Shifting Seas: A Case for Sustainable Shipping

Live Oak Consulting

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Who we are

Live Oak Consulting

Laura Key
Supply Chain

Steven Gooch
Marketing

Mia Barone
Marketing
Goal 14: Life Below Seas

"Conserve and sustainably use the oceans, seas, and marine resources for sustainable development."

– The UN 2030 Agenda for Sustainable Development
Supply Chain Overview

Manufacturer | Ocean Freight | Fulfillment | Shipping | Delivery

Inbound Logistics | Outbound Logistics
Amazon's Sustainability Commitment
Amazon Sustainability Report
June 2020

2030

Shipment Zero
Making all Amazon shipments net zero carbon through Shipment Zero, with 50% of all shipments net zero carbon by 2030.
Defining Shipment Zero

"Shipment Zero means that the fulfillment operations we undertake to deliver a customer’s shipment are net zero carbon—from the fulfillment center where an item is picked off the shelf, to the materials used to package the item, and the mode of transportation that gets the package to the customer’s door"

– Amazon Sustainability Report, June 2020
Shipment Zero + Inbound Transportation
Shipmenet Zero

Amazon's plan to make all deliveries carbon-zero, with half carbon-zero by 2030.

Fullfillment Facility Operations
Half of Fulfillment, Sortation, and Delivery Centers will be powered by wind projects, solar projects, or the clean energy grid, and therefore be net carbon zero, by 2030.

Packaging Materials
Ships In Own Container (SIOC), if already added by supplier, or net zero carbon packaging, will be used. Once Amazon receives them, half of all packages will not require additional carbon by 2030.

Outbound Logistics
50% of package deliveries of packages from fulfillment centers to distribution centers to businesses and homes will be net zero by 2030.

What if we dreamed bigger & went further?
Inbound logistics matter too.
Ex Works

When importing materials from other countries, Amazon follows import/export procedures defined by this INCOTERM.

Ex Works indicates that as the importer, Amazon takes responsibility for the items as packaged at the exporter’s warehouse or factory. The exporter is only responsible for the production and packaging of the product, and Amazon’s contracted carrier must load the goods onto a truck and take responsibility for the goods until they reach their fulfillment warehouse.
Transportation of Goods from Beijing, China to Amazon Fulfillment Center in Riverside, California

- **Ex Works @ Work**
- **Production & Packaging**
- **Loading & In-Country Transport**
- **Ocean Shipping & Insurance**
- **Customs**
- **Truck Transport**
- **Sorting & Fulfillment**

**Supplier**

**Transfer Responsibility**

**POSESSION** - Beijing Joyo Courier Service

**NVOCC** - Amazon
House Bill of Lading, Insurance, & Customs
Environmental Impact of Shipping
Shipping oxides have an acidifying effect on the marine environment.

Sulfur and nitrogen oxides are produced and released during fuel combustion.

Bunker fuel (HFO) is used for shipping and contains a high amount of sulfur.

Pollution from 1 cargo ship = pollution from 50 million cars

*Environmental Challenges in Maritime Transport*, University of Ljubljana
Calculated surface water pH changes arising from shipping-derived inputs of SOX and NOX.

Fuel mix for vessel types.

Bunker fuel makes up a large proportion of the merchant fleet's power.

HFO = Heavy Fuel Oil; MDO/MGO = Marine Diesel/Gas Oil; LSHFO = Low Sulfur Heavy Fuel Oil; LNG = Liquefied Natural Gas.

Direct Impacts of Shipping Emissions

- Reduced Calcification
- Erosion of Coral Reefs
- Adverse Effects on Human Health
What is slow steaming?

In slow steaming, a container ship travels at a speed of around 12–19 knots instead of the usual 20–24 knots.

Reducing the speed cuts down fuel and cargo emissions.
Fuel consumption of ships depends on the steaming speed

According to OOCL data, increasing speed by a couple of knots burns almost 50% more fuel per unit of distance traveled.

“The impact of slow ocean steaming on delivery reliability and fuel consumption”, Logistics and Transportation Review
Striking a balance

Findings from the University of Hamsburg suggest that the profits for many container vessels decline after speeds surpass approximately 20 knots.

"Slow steaming in container shipping", Hawaii International Conference on System Sciences
Win – win

1. Lower fuel costs
2. Reduced emissions

How will we implement this?
Implementation of Slow Steaming
Amazon's economies of scale give them a bargaining advantage. While costs to Amazon will not decrease, the ecological cost will. Courier Services will benefit from lower fuel costs, which will offset the opportunity cost of additional freight carried.

Amazon has the scale to develop their own networks, similar to what currently exists as Amazon Global Logistics. Though it requires an additional capital investment, the value-add is in the independence and security of Amazon's network.
Financial Implications

One-Time Costs:
• Increasing Size of Ship Fleet – $10.9M
• Converting Engines for Slow Steaming – $200K
• Increasing Inventory Carrying Cost (to Amazon)

Long-Term Savings:
• Reducing Gas Consumption – $12M / year

From a carrier's view...
• $925,000 gain per ship in first year of slow steaming

A Carrier's View
(per one 8,000 TEU ship)

<table>
<thead>
<tr>
<th>Item</th>
<th>One-Time Costs</th>
<th>Long-Term Savings (per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase Ship Fleet Size</td>
<td>$10,900,000</td>
<td>-</td>
</tr>
<tr>
<td>Engine Conversion</td>
<td>$200,000</td>
<td>-</td>
</tr>
<tr>
<td>Bunker Fuel Savings</td>
<td>-</td>
<td>$12,026,500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$11,100,000</strong></td>
<td><strong>$12,026,500</strong></td>
</tr>
</tbody>
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*see financial support in Appendix
Ethical Implications

Utilitarianism

How can our solution provide the greatest benefit overall?
Amazon's courier service suppliers will save on rising fuel costs by implementing slow steaming.

All humans breathe easier – the same gases that cause ocean acidification also pollute the atmosphere.

The shift would not only directly combat rising rates of surface water acidification, but it would substantially reduce GHG emissions as well.
As an NVOCC, Amazon bears full legal responsibility for cargo.

Amazon has a license from the Federal Maritime Commission to operate as an NVOCC from China to the U.S.

Cargo is carried under Amazon’s own Bill of Lading. As an NVOCC, Amazon pays for fuel (both charterer and carrier).
A Deep Dive – Fleet Size Increase

1. Days in Port v. Days on Ocean
   • Average of .69 days in port per trip
   • Average of 45 days per trip
   • In a year, ~8 trips, ~6 days in port, **359 days at sea**

2. Additional Ship Capacity Needed
   \[ F_1 = F_0 \frac{DAS_0}{1 - \%SR} + 365 - DAS_0 \]
   • 0: baseline case
   • 1: speed reduction case
   • F: fleet
   • DAS: days at sea – 359
   • SR: speed reduction – 10%
   • **1.109 ships** for every 1 ship currently in operation
   • **10.9% increase in container ships for slow steaming**
   • Average ship of 8,000 TEU costs $100M – **$10.9M capital investment per boat**
A Deep Dive – Bunker Fuel Savings

1. Days in Port v. Days on Ocean Revisited
   • Average of .69 days in port per trip
   • Average of 45 days per trip
   • In a year, ~8 trips, ~6 days in port, 359 days at sea

2. Bunker Fuel Savings (MT=Metric Ton)
   • Pricing: $507/MT in Los Angeles, $490.5/MT in Hong Kong
   • Average Price: $498.75/MT
   • 8,000 TEU ship burns 225 MTs / day, reduction of 30% would be 157.5 MT/day
   • Cost/day to operate normally: $112,000
   • Cost/day to slow steam: $78,500
   • $33,500 savings per day * 359 days = $12,026,500