

NUS-RightShip Hackathon Problem Statement

Release On: Friday, 26 January 2024

Release Time: 5.00 PM

Reducing Greenhouse Gas Emissions at Port of Singapore

Background:

International shipping contributes 3% of the global annual greenhouse gas (GHGs) emissions. While this number may appear small, the amount is equivalent to the amount emitted by Japan, the sixth biggest GHG emitter in the world.

The International Maritime Organisation (IMO) is a United Nations agency responsible for the safety and security of shipping, and the prevention of pollution by ships. They have set targets to achieve a net zero GHG emissions from shipping. Following suit, the Maritime Port Authority (MPA) of Singapore established the Maritime Singapore Green Initiative, which aims to reduce the environmental impact of shipping in Singapore.

Singapore is one of the busiest ports in the world, with thousands of vessels arriving and departing every year. Most of these vessels use fossil fuels to power their engines, which results in significant emissions of greenhouse gases and other pollutants. Port operators must have an accurate understanding of the vessel emissions to help them identify opportunities to reduce emissions and meet environmental targets.

As part of Singapore's efforts to reduce its carbon footprint, the Maritime and Port Authority of Singapore (MPA) has launched various initiatives to promote the use of cleaner fuels and technologies in the port. One of the key areas of focus is the electrification of vessels while they are berthed at ports. It is crucial to quantify the emission reductions and determine their effectiveness in reducing GHGs.

To achieve this goal, it is important to accurately determine the amount of GHG emitted by vessels, and also the electrification power required by vessels at a given berth or terminal. However, this is a complex problem that requires the integration of various data sources and mathematical formulas.

Objective:

Your main objective is to develop a baseline assessment of GHG emissions at Singapore ports and evaluate the effectiveness of electrification in reducing GHG emissions.

You are strongly encouraged to also consider including the following in your assessment:

- Is electrification an effective method to reduce GHG emissions?
- How much GHG emissions can be reduced when electrification is used?
- What is the variation in electrical load demand during daytime versus nighttime?

There are two ports of interest in this hackathon:

- Pasir Panjang Terminal (for participants in Category A – University Level)
- Marina Bay Cruise Centre Singapore (for participants in Category B – Junior College and Polytechnic Level)

Data Sources:

The following data sources will be provided to the participating teams:

- Automatic Identification System (AIS) movement data of vessels arriving and departing from the ports from August – September 2023 + Vessel characteristics such as size, type, and engine specifications
- Polygon data of the port of interest
- Methodology to calculate emissions

Deliverables:

- Submission
 - Submitted via <https://forms.gle/oJPZHnvYJfc52528> by **Saturday, 27th January 2024, 3 PM.**
- Case paper
 - Maximum of 4 pages with double spacing, Times New Roman font, size 12.
 - Includes a cover page, a half-page abstract (maximum 200 words)
 - Includes flowchart

Deliverables (Con't)

- Results
 - The results should be submitted in an Excel file with the below headers.
Please use the template provided.

Header Name	Data Type	Units	Definition
Team Name	String	-	Name of the submitting team
Category	String	-	Category the team belongs to (A or B) Please ensure that it is capitalised and does not have any spaces
TotalEmissions	Float	Tonnes	Total CO2 emissions in the port
Transit	Float	Tonnes	CO2 Emissions when the vessels are in transit mode
Anchorage	Float	Tonnes	CO2 Emissions when the vessels are in anchor mode
Manoeuvring	Float	Tonnes	CO2 Emissions when the vessels are in manoeuvring mode
Alongside	Float	Tonnes	CO2 Emissions when the vessels are in alongside mode
UniqueVessels	Integer	-	Number of unique vessels that visited the port
OverallEL	Float	kiloWatt	Overall electrical load
DayEL	Float	kiloWatt	Daytime electrical load
NightEL	Float	kiloWatt	Nighttime electrical load

Note: Cells should be left blank if the answer is not provided

This is what the Excel template looks like:

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DayEL	Float	kiloWatt	Daytime electrical load	
NightEL	Float	kiloWatt	Nighttime electrical load	
UniqueVessels	Integer	-	Number of unique vessels that visited the port	

IMPORTANT: Please do not make any changes to the headers and only fill in the yellow cells.

Links to required materials per category (to be downloaded):

Category A – University Level	https://drive.google.com/drive/folders/1Gj7LsQGjaGcqUMU-FbmzqgYYOMgEKaB?usp=sharing
Category B – Junior College & Polytechnic Level	https://drive.google.com/drive/folders/1-tJBm2Is4P4eTQijMqOvG6I4B3mXXkXr?usp=sharing

Judging Criteria:

The participating teams will be judged based on the following criteria's:

- Accuracy in determining the emissions and electrical loads
- Creativity and innovation in the approach to solving the problem
- Clarity and effectiveness of the presentation, including visualisations

NOTE: Judges' decisions are final

Clarifications on the Problem Statement:

- Any questions about the problem statement must be posted to the Hackathon Teams channel called Problem Statement
- Questions will be accepted from 5 PM – 7 PM SGT, 26 Jan 2024
- Questions that are sent via other channels or outside the stated timing will not be accepted

Conclusion:

The analysis carried out during this hackathon has the potential to make a significant impact in reducing the carbon footprint of Singapore's port. Understanding the benefits of using electrification over fossil fuels can help promote the use of cleaner fuels and technologies and support Singapore's efforts towards a more sustainable future. We encourage talented and motivated students to participate in this hackathon event and make a difference!