference | 0.997 | 0.999 | 1.000 |

Here we can see that total power input is 0.999215 correlated with total power output (Ideally it should be 1 if there is constant power loss), this is also acceptable.

Strangely Power consumed is more than Power generated.

1. Calibration Offset: There might be a calibration offset in the sensors measuring power input or power output. This offset could result in a consistent difference.
2. Baseline Consumption: There could be a constant baseline power consumption that is not accounted for separately. This could be due to systems that are always running and consuming a fixed amount of power.

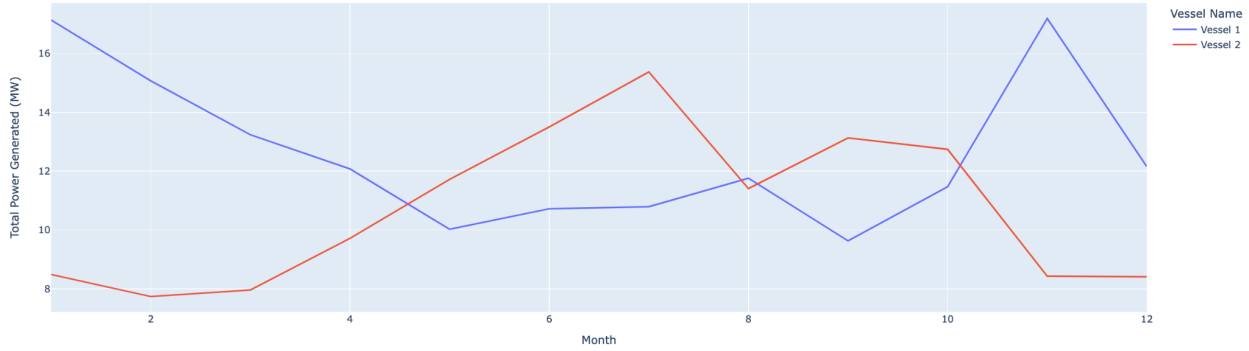
3. Additional Power Source: There might be an additional, constant power source not included in the input data, such as batteries or other generators.

But 0.999215 correlation states that we the pattern of overall power consumption can be captured with these 4 power generation pattern

This Missing power generation could be mainly used by power galley, since there is a higher correlation with the power difference

| | Power Galley 1 (MW) | Power Galley 2 (MW) | Total Power Generated (MW) | Total Power Consumed (MW) | Power Difference | Total Fuel Consumption (kg/h) |
|---|---|---|---|---|---|---|
| **Power Galley 1 (MW)** | 1.000 | 0.936 | -0.006 | 0.241 | 0.504 | -0.004 |
| **Power Galley 2 (MW)** | 0.936 | 1.000 | 0.022 | 0.261 | 0.511 | 0.022 |
| **Total Power Generated (MW)** | -0.006 | 0.022 | 1.000 | 0.939 | 0.707 | 0.222 |
| **Total Power Consumed (MW)** | 0.241 | 0.261 | 0.939 | 1.000 | 0.907 | 0.240 |
| **Power Difference** | 0.504 | 0.511 | 0.707 | 0.907 | 1.000 | 0.222 |
| **Total Fuel Consumption (kg/h)** | -0.004 | 0.022 | 0.222 | 0.240 | 0.222 | 1.000 |

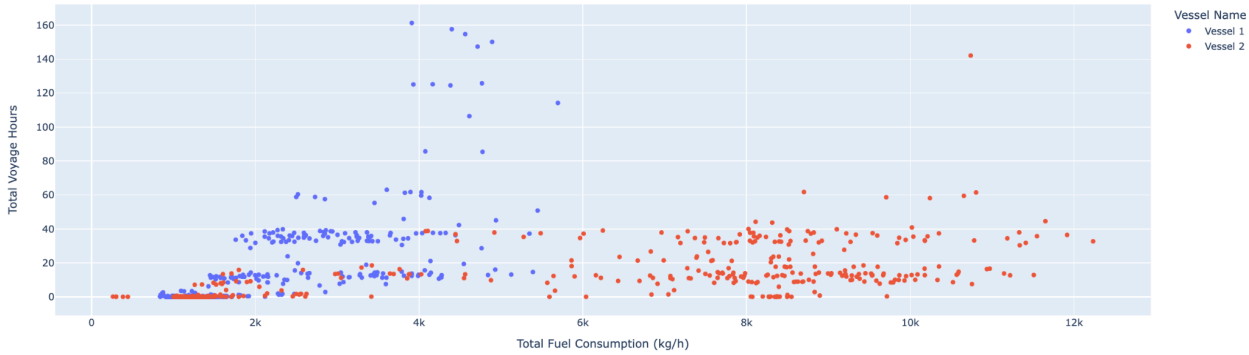
## Total Power Generated by Months



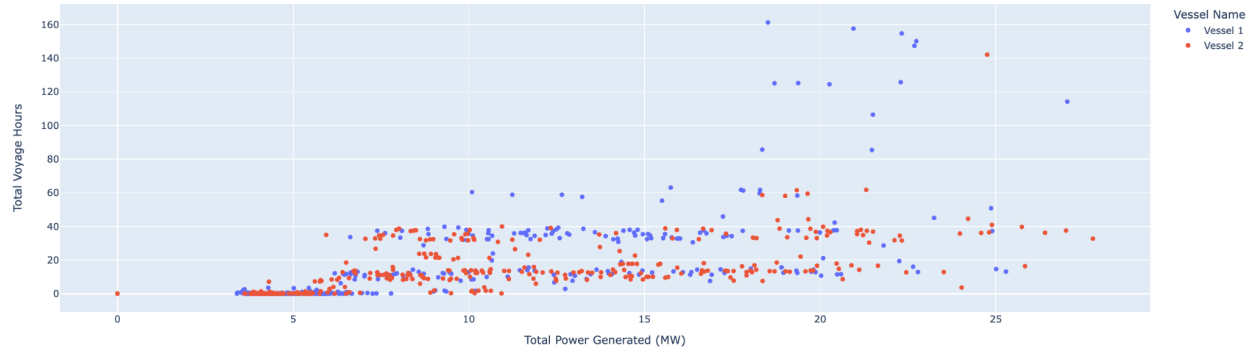

# Voyage Trends

Based on the voyage trends, it appears that Vessel 2 is less affected by total voyage hours compared to Vessel 1. The evidence supporting this observation comes from the graphs showing total voyage hours in relation to fuel consumption, total power generated, and specific fuel consumption (SFC).

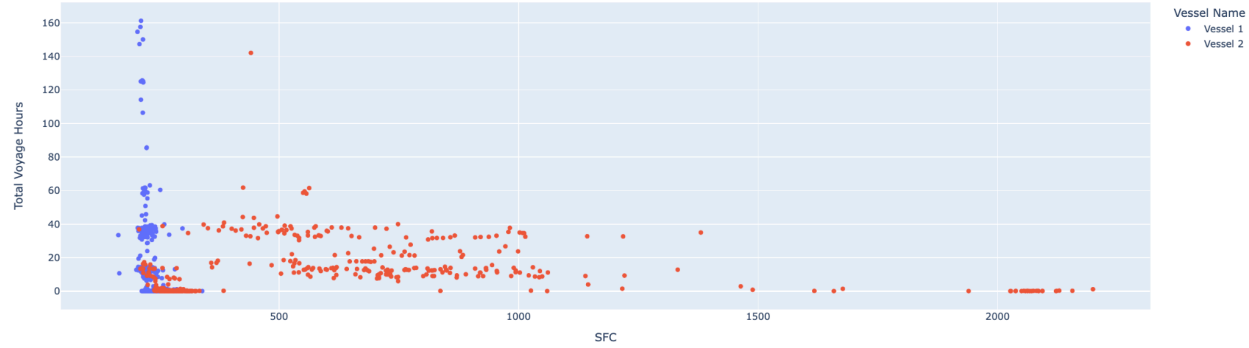
## Total Voyage Hours and Fuel Consumption(kg/h)



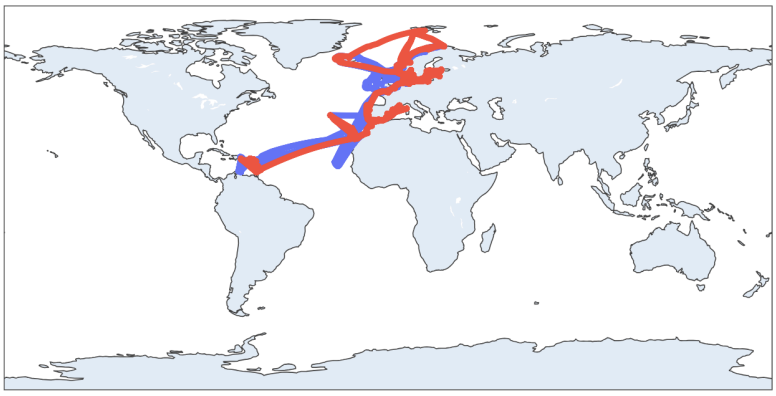

## Total Voyage Hours and Total Power Generated (MW)




## Total Voyage Hours and SFC




## Voyage Route


Vessel Name
Vessel 1
Vessel 2