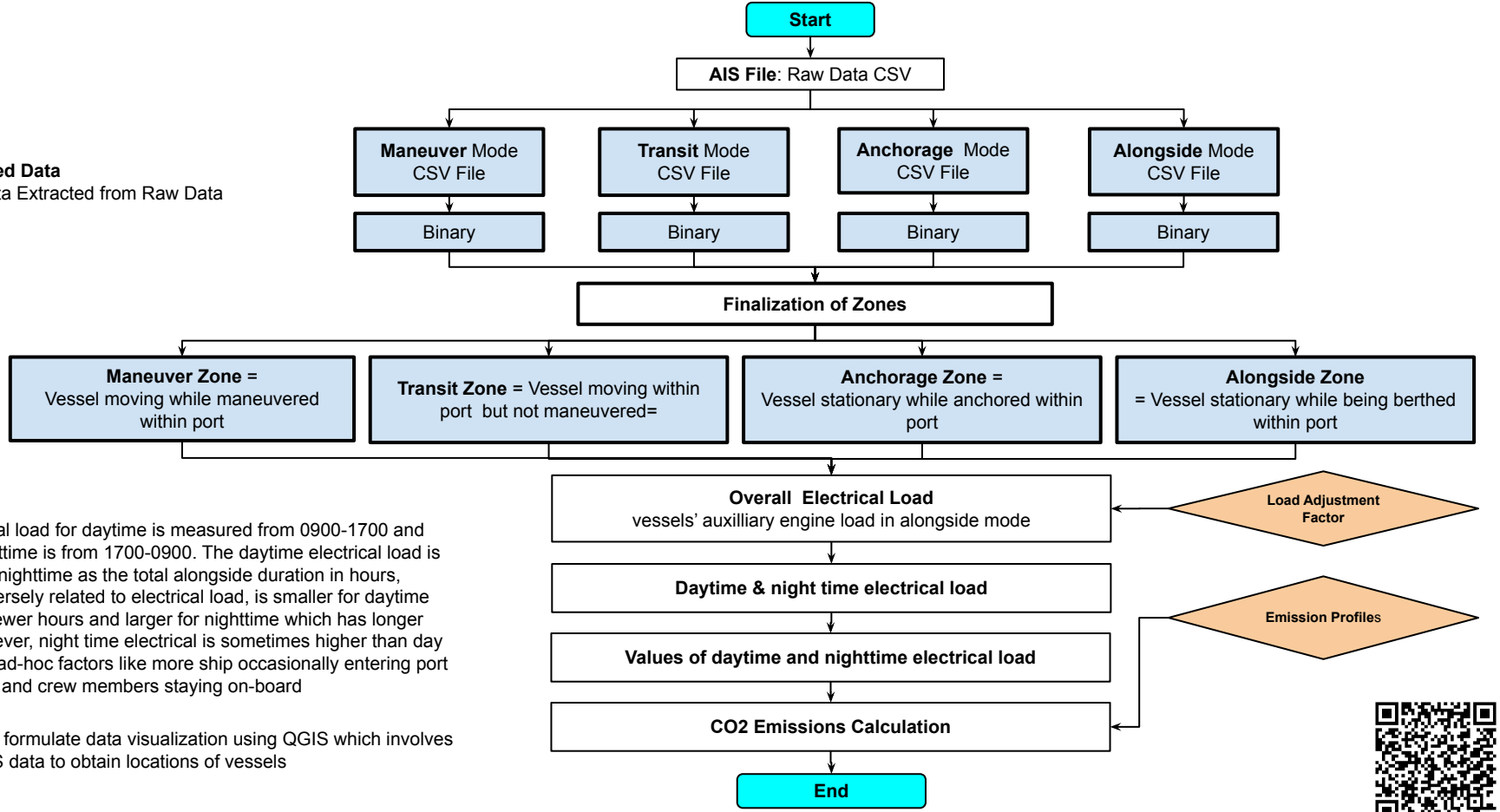
20240127 - NUS RightShip Hackathon - SIT team "Wait We're Doing This?" Flow Chart

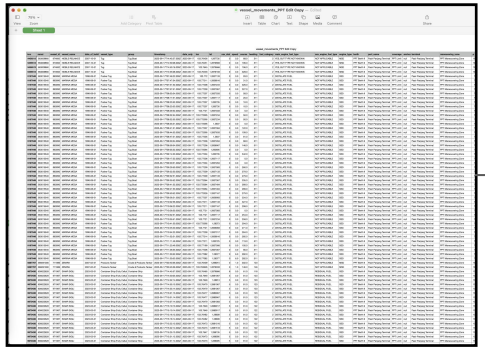
Engineered Data
Binary Data Extracted from Raw Data

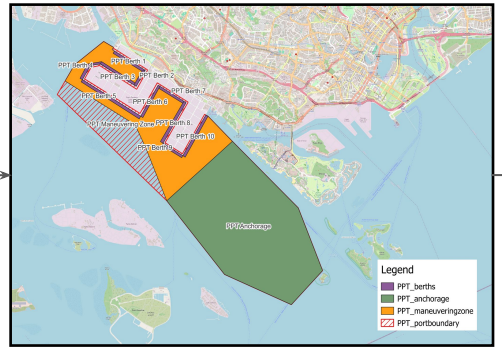


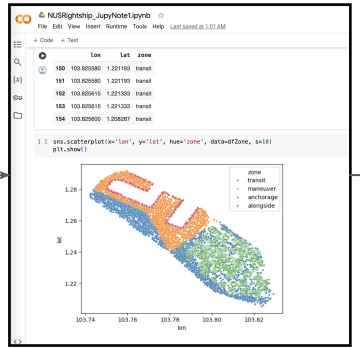
The electrical load for daytime is measured from 0900-1700 and that for nighttime is from 1700-0900. The daytime electrical load is higher than nighttime as the total alongside duration in hours, which is inversely related to electrical load, is smaller for daytime which has fewer hours and larger for nighttime which has longer hours. However, night time electrical is sometimes higher than day time due to ad-hoc factors like more ship occasionally entering port during night and crew members staying on-board

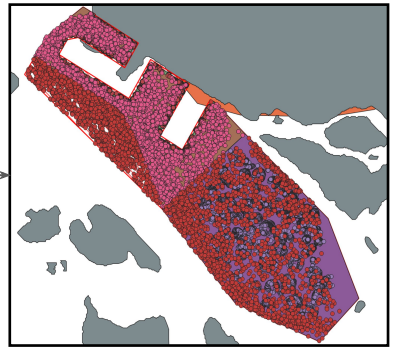
Can help us formulate data visualization using QGIS which involves inputting AIS data to obtain locations of vessels

Data Visualisation and Validation









[AIS (Automatic Identification System) CSV (Comma Separated Value File)](). Origin: SPIRE file

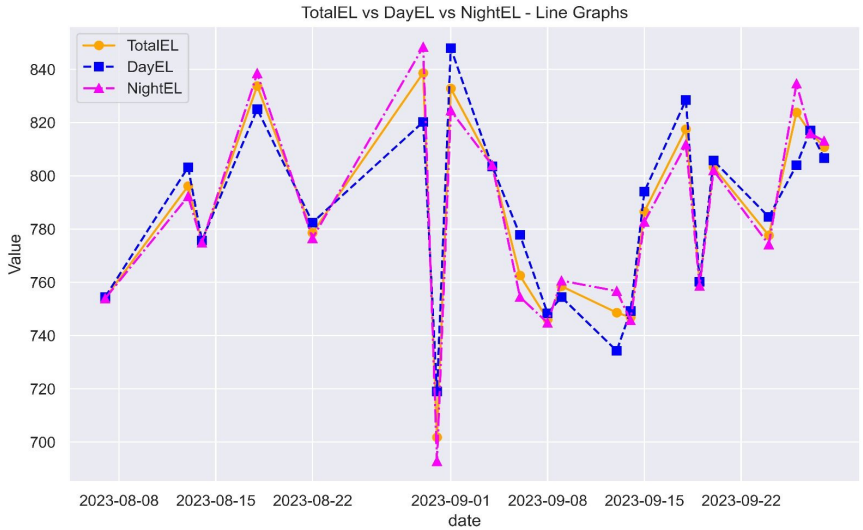
[Pasir Panjang Terminal Open Street Map Version]()

[Google Jupyter Notebook using the “Scatterplot” command]() showing every AIS reported locations.

Data visualization of the [AIS file within QGIS]()

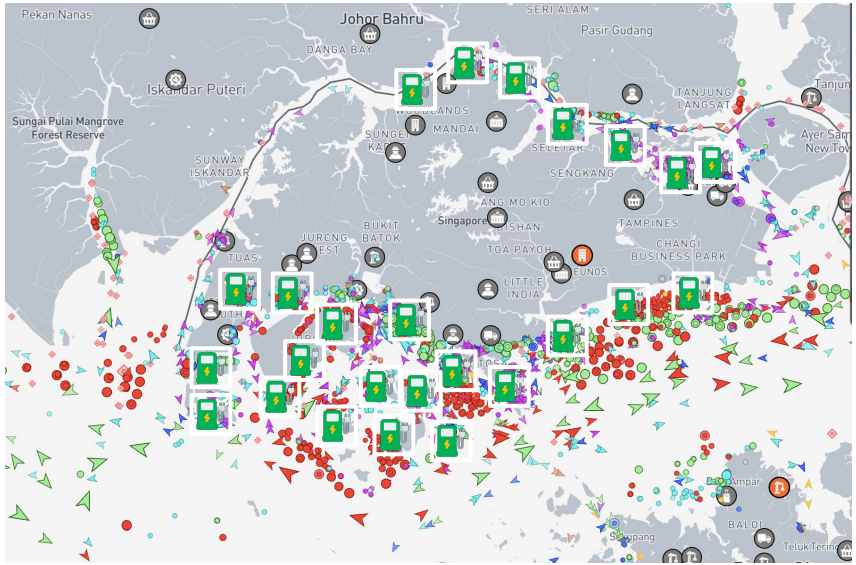
CO2 Emissions: Manoeuvering: 48%, Transit: 36%, Alongside: 11%, Anchorage: 5%

Conclusions and Recommendations



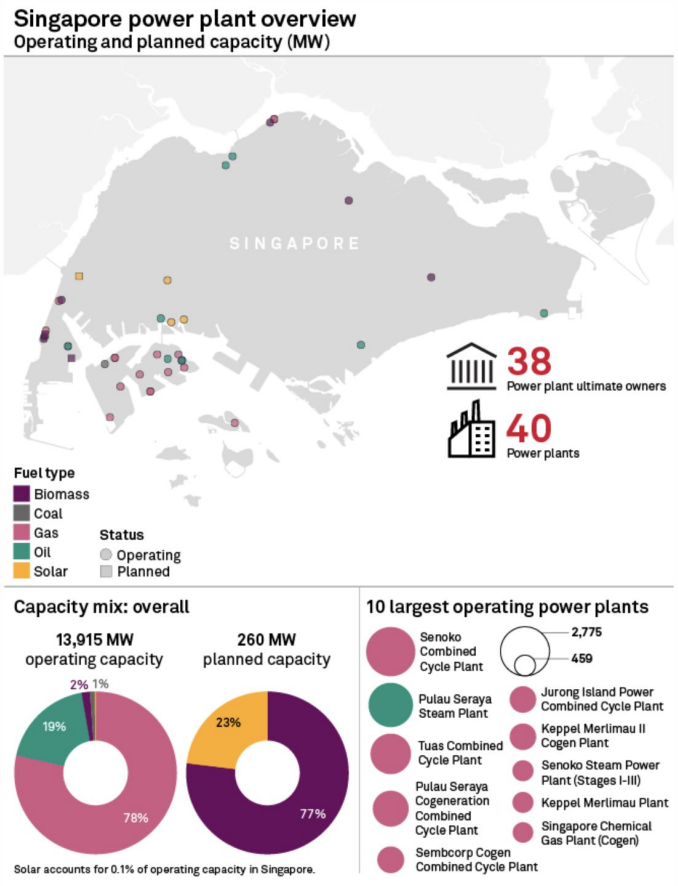
Total CO2 emissions in the port :	**475,326.852 Tonnes**
Transit mode CO2 Emissions:	167,846.71 Tonnes
Anchor mode CO2 Emissions:	25,197.424 Tonnes
Manoeuvring mode CO2 Emissions:	228,667.87 Tonnes
Alongside mode CO2 Emissions:	53,614.848 Tonnes
Overall electrical load:	**784.28 KiloWatt**
Daytime electrical load:	785.658 KiloWatt
Night time electrical load:	783.548 KiloWatt
Unique vessels visiting port:	2778 Vessels

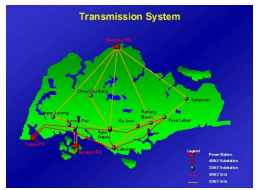
Real Time Data: https://www.marinetraffic.com/en/ais/home/centerx:103.8/centery:1.3/zoom:11

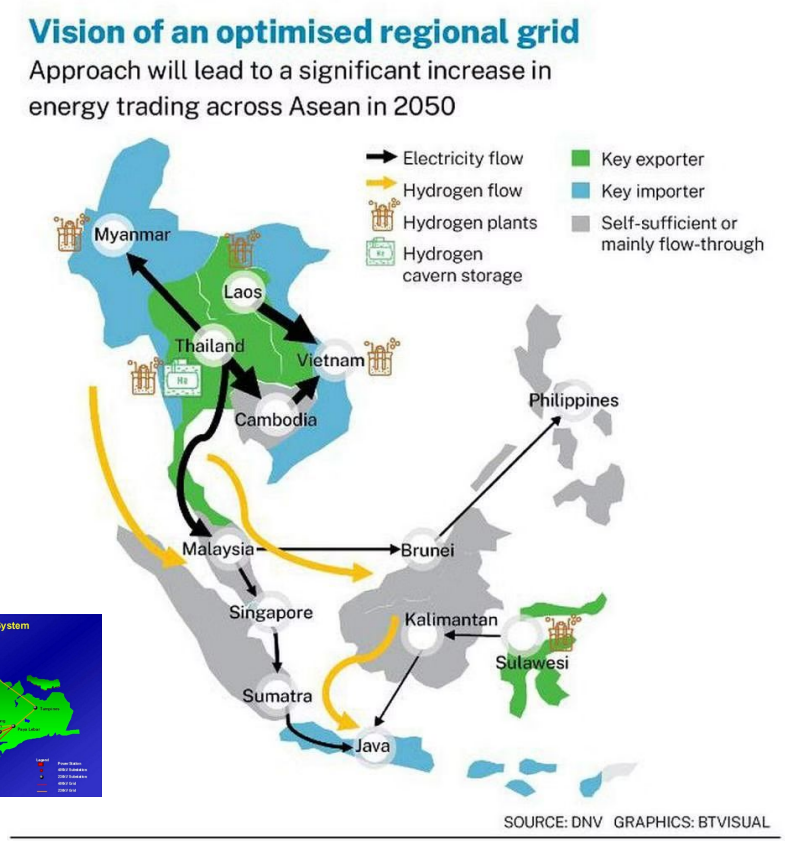


- 1) **Electrify vessels,** local and foreign
- 2) **Cleaner Energy Mix**: nuclear and renewables
- 3) Increase quantity **charging stations** for vessels
- 4) Reduce vessels delay and GHG emissions with **AI routing**
- 4) Connecting **ship data**, **environmental data** and **public health data** to reduce overall potential harm of our industry

Integration of Singapore in the Regional Grid







https://www.spglobal.com/en/research-insights/articles/daily-update-may-4-2022

https://www.businesstimes.com.sg/esg/asean-can-cut-grid-decarbonisation-costs-11-if-countries-cooperate-study

Delays in the Port (Rotterdam Case Study)

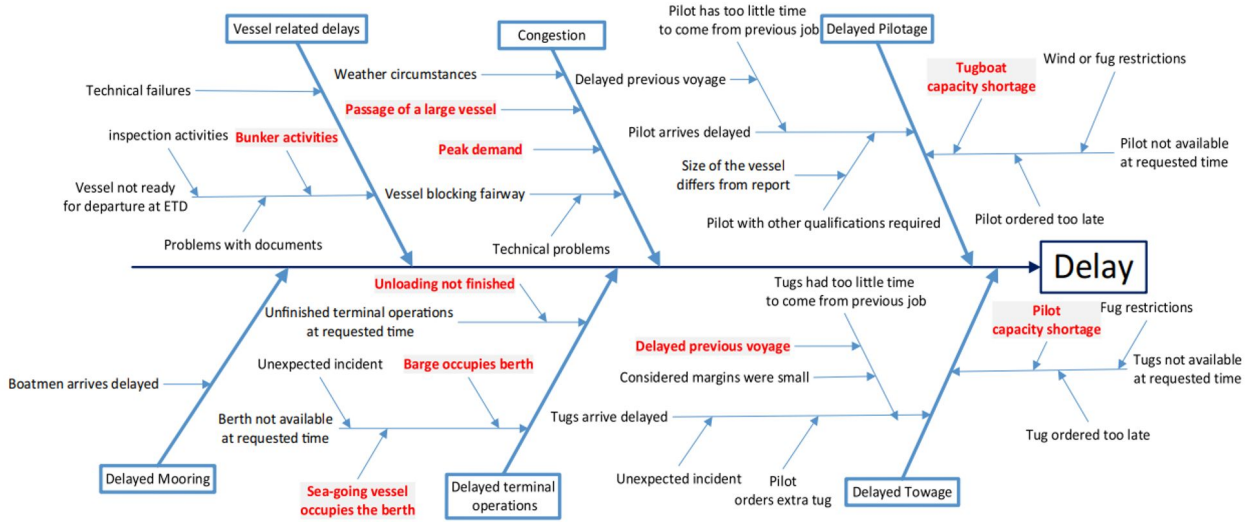
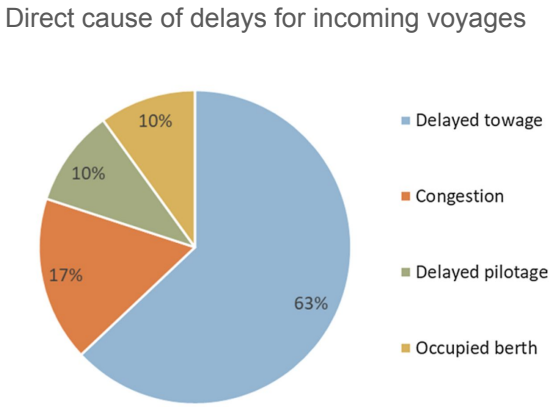


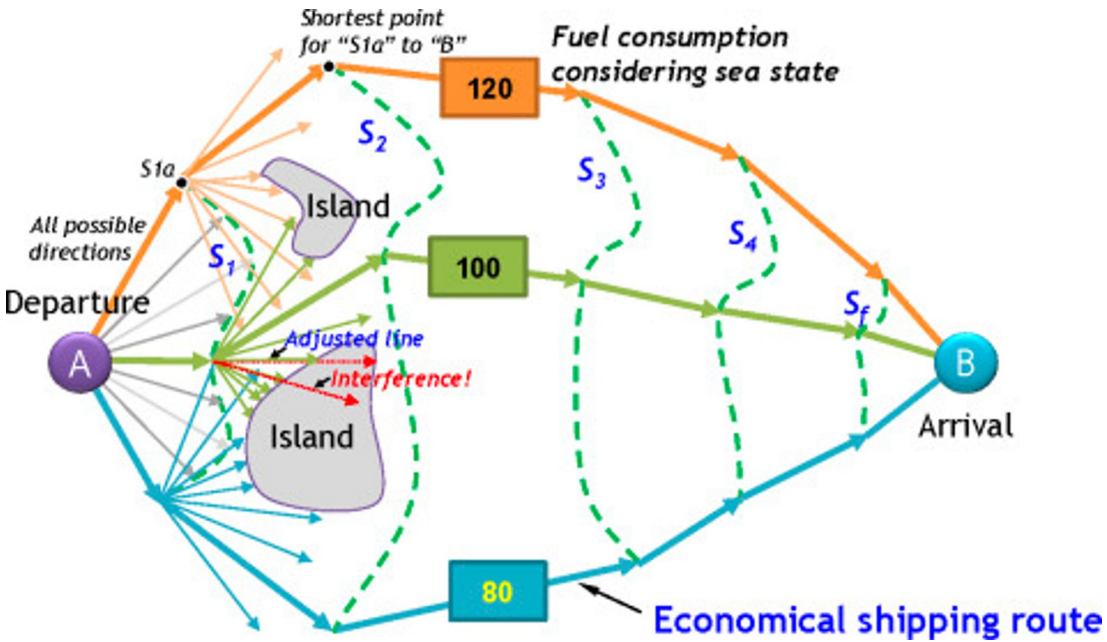
Fig. 6 Cause-and-effect diagram of delays in the Port of Rotterdam



"Information sharing to mitigate delays in port" by S. Nikghadam, F. Molkenboer, L Tavasszy, J Rezaei. https://link.springer.com/content/pdf/10.1057/s41278-021-00203-9

Reduce delays in port with electric charging with AI-powered routing, and more charging stations

Path Optimisation to Reduce Cost and Emissions



Data Analyzed

- Ship movements
- Weather conditions
- Port activities

Goal

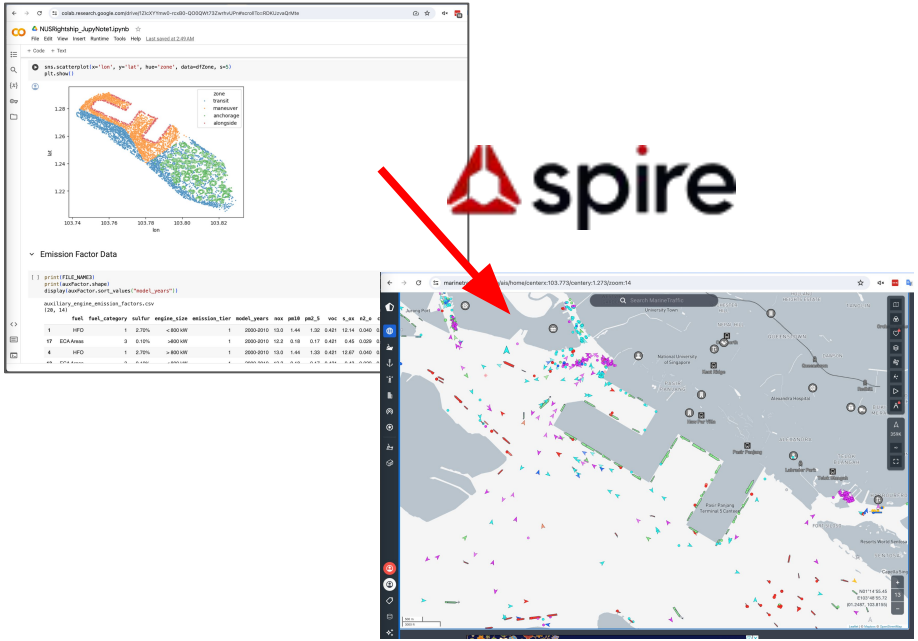
- Minimize waiting time
- Optimize route
- Streamline cargo movement

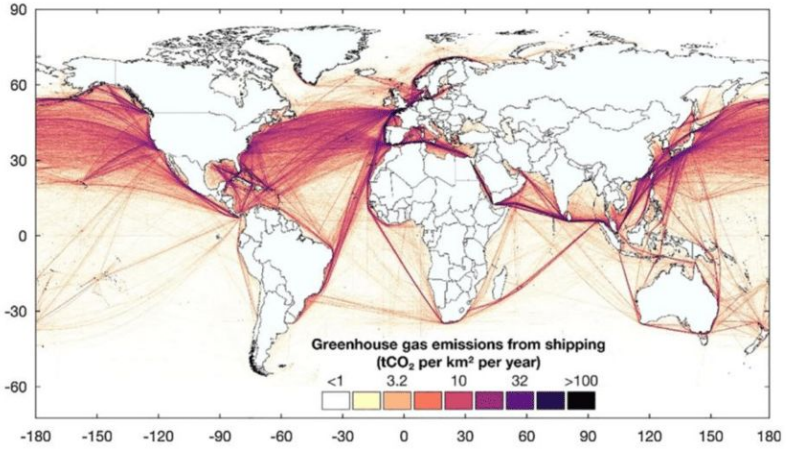
Result

- Reduced unnecessary fuel consumptions and emissions
- Identified opportunities for operational improvements
- Optimal berthing schedules
- Efficient use of infrastructure

"Determination of an economical shipping route considering the effects of sea state for lower fuel consumption" Myung-Il Roh. https://doi.org/10.2478/IJNAOE-2013-0130
https://www.sciencedirect.com/science/article/pii/S2092678216303958

Real-time AIS Data Visualization via API. Real time CO2 Simulation from Global AIS Data





Carbon Intensity Indicator

$$CII = CO2gr/(DWT*nm).$$

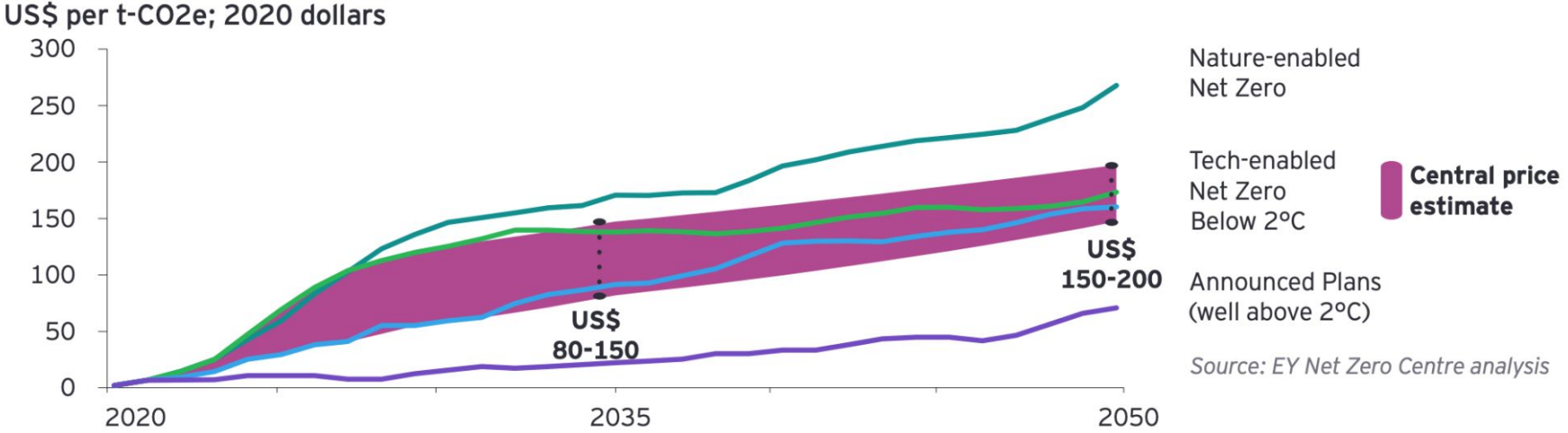
https://colab.research.google.com/drive/1ZIcXYYmw0-rcxB0-QO0QWt73ZwrhvUPn#scrollTo=RDKUzvaQrMte
https://spire.com/maritime/

https://www.researchgate.net/publication/363806269_Current_research_outlook_on_solar-assisted_new_energy_ships_representative_applications_and_fuel_GHG_emission_benefits/figures?lo=1&utm_source=google&utm_medium=organic
https://www.marinetraffic.com/blog/new-marinetraffic-carbon-calculator-supports-cii-compliance/

Projected Cost of Carbon Credits

Increasing demand, expectations of quality, and unit supply costs will make carbon credits scarce and expensive

Offset credit price outlook, 2020-2050



https://assets.ey.com/content/dam/ey-sites/ey-com/en_au/topics/sustainability/ey-net-zero-centre-carbon-offset-publication-20220530.pdf