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Executive Summary

The Port of Long Beach (POLB) designed the Green Ship Incentive Program in order to improve air quality. This program functions as an incentive scheme encouraging shipping companies to deploy a greater number of lower-emissions ships. The program utilizes the International Maritime Organization (IMO) standard that rank the emission rates of ships by tiers from worst to best — from Tier 0 to Tier 3. POLB awards $2,500 to a shipping company each time one of its Tier 2 ships comes to port. Intuitively, this incentive should entice shipping lines to send cleaner ships (i.e. of a higher Tier) in order to receive the monetary award. However, a new ship costs substantially more than a monetary award of a few thousand dollars, and POLB has a limited budget for such awards. In light of this policy challenge, our paper assesses other factors related to a monetary incentive that could increase shipping lines' deployment of Tier 2 ships to POLB and other ports in the Pacific.

The incentive program registration process can pose significant administrative burdens for companies. Currently, shipping lines' decisions to deploy ships are based on cost, route, size, and market demand, without considering Tier level. Shipping lines participate in the Green Ship Incentive Program and equivalent offerings at other ports already, but the program registration process demands significant administrative work from companies. We aim to increase shipping lines' willingness to deploy cleaner ships by, on the one hand, improving their customer experience and mechanisms for communication and feedback and, on the other hand, lowering administrative costs.

Focusing only on container ships, our policy options could impact the route and the administrative cost components of decision making by: (1) creating a new entity with other ports in the Pacific using a centralized data sharing platform, (2) collaborating with Pacific ports

managed through existing maritime alliances, or (3) utilizing a third-party environmental index to manage the incentive program. This study will evaluate proposed policy options according to the following criteria:

(1) Potential to Increase the Share of Tier 2 ships

(2) Financial Feasibility

(3) Political Adaptability

(4) Accountability

These elements will receive further attention and explanation in a later section of this report. Ultimately, we recommend that the current informal working group among Pacific ports establish a new, formal collaboration — the Pacific Port Partnership — and create and utilize an information portal (referred to as the Pacific Environmental Portal) to centralize data and communications with shipping lines. This strategy would improve shipping lines' awareness of Pacific port incentive programs and reduce the resources required to apply for ports' separate incentive offerings.

Client

This document serves as an advisory report to the Planning and Environmental Affairs Bureau in the City of Long Beach's Harbor Department, more commonly known as the Port of Long Beach (POLB). Located in the San Pedro Bay along the coast of Southern California, POLB ranks as the second-busiest port in the United States for ship container traffic.[1] This high volume of marine traffic makes POLB and its operations a significant source of economic activity and pollution for neighboring communities. For instance, findings from the 2011 City of Long Beach Community Health Assessment indicate that asthma afflicted about 55,000 Long Beach residents.[2]

Annual emissions inventories of air pollution sources have indicated that the majority of POLB's air pollution, particularly nitrogen oxide (NO_x) and sulfur oxide (SO_x) emissions, comes from shipping vessels.[3] This report will focus on container ships, which are the majority of ship types that call at POLB. The Green Ship Incentive Program is one of POLB's environmental programs intended to reduce ship air emissions. The incentive program provides $2,500 per Tier 2 ship call at POLB. 17 of 34 companies that deployed vessels to POLB sent one or more Tier 2 ships in 2017, but only five of these companies had their Tier 2 ship calls exceed 50% of their total calls at POLB.

[1] "About the Port". Port of Long Beach, accessed January 26, 2018 at http://polb.com/about/default.asp

[2] "2017 Clean Air Action Plan Draft Document - Final," accessed February 16, 2018, http://www.cleanairactionplan.org/documents/clean-air-action-plan-2017-draft-document-final.pdf, 19.

[3] "Air Emissions Inventory - 2016," Port of Long Beach, July 2017, prepared by Starcrest Consulting Group, LLC, accessed May 6, 2018, at http://polb.com/civica/filebank/blobdload.asp?BlobID=14109, p. ES-4.

List of Acronyms and Terminologies

AAPA American Association of Port Authorities

CAAP Clean Air Action Plan, a joint environmental sustainability initiative between the Ports of Long Beach and Los Angeles to reduce their air emissions

CARB California Air Resource Board

Call A ship's stop at a given port

COx Generic chemical formula for Carbon Oxides, a type of air pollutant

CSI Clean Shipping Index; a third-party organization that gives shipping lines a means of measuring ship emissions through levels (1-5)

ECA Emissions Control Area, a geographic area where air emissions restrictions apply

ECSA European Community Shipowners Association

EEDI Energy Efficiency Design Index; measures ship's theoretical CO_2 emission performance

EVDI Existing Vessel Design Index; developed by Rightship for ships without EEDI, measures ship's theoretical CO_2 per nautical mile travelled

ESI Environmental Ship Index; an index provider and program under the International Association of Ports and Harbors (IAPH) that gives shipping lines a means of measuring ship emissions through scores

GHG Greenhouse Gases; gases in the atmosphere that trap heat, including, but not exclusive to, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (NO_x), and ozone (O_3), SO_x and NO_x

Green Ship 1. POLB's program to incentivize deployment of lower-emissions ships, and

2. Terminology for more environmentally friendly vessels, with a higher International Maritime Organization-designated engine tier, higher ESI score, or higher CSI level

IAPH International Association of Ports and Harbors

ICS International Chamber of Shipping

IMO International Maritime Organization

Informal Working Group/ Stakeholder Ports

Current working group to address air quality-related programs, particularly clean ship programs; members include the Ports of Long Beach and Los Angeles (San Pedro Bay Ports), Oakland, Portland, Seattle and Tacoma (Northwest Seaport Alliance), Vancouver (Canada), Prince Rupert (Canada), Yokohama (Japan), Shanghai (China), and Antwerp (Belgium)

Index Provider

Third party organization/independent program that provides a rating system to qualify for port environmental incentive programs. Examples: ESI, CSI, Green Award, Green Marine, Rightship, Clean Cargo Group

Keel Laid Date

The day that ship construction formally begins, with a lower-emissions ship normally associated with a more recent keel laid date

NOx Generic chemical formula for Nitrogen Oxides, a type of air pollutant

NWSA Northwest Seaport Alliance; consists of the Ports of Seattle and Tacoma

Pacific Port Partnership

Suggested formal collaboration format between the Ports of Long Beach, Los Angeles, Oakland, Seattle, Tacoma, Vancouver, Prince Rupert, Yokohama, and Shanghai

Pacific Environmental Portal

This term is interchangeably used with "centralized data platform," and refers to a suggested information-sharing portal between ports and shipping lines that would contais information about incentive programs, customer service feedback, incentive collection, as well as other Pacific Port Partnership environmental issues

PM Particulate Matter; pollutant particles in the air (not limited to dust, smoke, dirt)

PMSA Pacific Merchant Shipping Association

POLB Port of Long Beach

Sox Generic chemical formula for Sulfur Oxides, a type of air pollutant

String The route taken to reach all scheduled calls

TAP Technology Advancement Program; a component of CAAP utilizing joint public-private research and development, policy evaluation, and pilot projects to identify new air emissions control strategies

TEU Twenty-foot Equivalent Unit - measure of cargo capacity (1,360 $feet^3$ or 39 $meters^3$)

Tier IMO's classification of ship engines: Tier 0, 1, 2, 3 — higher is cleaner (i.e. 3 > 2)

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CHAPTER I
INTRODUCTION

I.1. Environmental Initiatives at the Port of Long Beach

The Port of Long Beach (POLB)'s environmental efforts began in 2003 with its Healthy Harbor Program, which emphasized initiatives focusing on air, water, wildlife, and sediment. This program paved the way for the adoption and implementation of POLB's Green Port Policy in 2005, expanding its policy emphasis to sustainability and community engagement. Among other environmental goals, the Green Port Policy specifically targets reduced ship air emissions.[4] POLB has collaborated since 2006 with the Port of Los Angeles (POLA) on the Clean Air Action Plan (CAAP), a joint commitment to reduce air pollution in the San Pedro Bay. The CAAP targets reductions in diesel particulate matter (DPM), sulfur oxides (SOx), and nitrogen oxides (NOx) from ships and requires that both ports maintain incentive programs designed to reward shipping companies for more environmentally friendly behavior.[5] These incentive programs include initiatives to slow ship speeds a certain distance away (e.g. 20 miles) from the port, modifications to ship technology in order to reduce air emissions, and provision of monetary rewards to companies based on calls by Tier 2 and above ships.

Our work with POLB focuses on their Green Ship Incentive Program, which provides monetary incentives to shipping lines for calls they make with Tier 2 and above ships at the Port. The Green Ship Incentive Program's incentive amounts vary according to engine tier, which the United Nations International Maritime Organization (IMO) defines by a ship's keel

[4] "White Paper", Port of Long Beach, accessed January 26, 2018, http://polb.com/environment/green_port_policy.asp

[5] "About the Plan," Clean Air Action Plan, accessed January 26, 2018, http://www.cleanairactionplan.org/about-the-plan/

laid date. As detailed in Table I-1 and Table I-2 below, ships with keel laid dates (recognized start date of a ship's construction) between January 1, 2011 and December 31, 2015 must meet Tier 2 engine standards, while ships with keels laid after January 1, 2016, are required to meet the Tier 3 standards.[5] These construction dates pair with lower sulfur oxide (SOx) and nitrogen oxide (NOx) limits. Higher-tier ships produce lower rates of emissions - i.e. Tier 3 vessels produce less air pollution than Tier 1 and Tier 2 vessels. POLB offers $2,500 per call for Tier 2 ships and $6,000 per call for Tier 3 ships,[6] although Tier 3 ships have yet to call in the US.

Tier	Date	NOx Limit, g/kWh		
		n < 130	130 ≤ n < 2000	n ≥ 2000
Tier I	2000	17	$45 \cdot n^{-0.2}$	9.8
Tier II	2011	14.4	$44 \cdot n^{-0.23}$	7.7
Tier III	2016†	3.4	$9 \cdot n^{-0.2}$	1.96

Table I-1. Marine Pollution Annex VI NOx Emission Limits[7]

Date	Sulfur Limit in Fuel (% m/m)	
	SOx ECA	Global
2000	1.50%	4.50%
2010.07	1.00%	
2012		3.50%
2015	0.10%	
2020		0.50%

Table I-2. Marine Pollution Annex VI SOx Emission Limits[8]

[6] "Green Ship Incentive Program," Port of Long Beach, accessed January 26, 2018, http://polb.com/environment/air/greenship.asp

[7] "International: IMO Marine Engine Regulations", DieselNet, accessed January 22, 2018, https://www.dieselnet.com/standards/inter/imo.php;

† means measures in NOx Emission Control Areas (Tier II standards apply outside ECAs)

[8] Ibid

I.2. Stakeholders

In addition to POLB, additional stakeholders relevant to this report are other ports, shipping lines, industry associations, and index providers. The differing priorities of these stakeholders naturally complicate the dynamics of policy-making in this industry, as with other economic sectors. We will utilize the concept of polycentricity to assess challenges to achieving substantial ship emissions reductions and how collaboration among stakeholders may serve as a policy solution. Polycentricity is characterized by multiple governing authorities, rather than a single, monocentric authority.[9] Each governing authority implements regulations within its own domain — such as a national government for the contiguous boundaries of a given country and a municipal government within city limits. Polycentric systems are valuable because participants can observe other policy approaches and develop improved implementation strategies of their own over time.[10] In the context of our report, this cooperative, polycentric approach offers a greater scale of opportunity to reduce greenhouse gas (GHG) emissions.[11]

I.1.1. Informal Working Group Ports

POLB is involved in an informal working group of ports interested in collaborating on environmental programs. Except for the Port of Antwerp in Belgium, all of the working group's ports are located along shipping routes (also known as "strings") in the Pacific; the working group's membership consists of the Ports of Long Beach, Los Angeles, Oakland, Portland, Seattle, Tacoma, Vancouver, Prince Rupert, Yokohama, and Shanghai. Since these

[9] V. Ostrom. "Polycentricity (Parts 1 and 2). In: McGinnis, M. (Ed.), "Polycentricity and Local Public Economies". University of Michigan Press, Ann Arbor, (1999): 52–74, 119–138.

[10] E. Ostrom. "Polycentric Systems for Coping with Collective Action and Global Environmental Change: Global Environmental Change". no.4 (2010): 550–557.

[11] Ibid.

group members share a common ocean with one another, they are more likely to have ships that call along a common string.

Among the members, there are two existing port partnerships:

1. The San Pedro Bay Ports (POLB and POLA) and their Clean Air Action Plan (CAAP); and
2. The Ports of Seattle and Tacoma under the Northwest Seaport Alliance (NWSA).

These collaborations set precedent for cooperation among ports but still have their own vulnerabilities. For example, POLB and POLA have different approaches to their clean ship incentive programs (including different reward systems for cleaner vessels), and their proximity to one another creates competition for the same shipping customers. This competition for public recognition and ship calls thus undermines full cooperation between the two. NWSA is more integrated in business and investments than the San Pedro Bay Ports, but Seattle and Tacoma are managed through different operators.

Furthermore, these ports all offer distinct environmental programs with different standards and administrative requirements. These requirements are detailed in Table I-3, with incentive provider explanations in Chapter I.1.2.

Port	Green Ship Incentive, Participating in Index Provider		Green Ship Incentive under IMO Standard	Vessel Speed Reduction	Other Relevant Programs
Port of Long Beach	Not participating		Tier 2: $2,500/ call Tier 3: $6,000/ call	Yes	- Technology Advancement Program - Shorepower
Port of Los Angeles	ESI	Score 50+: $2,500/ call Score 40-49:$750/ call	Tier 3: $3,250 Tier 2: $750 Main Engine Demo: $750	Tier 1: 15% discount port fees Tier II: 30% discount port fees (1st day of dockage)	- SOx scrubber, replacement for shorepower - Incentive for Technology Advancement Program - Draft: charge higher fees for Tier 0/1
Port of Prince Rupert	ESI	Score 20-30: 10% discount Score >30-50: 20% discount Score >50: 50% discount	Yes. Paper application required		EEDI - 5% better than required: 10% discount - 10% better than required: 20% discount
	CSI	Yellow: 10% discount Green: 20% discount			
	Green Award	10% discount for all Green Award certified vessels			
	Rightship (GHG Level/ Environmental Level)	- GHG B,C OR Env 3+: 10% discount - GHG B AND Env 3+: 20% discount - GHG A: 50% discount			
	Green Marine (GHG Level/ Environmental Level)	- GHG Lv 3/Env Lv 2: 10% discount - GHG Lv 4 AND Env Lv 2: 20% discount - GHG Lv 5 AND Env Lv 2: 50% discount			
Port of Vancouver	Join ESI, CSI, Green Award, Right Ship, and Green Marine		Yes	Yes	LNG Program
Port of Tokyo	ESI	Score 20 - 29.9: 30% discount Score 30 - 39.9: 40% discount Score 40+: 50% discount			

Table I-3. Comparison of Port Clean Air Programs[12]

I.1.2. Sustainability Index Providers

Index providers are third-party entities that provide ports with systems to measure the sustainability performance of ships. Examples of providers include the Environmental Ship Index (ESI), Clean Shipping Index (CSI), RightShip, Green Marine, and Clean Cargo Working Group (Table I-4).

ESI, the most popular index, was developed under the World Ports Climate Initiative

[12] Working Document: "Incentive Programs in Pacific Ports" by Christine Rigby, Environmental Specialist in in Port of Vancouver. December 2017; Presentation: "Port Environmental Initiatives: The Vessel Perspective" by Lee Kindberg, Director of Environment and Sustainability in the Maersk Line. December 2017.

(WPCI) and is administered by the ESI bureau of the International Association of Ports and Harbors (IAPH). Adopted by 47 ports and approximately 5,500 vessels worldwide,[13] ESI is utilized as a tool to assess a ship's NO_x, SO_x, and CO_x emissions, as well as whether the vessel has On-shore Power Supply (OPS) capability. These four inputs are calculated to produce scores used by ports to determine ships' eligibility for environmental program rewards. Based on these data and their subsequent scores, ships receive a certificate. Along with completed program registration forms, these certificates are a prerequisite for the receipt of monetary awards from port incentive programs. Once an ESI-registered vessel calls at a participating port, a monetary award is credited or disbursed according to the ship's ESI score. As we will discuss later, ESI is included in one of our policy options because of its high utilization by both shipping lines and ports, as well as its strong focus on air quality.

No	Environmental Criteria		ESI	CSI	Clean Cargo Working Group	Green Award	Green Marine	Rightship
1	Exhaust emission	CO_2	✓	✓	✓	✓	✓	
2		SOx	✓	✓		✓	✓	
3		NOx	✓	✓		✓	✓	
4		PM		✓				
5	Engine	EEDI/EVDI						✓
6		OSP Supply	✓			✓		
7	Waste Management			✓		✓	✓	
8	Water Ballast			✓		✓		
9	Fluids (Fuel, Oil, Water)						✓	
10	Chemical Balance			✓				
11	Underwater Noise						✓	
12	Navigation in "sensitive area"					✓		
13	Anti-Fouling					✓		
14	Ship Breaking					✓		

Table I-4. Comparison of Criteria Between Index Providers[14]

[13] "About ESI", Environmental Ship Index", accessed January 22, 2018, http://www.environmentalshipindex.org/Public/Home/AboutESI

[14] "Formulas", Environmental Ship Index", accessed January 28, 2018, http://www.environmentalshipindex.org/Public/Home/ESIFormulas
"Global_Maritime_Trade_Lane_Emissions_Factors", Clean Cargo Working Group, accessed January 28, 2018, https://www.bsr.org/reports/BSR_CCWG_2016_Global_Maritime_Trade_Lane_Emissions_Factors.pdf

I.1.3. Shipping Lines

The shipping industry has experienced a major shift in recent years. The early 2000s were a boom period in which increased global demand for containerized trade led to heavy investment in ship fleet expansion, especially toward the purchase of larger vessels. However, the global recession impacted trade demands, straining the industry after a period of large-scale investment.[15] While the recession has since ended, the industry is still in a state of recovery and financial sensitivity after intense losses.

To achieve its CAAP goals, POLB must reduce major air pollution from sea-based traffic entering and exiting the port without reducing the cargo volume it receives. For this project, POLB requested analysis of how to increase the effectiveness of its Green Ship Incentive Program so that lower-emissions ships comprise a greater share of vessels calling at the Port and local air pollution levels decrease. Despite gradual improvements in these domains, shipping companies have not changed the makeup of their fleets in the time or manner preferred by POLB and other ports.

We have chosen to focus on analyzing shipping lines' decisions to deploy cleaner (Tier 2) ships and how incentive programs can affect this behavior. Among the 11 member ports of the working group, we were able to collect data from five ports. Within this data there are 15,077 port calls made by 17 shipping line companies at those five ports, across the following years: POLB and POLA (2012-2017), Oakland (2016-2017), and Seattle and

"How It Works", Clean Shipping Index, accessed January 28, 2018, http://cleanshippingindex.com/how-it-works/
"Requirements", Green Award, accessed January 28, 2018, http://www.greenaward.org/greenaward/346-requirements.html
"GHG Emission Rating", Rightship, accessed January 28, 2018, https://site.rightship.com/sustainability/ghg-rating/
"2016 Performance Report", Green Marine, accessed January 28, 2018, https://www.green-marine.org/wp-content/uploads/2017/05/2016_Performance_Report.pdf

[15] Bomboma Kalgora and Tschibuyi Mutinga Christian. "The Financial and Economic Crisis, Its Impacts on the Shipping Industry, Lessons to Learn: The Container-Ships Market Analysis," Open Journal of Social Sciences 4, (2016): 38-44. http://dx.doi.org/10.4236/jss.2016.41005

Tacoma (NWSA) (2016). This dataset accounts for 86.4% of all port call data we received. Table **I-5** shows a breakdown of ship calls, incentives received, and administrative costs for 17 shipping lines.

No	Shipping Line Companies	(a) Total Call	(b) Total Call made by Tier 2	(c) Percent of Tier 2 ships (b/a)	(d) Total of Monetary Incentive	(e) Total Administrative Cost
1	Mediterranean Shipping Company	426	62	14.6%	$ 105,500	$ 367,893
2	Evergreen Line	425	82	19.3%	$ 122,250	$ 368,571
3	Nippon Yusen Kaisha	419	0	0.0%	$ 139,250	$ 352,020
4	Hapag-Lloyd	353	12	3.4%	$ 31,500	$ 301,515
5	Matson	347	40	11.5%	$ 100,000	$ 268,968
6	American President Line	324	108	33.3%	$ 89,750	$ 280,323
7	Hamburg_Sud	263	35	13.3%	$ 85,000	$ 197,106
8	Maersk Line	244	11	4.5%	$ 750	$ 199,052
9	Mitsui O.S.K. Line	240	34	14.2%	$ 81,500	$ 207,549
10	Kawasaki Kisen Kaisya	218	39	17.9%	$ 58,000	$ 187,968
11	COSCO	211	50	23.7%	$ 100,000	$ 183,194
12	YangMing Marine Transport	194	50	25.8%	$ 64,000	$ 167,880
13	Orient Overseas Container Line	184	35	19.0%	$ 94,500	$ 159,648
14	Hanjin Shipping	164	43	26.2%	$ 61,250	$ 142,239
15	CMA CGM	144	7	4.9%	$ 18,250	$ 125,271
16	China Shipping	124	29	23.4%	$ 42,750	$ 107,619
17	United Arab Shipping Company	32	14	43.8%	$ 15,500	$ 27,840

Table I-5. Summary of 17 Major Shipping Lines' Calls at the Ports of Long Beach, Los Angeles, Oakland, Tacoma, and Seattle in 2016[16]

Among the 17 shipping lines, Mediterranean Shipping Company has the highest number of calls at these ports, followed by Evergreen Line, Nippon Yusen Kaisha, and Hapag-Lloyd. United Arab Shipping Company deployed the highest percentage (43.75%) of Tier 2 ships that called at POLB, POLA, Oakland, and NWSA, but their total number of ship

[16] Source Data: POLA, POLB (2012-2018), Port of Oakland (2016-2017), Seattle and Tacoma (2016). Although COSCO and China Shipping have been merged into China COSCO Shipping Corporation Limited in January 4, 2016, we distinguished these two companies because our data from the ports distinguishes these companies in 2017.

calls is much smaller than those of the other companies. The significantly higher percentage of Tier 2 ship calls by United Arab Shipping Company may be related to the smaller size of their fleet. This may be due to a decision to put company capital toward a lower number of Tier 2 ships, which are larger in size, rather than a greater number of Tier 1 or 0 ships, which tend to be smaller. There is not enough evidence to indicate a causal dynamic between share of Tier 2 calls and fleet size because this relationship varies dramatically across shipping lines.

II.2.1. Shipping and Port Associations

As global business enterprises, shipping lines must adapt to different trade dynamics, regulations, and policy requirements along their shipping routes. Shipping lines must keep up with a competitive technological landscape as well as changing environmental standards. Moreover, shipping lines must comply with a variety of laws relating to the types of goods they deliver. For these reasons shipping lines often create alliances, which are intended to overcome standardization issues and meet the needs of stakeholders around the world. These alliances are distinguished by their goals, including improved environmental performance (e.g. the Sustainable Shipping Initiative [SSI]), business focuses, geographic proximity (e.g. the European Community Shipowners Association [ECSA]), and service or streamlined supply chains (e.g. the International Chamber of Shipping [ICS]). Association membership is typically more important to shipping lines than to ports because of the logistical benefits it can provide.

On the other hand, ports are managed by cities and are minimally liable to outside entities or their regional authorities. Ports are typically in competition for ship traffic and would likely see a mutual alliance as beneficial if they could not sustain themselves independently or were unable to meet shipping demands. In this report, we will focus on two

associations with which POLB already works: the Pacific Merchant Shipping Association (PMSA) and the American Association of Port Authorities (AAPA).

PMSA is an independent, not-for-profit advocacy organization with a membership base consisting of 58 shipping companies, owners, and operators of marine terminals. It represents broad private sector interests, as well as individual member concerns, of owners and operators of marine terminals and ship vessels.[17] Examples of members include CMA-CGM, Evergreen Corp, Hapag-Lloyd, and Matson, Inc.[18] (Full list detailed in Table I-4.) PMSA provides members with current market and policy information relating to the shipping industry. However, PMSA currently has no collective strategy to address air pollution reduction.

AAPA consists of ports in the Americas — ranging from Bahia, Brazil; St. John's, Canada; to Guam. Much of AAPA's programming concentrates on politically advocating on behalf of ports,[19] as well as providing training for new port standards and regulations, increasing international business reach, enhancing stakeholder relationships, and creating social value within local communities.[20] However, currently AAPA does not have any programming specifically to address environmental collaboration among member ports.

[17] "Environmental Programs", Pacific Merchant Shipping Association, accessed January 22, 2018, http://www.pmsaship.com/environmental-programs.aspx

[18] "Membership", Pacific Merchant Shipping Association, accessed January 22, 2018, http://www.pmsaship.com/member-list.aspx

[19] "Advocating for the US Ports", American Alliance of Port Authorities, accessed January 22, 2018, http://www.aapa-ports.org/advocating/landing.aspx?ItemNumber=21134&navItemNumber=20764

[20] "Unifying Ports of the Hemisphere", American Alliance of Port Authorities, accessed January 22, 2018, http://www.aapa-ports.org/unifying/?navItemNumber=20762;
Lee Kindberg, Environmental Specialist at Maersk, interviewed on January 23, 2018.

II.2.2. Policy Problem

POLB's Green Ship Incentive Program is intended to increase the share of Tier 2 ship calls at the port. On the shipping line's end, they must decide from a long-term planning perspective when it is appropriate to purchase a new ship or retrofit an existing ship. Components that factor into buying new ships include depreciation value, time to realize return on investment, high shipping demand, and asset allocation. When shipping demand is higher, shipping lines prefer to lease rather than buy new ships. This creates less flexibility among their deployment options.

Furthermore, shipping lines' deployment decisions are affected by a number of other factors, including: (1) market demand (including the container delivery schedule) of the port at which they intend to call, (2) specifics of the delivery route for each port, (3) port terminal reliability, (4) port loading logistics, (5) operational speed, and (6) the cost of deployment relative to ship size.

From a day-to-day planning perspective, shipping lines develop port call schedules that prioritize these concerns and do not factor in the Tier levels of ships being deployed.[21] This means that shipping companies that do receive incentives are likely to be receiving them because of their separately considered purchasing and routing decisions, rather than because they are aiming to receive incentives. Given that ports continue distributing these incentives with the intention of encouraging shipping lines to continue deploying cleaner ships, it is important that these incentive programs address the aforementioned decision-making factors.[22]

[21] Lee Kindberg, Environmental Specialist at Maersk, interviewed on January 23, 2018.

[22] Chaug-Ing Hsua and Yu-Ping Hsieh. "Routing, Ship Size, and Sailing Frequency Decision-Making for a Maritime Hub-and-Spoke Container Network", Mathematical and Computer Modelling (2012): 899-916. https://www.sciencedirect.com/science/article/pii/S0895717706003244

The daily cost of transporting cargo is one of the main factors that determines a shipping line's deployment decisions. A shipping company's overall cost breakdown consists of variable costs (primarily fuel), depreciation costs, and fixed costs. Fixed costs include administration, crew, insurance, maintenance, and storage. Of these factors, ports are able to address storage and administrative costs.[23]

A number of dynamics have restricted the rate of increase in the share of lower-emissions ships in the global fleet. Firstly, the cost of purchasing new, lower-emitting ships far exceeds any individual port monetary incentive for them, with daily operating costs on par with monetary amounts that ports with incentive programs typically offer.[24] Secondly, firms must also consider the priorities of customers whose goods they ship, deployment schedules, terminal ports' ability to efficiently unload cargo, among other factors. Thirdly, shipping line alliance membership plays a role in ship string schedules and deployment decisions. Lastly, North America often receives ships after they have finished their circulation in Europe, meaning that West Coast ports will likely have to wait longer to see lower-emissions ships call at their ports.

Consequently, ports have begun to explore collaboration with one another to accelerate progress toward shared environmental goals along Pacific trade routes and improve their customers' experiences. Collaboration is a form of the aforementioned polycentric governance system. Maritime polycentrism would appear to have a positive impact on air pollution regulation because of its collaborative capacity.[25] One of the main challenges to interport collaboration, though, is the integration of varying incentive-based

[23] Randy Smith, Port Trade Analyst at POLB, interviewed on February 13, 2018.

[24] Interviews with various ports

[25] E. Ostrom. "Polycentric Systems for Coping with Collective Action and Global Environmental Change: Global Environmental Change". no.4 (2010): 550–557

environmental programs. Polycentric governance is subject to high transaction costs due to: (1) Coordination costs, such as those spent on negotiation, monitoring, and enforcing agreements, as well as the budget necessary for monetary incentives as well as staffing, (2) Information costs associated with searching for and organizing information, as well as the errors resulting from low-quality or incomplete information, and (3) Strategic costs that result from asymmetries in information, power, or other resources such that some obtain benefits at the expense of others.

Variations in regulations between the different regions, states, and countries along the West Coast further complicate interport collaboration. One port's voluntary emissions goal may be another's regulatory mandate, as is the case with California and its requirement for ships to plug into the onshore electrical power grid when berthed at port. In sum, transaction costs tend to increase when the number of participants and routine interactions in the system increases.[26]

II.2.3. Policy Goal

This report is intended to advise POLB on improvements in the execution of their Green Ship Incentive Program. Our approaches to this are twofold: address air emission issues that POLB has prioritized, and improve the customer experience of shipping lines in their deployment of clean ships.

Given the aforementioned policy issues, we have developed a research question centered on how to best incentivize shipping companies to deploy more container vessels with Tier 2 or above engines in order to reduce air pollution at POLB: ***What is the optimal strategy to increase the deployment of Tier 2 ships to POLB through incentive programs?***

[26] M. Levi. "A logic of Institutional Change and the Limits of Rationality." University of Chicago Press (1990).

CHAPTER II.
APPROACHES TO POLICY ENGAGEMENT

Having addressed the current context of POLB and the shipping industry more broadly, we will now focus on policy approaches to the Green Ship Incentive Program. These approaches cover various ways the port incentive program could be formulated, as well as their limitations. This section is intended to address the connection between the current shipping industry paradigm and the policy options we have chosen to suggest, as well as those we felt were not feasible at this point in time. Our focuses here include transparency of tax use in relation to a given program option, budgetary limitations for POLB , and maritime industry preferences.

II.1. Fees and Taxes

POLB's current program is premised on rewarding shipping companies for their deployment decisions. However, the program could instead be restrictive toward pollution, potentially through the imposition of taxes or fees on less clean ships, or through a cap-and-trade style system. In both cases it is likely that without collaboration from other ports, especially the nearby POLA, POLB would lose business to competitors because their emission program would be viewed as punitive and less desirable compared to incentive-style programs. Because of the competitive nature of the shipping industry, a restrictive policy would not be viable for the port's business model. Moreover, incentives should theoretically be more effective in promoting changes in behavior rather than imposing a hard intervention through taxes or fees.[27]

[27] Alfie Kohn. "Punished by Rewards". Boston: Houghton Mifflin (1999).

II.2. Non-Monetary Incentives

The current Green Ship Incentive Program design is oriented around the provision of monetary incentives to promote desired behavior from shipping companies. These incentives are expensive and are restricted by POLB's budgetary limitations. POLB's Vessel Speed Reduction (VSR) offers an example of a non-monetary environmental program, including the associated limitations. The program has a high participation rate and shipping lines like the awards given (customized flags presented annually). Non-monetary incentives like VSR programs are are effective both because these programs don't require monetary investment from the ports that implement them and because they have are mutually beneficial to shipping lines — reduced speed is associated with reduced fuel consumption.[28] We expect that a non-monetary incentive is unlikely to elicit changes in behavior from shipping lines when that behavior requires higher fiscal costs, although it is important to note that environmental programs should consider the interest shipping lines have in saving money.

II.3. Monetary Incentives

POLB's current Green Ship Program utilizes a monetary incentive setup to promote shipping behavior. There are several types of adjustments that can be made to the incentive program, including increasing the incentive amount, tapering the incentives over time, and pooling the incentive amount with other ports. However, these adjustments face their own restrictions. Increasing the incentive amount would be well-received by shipping lines, but unless the amount matched operational costs it is unlikely to substantially change their deployment; currently POLB does not have the budget for this. POLB could also reduce the incentive amount over time in order to induce more urgency among shipping lines. This

[28] Lee Kindberg, Maersk, interviewed on January 23, 2018;
Thomas Jelenic, PMSA, interviewed on February 19, 2018

would potentially save money, but would risk losing business, particularly Tier 2 ships, to rival ports, especially to nearby POLA with its competitive monetary incentives.

II.4. Collaboration

On its own, POLB faces a number of restrictions developing its incentive program, including budgetary limitations and competition from other ports. Arguably, the most direct way to address both issues would be collaboration between POLB and other ports. Jointly pooling incentives represents one possibility, but this is not possible within the current public budgeting system given that funding allocated to ports must be spent on those ports. Another option would be to merge with POLA into one entity for the San Pedro Bay ports, rather than continuing to partner with them for initiatives such as the CAAP. This has been discussed among stakeholders but has not taken off, and faces complications in terms of jurisdiction and competition between the ports.[29] The option is not impossible but is not expediently viable.

Beyond POLA, collaboration is possible with a larger range of ports and other entities. POLB has connections with various ports on the West Coast, including POLA, the Ports of Oakland, Seattle, and Tacoma, as well as the Canadian Ports of Vancouver and Prince Rupert. These ports have been working under an informal working group, and their member presence along shipping lines would provide them with greater political power. One possibility would be to form a new entity representing all of these ports collaboratively.

Similarly, there are several maritime organizations that POLB (and affiliated other ports) could collaborate under. These include the American Association of Port Authorities (AAPA), which politically represents ports, and the Pacific Maritime Shipping Organization

[29] Christine Rigby, Environmental Specialist at Port of Vancouver. Interviewed at October 10, 2017; Renee Moilanen, Environmental Specialist at POLB, Interviewed at November 14, 2017.

(PMSA), which politically represents shipping lines. There is also the Environmental Ship Index (ESI), which is administered through the International Association of Ports and Harbors (IAPH) and is used by many ports as a basis for their incentive programs.

Collaboration through a new or existing entity offers the best chance for POLB to increase the share of Tier 2 ship calls given the port's budget limitations and the market competition inherent to the industry. Considering that there is a principal-agent problem with the future use of incentive money from ports to shipping lines, any form of collaboration requires solid feedback mechanisms to track how shipping lines currently perform at the ports along Pacific lines. While reporting and feedback usually mean additional administrative costs, collective requirements among the collaborative ports would be less burdensome for the customers. Large-scale collaboration will be necessary for both communication among ports and communication between ports and shipping lines about their incentives and other environmental programs. Therefore, we will be focusing our policy recommendations on methods of collaboration.

CHAPTER III.
DATA ANALYSIS

III.1. Current Administrative Works

Improving customer experiences with incentive programs requires a substantial amount of administrative work.[30] This is in part because integrating environmental standards into business practices shifts attention from shipping coordination.[31] Administrative costs are also the only cost ports are able to address with regard to shipping line deployment decisions, and thus these costs are relevant to POLB's incentive program.

There are of course differences in the administrative burdens associated with environmental programs run by the informal working group member ports. For example, POLB requires shipping lines to submit tax forms, while POLA utilizes ESI, which requires more procedural work but is arguably simpler for ports to use. **Table I-5** summarizes calls at Pacific ports that share the same shipping strings, while Table III-1 shows the total port calls for the Ports of Long Beach, Los Angeles, Oakland, and Seattle and Tacoma through the NWSA for 2016.

Annual Data	POLB	POLA	NWSA	Oakland	Total
Port Calls	961	1,256	1,143	1,691	5,051
Unique Vessel Calls	265	308	241	466	1,280
Shipping Line Companies	33	22	28	22	105

Table III-1. Summary of Port Calls – POLB, POLA, Oakland, NWSA in 2016[32]

[30] Lee Kindberg, Environmental Specialist at Maersk, interviewed on January 23, 2018.

[31] Chaug-Ing Hsua and Yu-Ping Hsieh. "Routing, Ship Size, and Sailing Frequency Decision-Making for a Maritime Hub-and-Spoke Container Network", Mathematical and Computer Modelling (2012): 899-916. https://www.sciencedirect.com/science/article/pii/S0895717706003244

[32] POLA, POLB (2012-2018), Port of Oakland (2016-2017), Seattle and Tacoma (2016).

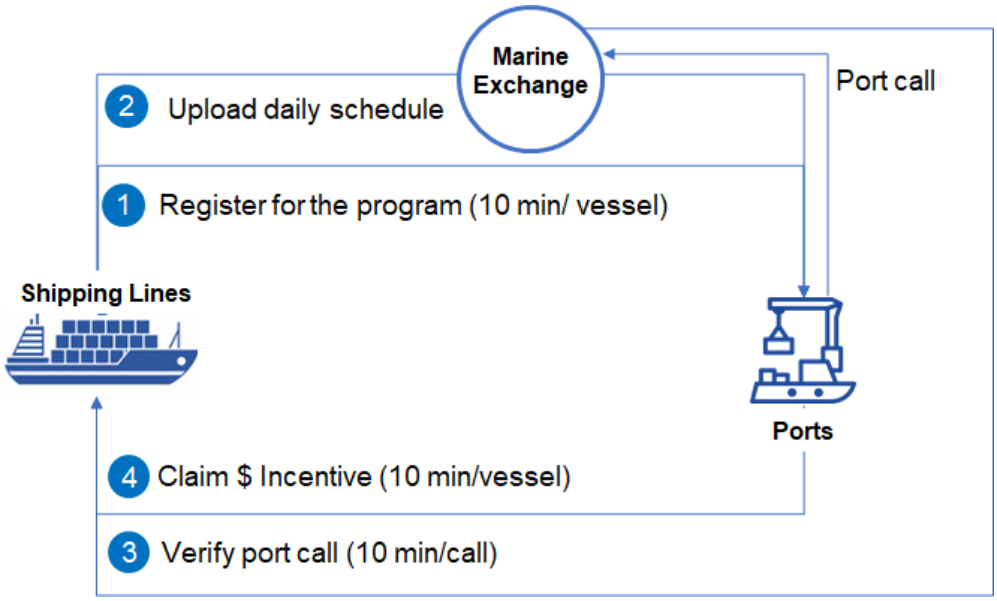

Figure III-1. Existing Port Program Flow of Information

Figure III-1 illustrates activities and the flow of information between ports and shipping lines, while Table III-2 shows the potential administrative workload for shipping lines that register at a given port. An assumption of 10 minutes per administrative task is used, based on average data entry speeds of 7,000 keystrokes per hour.[33]

Steps	Activities	Actors/Stakeholders	Value	Unit	Annual Hour
1	Register vessel/prepare documentations for port programs	Shipping lines (Operation) to Port (Operation)	10	mins/vessel	213
2	Upload daily dispatching schedule	Shipping lines (Operation) using Marine Exchange website	10	mins/company	18
3	Verify vessel arrival/ port call	Downloaded through Marine Exchange website, with Port (Operation) verification	10	mins/call	842
4	Collect incentive per vessel	B2B Financial Agreement with Port (Finance)	10	mins/vessel	213
				TOTAL ADM HOURS	**1,286**

Table III-2. Simulation of Shipping Line Administrative Work (Status Quo)

[33] "What is a Good Data Entry Speed", Data Entry Outsource Blog, accessed February 1, 2018, https://www.dataentryoutsourced.com/blog/what-is-a-good-data-entry-speed/

III.2. Regression Analysis: Potential Factors Affecting Tier 2 Ship Deployment

The objectives of the regression analysis are to address the following research concerns, which correspond to information gleaned from our qualitative research:

1. Testing the relationship between shipping lines' administrative costs and their deployment of cleaner (Tier 2) ships. Our interviews revealed contradicting perceptions among port staff and shipping line staff with regard to the importance of administrative costs to deployment of cleaner ships.[34]
2. Testing the extent to which the existence of financial incentive programs affects shipping lines' decisions to deploy cleaner ships. This is of concern because some shipping line staff mentioned that the existence of these programs is rarely considered in planning vessel deployment.[35]
3. Testing the relevance of the monetary amount provided by ports to shipping lines that deploy cleaner ships. Interviews with port staff revealed that some ports intend to lower the amounts provided through their environmental incentive programs.[36]

We have conducted our analysis using the previously discussed port call data, which consists of 15,077 total calls at 5 ports (Los Angeles, Long Beach, Seattle, Tacoma, and Oakland) made by 17 shipping companies between 2012 and 2017. Using this data we classified the five stakeholder ports into three subsets:

1. **Incentive Providers:** This consists of ports in the San Pedro Bay (POLB and POLA). These ports provide their own incentive programs for ocean-going vessels.

[34] Renee Moilanen, Environmental Specialist at POLB, Interviewed at November 14, 2017.

[35] Lee Kindberg, Environmental Specialist at Maersk, interviewed on January 23, 2018.

[36] Renee Moilanen, Environmental Specialist at POLB, Interviewed at November 14, 2017; Christine Rigby, Environmental Specialist at Port of Vancouver. Interviewed at October 10, 2017.

2. **Non-Provider 1:** This consists of ports in the Northwest Seaport Alliance (the Ports of Seattle and Tacoma). These ports do not have environmental programs that provide incentives for ocean going vessels,[37] but they do share 10 out of 20 major strings that also include POLB or POLA.[38] We are investigating the relationship between incentive provider ports and those that do not provide incentives but may benefit from cleaner ships calling at their ports as a result of other ports' programs.
3. **Non-Provider 2:** This consists solely of the Port of Oakland. This port does not share any major shipping strings with POLB or POLA,[39] nor does it offer an environmental incentive program.[40] However, Oakland still receives benefits from incentive programs provided by other ports when Tier 2 ships call at its port. This is because the Port of Oakland shares major strings with the Port of Vancouver and other incentive-providing ports.

The regression model is presented and explained below:

$$\mathbf{Y_{it} = \beta_0 + \beta_1 \cdot X_{1it} + \beta_2 \cdot X_{2it} + \beta_3 \cdot X_{3it} + \beta_4 \cdot X_{4it}} \qquad \text{(Model III-1)}$$

where **i =** identification number, standing for a combination of PortTypes and Shipping Lines (SL_PortType_id), and **t =** year 2012 to 2017.

Y: **Percent_Tier2;** the dependent variable, or the variable of interest — represents the percentage of a shipping line's calls made by Tier 2 ships in the specific port category. This

[37] "Northwest Ports Clean Air Strategy - Implementation Report 2016", The Northwest Seaport Alliance, accessed February 1, 2018, https://www.nwseaportalliance.com/sites/default/files/nwpcas_implementation_report_ 2016-updated_final-2017-11-28.pdf

[38] "Weekly Ocean Carrier Services", Port of Long Beach, accessed February 16, 2018, http://www.polb.com/economics/cargotenant/weekly.asp

[39] Ibid

[40] "Environmental Stewardship Programs", Port of Oakland, accessed February 1, 2018, http://www.portofoakland.com/community/environmental-stewardship/programs/

data is calculated by dividing the number of a shipping line's calls made by Tier 2 ships by the total calls in the year made by shipping lines at each port category.

The explanatory variables are represented by X_1 to X_4

***X_1:* PortType;** a dummy variable representing port category. This variable is intended to address the effect of incentive providership on shipping line decision making. The dummy variable codes are 0 (Incentive Provider), 1 (Non-Provider 1), and 2 (Non-Provider 2).

***X_2:* LogIncentive;** a variable representing the year's cumulative dollar amount of incentives provided by each port category, organized by shipping line and as a percentage. This model checks if the year's incentive program dollar amount affects the shipping line's Tier 2 ship deployment. The data used is the cumulative incentive dollar amount in the year for each shipping line, for POLB and POLA. Here we have used "0" for NWSA ports and Oakland because they are not incentive providers.

A logarithmic scale is used to reduce skew and standardize the data to create a normal distribution. Because the data contains 56 values of $0 for the year's cumulative dollar amount, we were unable to apply a logarithm function to these values. Thus, we have added 1 to all values before using the logarithm (log(1) = 0). Given that the remaining 94 positive values range from $500 to $275,500, adding 1 does not distort these values after taking the logarithm of the variable.

***X_3:* Adm_cost;** a variable representing the year's cumulative administrative costs incurred by an SL for its container ships, by port type. Considering ship deployment planners refer to shipping data when making decisions, it is plausible that the year's administrative costs affect decisions on deployment. Data for daily administrative costs is based on the ship's capacity to hold twenty-foot equivalent units (TEUs), a measure of a ship's capacity (Table III-3).

Shipping Line's Size (TEU)	Daily Administrative Cost (USD)
100-1,000	521
1,001-2,000	630
2,001-6,000	861
6,001-10,000	870

Table III-3. Administrative Cost per Ship[41]

***X_4:* Tier2calls;** a variable representing the number of Tier 2 calls made by the shipping lines at the port type in the year. It is apparent that the number of Tier 2 calls may affect the percentage of Tier 2 calls out of all calls made by a shipping line, and that including this variable does not induce multicollinearity (Appendix 4). Moreover, considering that deployment of cleaner ships to incentive provider ports may require shipping lines to experience a greater administrative burden, it follows that more Tier 2 ship deployments may increase the administrative burden.[42] As a result, the percentage of Tier 2 ship deployments (the dependent variable) may be negatively associated with calls made by Tier 2 ships.

The unbalanced panel data for the years t=2012 to 2017 are coded with identification numbers (SL-PortType_id). These are a combination of the shipping line and the port type. For example, the number for American President Line Ltd. and Incentive Provider is 001, American President Line Ltd. and Non-Provider 1 is 101, Evergreen Line and Incentive Provider is 002, and Evergreen Line and Non-Provider 2 is 202.

[41] "Administration Cost", OpCost Online, accessed January 26, 2018, https://www.opcostonline.com/#/

[42] Lee Kindberg, Environmental Specialist at Maersk, interviewed on January 23, 2018; Hitoshi Nakamura, Port of Yokohama, interviewed on March 14, 2018

Table III-4 shows a sample of unbalanced panel data as the basis data for our regression analysis, which is a cross-tabulation of data consisting of ship calls, type of ports, the number of Tier 2 vessel calls, monetary incentive amount disbursed, and administrative cost in year *t* by identification number *i*.

No	Year	Shipping_Line	PortType (X_1)	SL-PortType_id	Incentive (X_2= Log Incentive)	Adm_cost (X_3)	Total Calls	Tier2calls (X_4)	Percent_Tier2 (Y)
1	2012	American President Line	0 Incentive Provider	001	$ 12,250	$ 99,921	116	0	0.0%
2	2013	American President Line	0 Incentive Provider	001	$ 6,000	$ 201,798	234	12	5.1%
3	2014	American President Line	0 Incentive Provider	001	$ 53,750	$ 214,803	249	43	17.3%
4	2015	American President Line	0 Incentive Provider	001	$ 78,250	$ 139,851	162	33	20.4%
5	2016	American President Line	0 Incentive Provider	001	$ 89,750	$ 119,250	138	43	31.2%
6	2016	American President Line	1 Non-Provider 1	101	$ -	$ 39,975	46	32	69.6%
7	2016	American President Line	2 Non-Provider 2	201	$ -	$ 121,098	140	33	23.6%
8	2017	American President Line	0 Incentive Provider	001	$ 3,000	$ 40,683	47	24	51.1%
9	2017	American President Line	2 Non-Provider 2	201	$ -	$ 90,003	104	37	35.6%
10	2012	Evergreen Line	0 Incentive Provider	002	$ 22,750	$ 63,096	73	0	0.0%
11	2013	Evergreen Line	0 Incentive Provider	002	$ 15,500	$ 148,830	172	2	1.2%
12	2014	Evergreen Line	0 Incentive Provider	002	$ 74,000	$ 145,692	168	36	21.4%
13	2015	Evergreen Line	0 Incentive Provider	002	$ 125,000	$ 123,207	142	51	35.9%
14	2016	Evergreen Line	0 Incentive Provider	002	$ 122,250	$ 132,741	153	45	29.4%
15	2016	Evergreen Line	1 Non-Provider 1	102	$ -	$ 102,219	118	2	1.7%
16	2016	Evergreen Line	2 Non-Provider 2	202	$ -	$ 133,611	154	35	22.7%
17	2017	Evergreen Line	0 Incentive Provider	002	$ 86,250	$ 126,642	146	40	27.4%
18	2017	Evergreen Line	2 Non-Provider 2	202	$ -	$ 128,445	148	36	24.3%
19	2012	Mediterranean Shipping Co.	0 Incentive Provider	003	$ 22,500	$ 160,866	186	7	3.8%
20	2013	Mediterranean Shipping Co.	0 Incentive Provider	003	$ 42,500	$ 175,353	203	17	8.4%
21	2014	Mediterranean Shipping Co.	0 Incentive Provider	003	$ 20,000	$ 182,241	211	8	3.8%

Table III-4. Sample of the Unbalanced Panel Data for the Regression Analysis

Although we initially expected the incentive amount to have a positive correlation with percentage of Tier 2 ships and a negative correlation with administrative costs, our results indicated otherwise. Instead, the regression result (Table III-5) shows that there is **not a statistically significant** relationship between the percent of Tier 2 ship calls and any incentive provider (or non-provider) category. Because ports are indirectly connected through shipping strings, this counterintuitive result may indicate that the presence of incentive programs has a distributed impact across a shipping string rather than just for the port utilizing the program.

The result also shows that the **dollar amount received from incentive programs in the year also does not have a statistically significant impact on the deployment of Tier 2**

vessels. This result aligns with opinions expressed by maritime industry professionals who argue that the dollar amount of incentive programs is too small to compensate for shipping costs.[43]

On the other hand, **shipping lines' calculated dollar amounts in anticipated administrative costs for the year had a very small (but still statistically significant) negative correlation with the deployment of Tier 2 vessels at a 99% confidence level.** This suggests that a large unit increase in administrative burden would very slightly lower the deployment of Tier 2 vessels, holding all other variables constant. This result also supports shipping lines' concerns that the administrative burden was generated by substantial paperwork required to participate in incentive programs.[44]

Finally, the **number of Tier 2 calls has a positive correlation with the deployment of Tier 2 container ships at a 99% confidence level**. This relationship suggests that, while the percentage of Tier 2 ship calls is affected by the number of total calls made by shipping lines, and while greater deployment of cleaner ships may increase the administrative burden for shipping lines, more Tier 2 vessels induce shipping lines to increase their share of Tier 2 vessel deployments. This contradiction with our interviews with maritime professionals may be related to the relatively automated procedures of obtaining financial incentives at the ports from which our data has come, which may lower the administrative burden associated with Tier 2 ship deployments.

[43] Lee Kindberg, Environmental Specialist at Maersk, interviewed on January 23, 2018.

[44] Lee Kindberg, Environmental Specialist at Maersk, interviewed on January 23, 2018; Hitoshi Nakamura, Port of Yokohama, interviewed on March 14, 2018.

Variables	Percent of Tier 2 ships *Coefficent (Std. Error)*
Port type	
Non-provider 1	0.156
	(0.097)
Non-provider 2	0.105
	(0.094)
Log (Incentive Amount)	0.017
	(0.013)
Shipping Line's Administration Cost	- 1.50E-6***
	(4.52E-7)
Tier 2 Calls made by Shipping Lines	0.008***
	(0.001)
Constant	0.032
	(0.071)
Observation	150
Groups	51
R-square	0.5016

*** p<0.01, **p<0.05, *p<0.1

Source: OpCost, 2018
Ship call data from Port of Los Angeles (year 2012-2017), Port of Long Beach (2012-2017), Port of Oakland (2016-2017), Port of Tacoma (2016), Port of Seattle (2016)

Table III-5. Regression Results

One limitation of the regression was the discontinuity in years of data available from each port, although we still were able to generalize the regression results for all shipping line deployment behavior. This is because the statistical significance of the coefficient of the shipping line's administrative cost for all provider types suggests that the administrative burden experienced by shipping lines does affect deployment behavior.

III.3. Qualitative Research/Interview with Maritime Stakeholders

Our qualitative research mainly draws from interviews with maritime industry

professionals in both the public and private sectors, as detailed below.

1. Interviews with environmental and air quality staff at different ports in the informal working group, namely POLB, POLA, Vancouver, Prince Rupert, and Yokohama. Among the 10 stakeholder ports, those 5 are the most interested in (or already are) collaborating with POLB on environmental programs. These interviews helped us conceptualize how incentive programs are maintained in their respective ports, the different budgeting conditions, varying opinions about incentive programs, and different views on formal interport collaboration. Unfortunately, we had limited interview time with ports outside the US, and therefore we only included ports in China and Japan, which work directly with POLA and the Port of Vancouver, within our policy options. The main takeaway from our port interviews is that they are willing to collaborate on environmental programs, need better communication strategies, and are not willing to provide detailed information about environmental standards or current measurement metrics.

2. Interviewed and collected questionnaire responses from shipping line representatives, including Wolram Guntermann (Hapag-Lloyd), Lee Kindberg (Maersk Line), and Takashi Danno (Mitsui O.S.K Lines Ltd.). These stakeholders provided a perspective on how to improve shipping lines' experiences as customers. This secondary objective could help promote program implementation and communication between POLB and shipping lines. Our shipping line survey (see Appendix 9-10) consisted of seven multiple-choice and free response questions concerning shipping company decision-making, participation in and awareness of incentive programs, and experience as the customers of ports. Interviews with shipping line representatives also focused on these topics. The content of these interviews and the survey responses that we received helped inform policy options

to affect ship deployment behaviors. However, there were only three questionnaire respondents, and therefore the information we received from these respondents is treated as interview rather than survey data. Since ports cannot raise their incentive amounts, this report focuses on how to improve shipping lines' customer experiences with a focus on how to reduce environmental program costs.

3. Interviewed industry organizations and alliances, including the shipping line trade association PMSA and the interport forum Pacific Ports Clean Air Collaborative (PPCAC). The perspectives of these entities' representatives provided insight into how ports may better engage shipping lines and manage a proposed formal partnership. They provided their understanding of ship deployment, helped us narrow our policy options, and addressed how their organizations can potentially contribute to the implementation of clean ship incentive programs. However, we were not able to conduct an interview with AAPA, and environmental departments in the ports typically do not interact with alliances outside of collaboration on environmental programs. We have treated our interview with PMSA as indicative of how AAPA and the ports might approach an alliance form of collaboration.

Interviewed Bruce Anderson (Starcrest Consulting LLC) to understand the dynamics of the shipping industry and how clean ship incentive programs may become more effective. Bruce has worked for many years on forecasting the global shipping fleet and greenhouse gas emissions in the maritime sector. He also frequently conducts policy evaluation for POLB and other ports on the US west coast. Soliciting a consultant's perspective balanced out the opinions of the ports, shipping lines, and maritime alliances, as this perspective was fairly neutral. This was especially beneficial given that there were several stakeholders we were unable to reach.

CHAPTER IV.
CRITERIA AND METHODS

We use four criteria to assess the policy options: (1) Potential to Increase Share of Tier 2 Ships, (2) Financial Feasibility, (3) Adaptability, and (4) Accountability. Each criterion will be weighted according to the client's preference and priority for Green Ship Incentive Program.

IV.1. Potential to Increase Share of Tier 2 Ships

This criterion refers to a given policy option's likelihood of increasing the proportion of Tier 2 ship calls at POLB. Tier 2 ships meet higher standards (as set by the IMO) for fuel consumption and produce fewer air emissions compared to Tier 0 or 1 vessels. The Green Ship Incentive Program encourages more calls by Tier 2 ships, which should result in improved air quality for Long Beach.

Methodology

a) Calculate the potential reduction of administrative burden for each policy option as compared to the status quo;

b) Assess the relationship between administrative burden and potential increase of Tier 2 ships using regression model **(**Model III-1)

IV.2. Financial Feasibility

Financial Feasibility refers to the port's costs and financial limitations that are associated with a given policy alternative. Presently, POLB utilizes information provided from shipping lines, specifically engine certificates and tax forms, to determine eligibility and

administer incentives through the Green Ship program, Expansion beyond this would likely incur costs in both the short- and long-term as POLB changes its operations.

Methodology

a) Assess budgetary limitations through interviews with POLB;

b) Estimate the fiscal details by activity of each policy alternative that would require POLB financing, including the cost of the given collaboration strategy as well as information management to support the collaboration;

c) Score options based on the anticipated cost of implementation

IV.3. Political Adaptability

Political Adaptability refers to the flexibility of a policy option to remain effective in the face of changes mandated by regulatory bodies or ports. Ports in the current working group answer to different city, state, and national authorities. For this report, the optimal policy proposal should be sustainable in the face of changing political dynamics and include the possibility for ports to adjust their incentive programs based on changes in their particular regulations, operations or budgeting.

Methodology

a) Interview ports and professionals in the maritime industry to assess their preferences in policy autonomy and flexibility, how the stakeholders in each policy option would react to differences in environmental standards or regulations, and how they would anticipate operational or relationship changes that depart from the status quo;

b) Estimate the cumulative hours of potential coordination needed between stakeholders to implement each policy option, using Graicunas' theory of span of control of peer-to-peer or

cross-relationship (Formula IV-1) [45];

$$\textbf{Minimum relationship: } \frac{n}{2}(n-1) \quad \textbf{(Formula IV-1)}$$

c) Score the policy options based on the least number of stakeholders (which implies the least time spent coordinating); also considered is whether the proposed changes would affect the nature of environmental goals, operation details, and stakeholder relationships as they compare to the status quo

IV.4. Accountability

Accountability refers to each port's responsibility to support collaborative transparency and maintain information confidentiality among ports. The information flow between shipping lines and ports is useful for sharing information about environmental programs, particularly those that offer incentives, as well as tracking compliance and rates of Tier 2 ship deployment. The methodology to obtain information should be easy, trustworthy, transparent, yet confidential.

Transparency matters because ports receive public funds and are accountable to political bodies, as well as their surrounding taxpayers. For example, a collaboration format that includes payment to a third party would require open transaction records as well as an explicit clarity of purpose. In this context, the expectation of transparency would also extend to interactions with shipping lines. Additionally, each alternative's collaboration format should enable confidentiality sufficient to protect each entity's private operational and financial data.

[45] Fred Nickols. The Span of Control and the Formulas of V.A.Graicunas. 2011. https://pdfs.semanticscholar.org/bc74/6ca02ff7a67b65fd35236a114fcc89bc185c.pdf

Methodology

a) Consulted POLB and ports involved in the informal working group about their preferred form of information flow in the potential collaboration;

b) Scored the highest option based on ease of information transfer and transparency as well as capacity to ensure confidentiality; that is, which has the easier method of transferring information, yet is also transparent and able to maintain confidentiality between entities.

CHAPTER V.
POLICY OPTIONS

As discussed in previous sections, POLB currently does not have the budget to induce changes in ship deployment through its monetary incentives alone. Shipping lines are most concerned with saving costs when they make deployment decisions. As a single port, POLB is limited in its capacity to address ship deployment. Therefore, we feel the best chance for increased Tier 2 deployment lies in working with other ports. Because of this, we are approaching our policy options from the perspective of optimizing shipping line awareness of incentive program offerings — and with that, Tier 2 deployment. Interport collaboration could help simplify and streamline the process for shipping lines to choose their routes and would facilitate communication about incentive programs between ports and across shipping strings. Therefore, we have developed policy options that strengthen cooperation between POLB and other ports.

These policy options fall into three categories:

1. Creation of a new organization to formalize working group efforts
2. Centralization of the working group through an existing industry association
3. Standardization of port incentives through an existing index provider

The first two options entail the creation of a database to organize information about member port incentive programs, as well as other environmental programs. The purpose of this centralized data portal would be to facilitate stronger communication within the port working group and between ports and shipping companies. This is not unlike the way an index such as ESI functions, but ports have greater flexibility in managing their environmental criteria. In this case there would also be greater potential for transparency in communication between shipping lines and ports. Shipping companies would be able to

access synchronized information about ports along their shipping strings, including the environmental programs specific to each port as well as their associated standards and ship incentives. Ideally, this platform would also be connected to the IMO Database, a ship scheduling website (Marine Exchange), and index providers (ESI, CSI, Green Award, Green Marine, Working Cargo Group, Rightship), thereby providing shipping companies with an easier way to access information about their eligibility and the steps for enrollment. Unlike the current rigid enrollment structures offered through index providers and individual ports, the Pacific Data Portal would enable ports to individually update their program criteria, edit environmental programs (even those outside of any incentive programs), and automatically communicate with shipping lines about updates.

The decision to promote this data portal through a port partnership comes from the need for stronger communication among shipping entities.[46] Working alongside other ports is important for pursuing mutual goals, but a data portal provides better structural support for transparency and cohesion among members. In order to maintain neutrality, this communication platform would be built by a third party rather than any member ports. Platform management is discussed in our policy options.

V.1. Proposed Policy Options

The following are our proposed policy options:

1. Creation of a New, Formalized Working Group Using a Centralized Data Platform
    1.1. Membership Limited to Pacific Ports
    1.2. Membership Open to Ports Around the World
2. Creation of a Centralized Data Platform Through an Existing Alliance

[46] Christine Rigby, Environmental Specialist at Port of Vancouver, interviewed on February 08, 2018; Renee Moilanen, Environmental Specialist at Port of Long Beach, interviewed on March 15, 2018.

2.1. American Association of Port Authorities (AAPA)

2.2. Pacific Merchant Shipping Association (PMSA)

3. Recommend Ports Join a Standardized Index Provider (ESI Under IAPH)

V.1.1. Option 1: New Partnership with Pacific Members

In this case, ports that are currently members of the West Coast ports informal working group would formalize their partnership through the creation of a new entity. We call this option the Pacific Port Partnership (PPP), consisting of the Ports of Long Beach, Los Angeles, Seattle, Tacoma, Vancouver, Prince Rupert, Yokohama, and Shanghai. While neighboring ports, like POLB-POLA and Seattle-Tacoma compete for business from shipping companies because of their proximity, other members of the working group are likely to receive container ships on the same strings. By limiting membership to ports in the Pacific, the partnership would have a stronger regional influence and more clearly differentiate itself from other existing interport organizations. PPP would be supported by a centralized data platform, the Pacific Environmental Portal, which would function as a communication platform for member ports and between ports and shipping lines. PPP would also better focus on shared issues by limiting the number of ports eligible to join. Partnership members would maintain full control over their own incentive programs and would be responsible for the actual monetary distribution of their incentives.

Compared to the status quo (Figure III-1), using a data platform would reduce time spent by shipping lines on administrative procedures to join environmental programs as shown in Figure V-1.

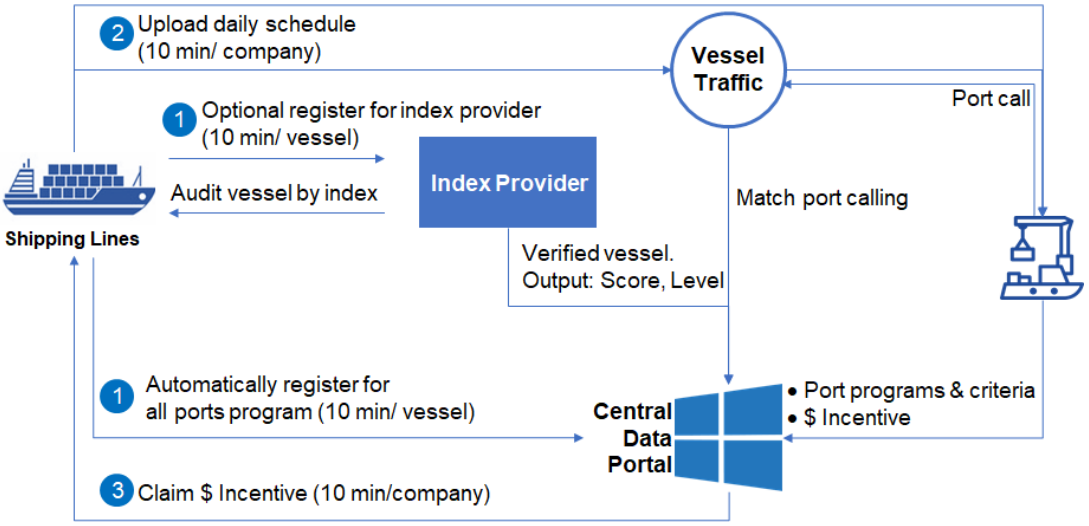

Figure V-1. Information Flow for Option 1 and 2

V.1.2. Option 2: New Partnership with Membership Open to Ports Around the World

This option is largely similar to the previous policy option but instead would feature *open membership* to any port supporting the environmental programs of the partnership. An open Partnership would allow collaboration to occur on a larger and more international scale, meaning a greater presence in more regions and more connections outside of ports on shared shipping strings. One advantage is that this would allow more cooperation between ports at both the origin and destination of shipping strings, meaning stronger partnerships between ports on the US's East Coast and those in Europe. Moreover, open partnership with an associated data portal would ease shipping lines' administrative work burden by providing them with information through one comprehensive portal. However, this approach would generalize environmental efforts on a global scale rather than addressing regional needs.

V.1.3. Option 3: Centralized System through Existing Alliance: American Association of Port Authorities (AAPA)

Rather than creating an entirely new organization, members of the working group would coalesce their efforts through an existing port organization: the American Association of Port Authorities (AAPA). This option would still include the creation of a centralized data portal, but AAPA would have responsibility for its management. The portal would include information about current AAPA member ports, as well as those ports in the West Coast working group. Because AAPA represents ports in the Americas, the collaborative entity in this option would exclude ports in East Asia but would otherwise consist of working group members

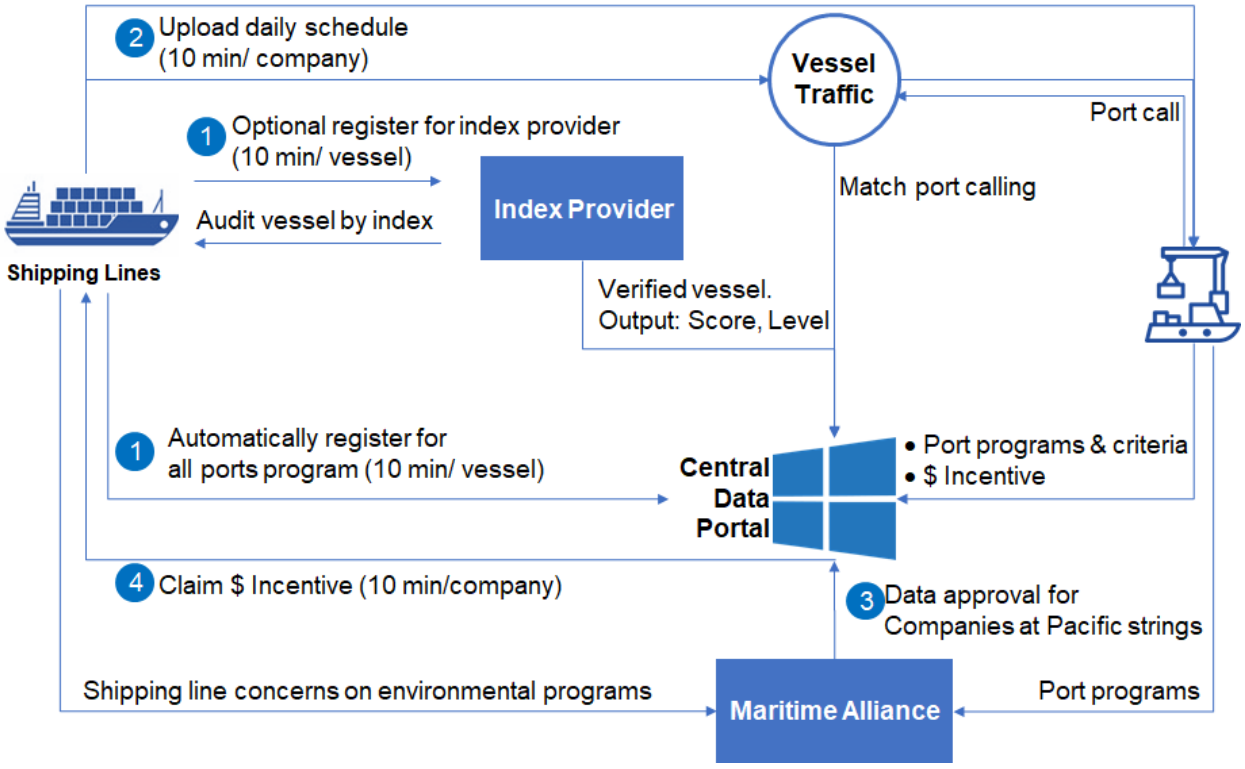

Figure V-2. Information Flow for Option 3 and 4

Figure V-2 shows that shipping lines can reduce the burden of their administrative work using a centralized platform. However, because the incentive payments are collected

from different incentive providers, this option requires an additional stage of work compared to the status quo.

V.1.4. Option 4: Centralized System through Existing Alliance: Pacific Merchant Shipping Association (PMSA)

Instead of AAPA, ports would organize their collaboration through the Pacific Merchant Shipping Association (PMSA), a shipping association based out of the United States. In this case, membership would be open to ports around the world, as PMSA has no membership restrictions. The focus of this collaboration would be deliberate engagement between ports and shipping lines, rather than ports working through their own politically representative entity. Because PMSA's membership is made up of ship owners and operators, working with them would provide greater contact with the customer base targeted by ship incentive programs. This could provide more opportunities to address customer experience issues and environmental concerns. However, PMSA as a mediating entity would be working on shipping lines' behalf in the end. In this option, member ports would still facilitate the creation of a portal.

V.1.5. Option 5: Ports Join a the Standardized Index Provider Environmental Ship Index (ESI) under International Association of Ports and Harbors (IAPH)

This option moves away from collaboration under a structured entity and creation of data portal. Instead, this option (Figure V-3) has member ports standardizing their incentive programs through ESI, which is run through IAPH. Several members of the current West Coast working group already use ESI for their incentive programs (POLA exclusively,

Vancouver and Prince Rupert as part of several measures), and the index was designed to be used as a basis for interport environmental efforts. Because ESI is one of the most commonly used index providers, it would be the practical choice for the working group ports to use as a standardized index. However, ESI has conflicting levels of satisfaction, with ports claiming that ESI is less administratively burdensome than managing their own incentive programs[47] and shipping lines stating that the ESI registration process should be less complicated and more streamlined.[48]

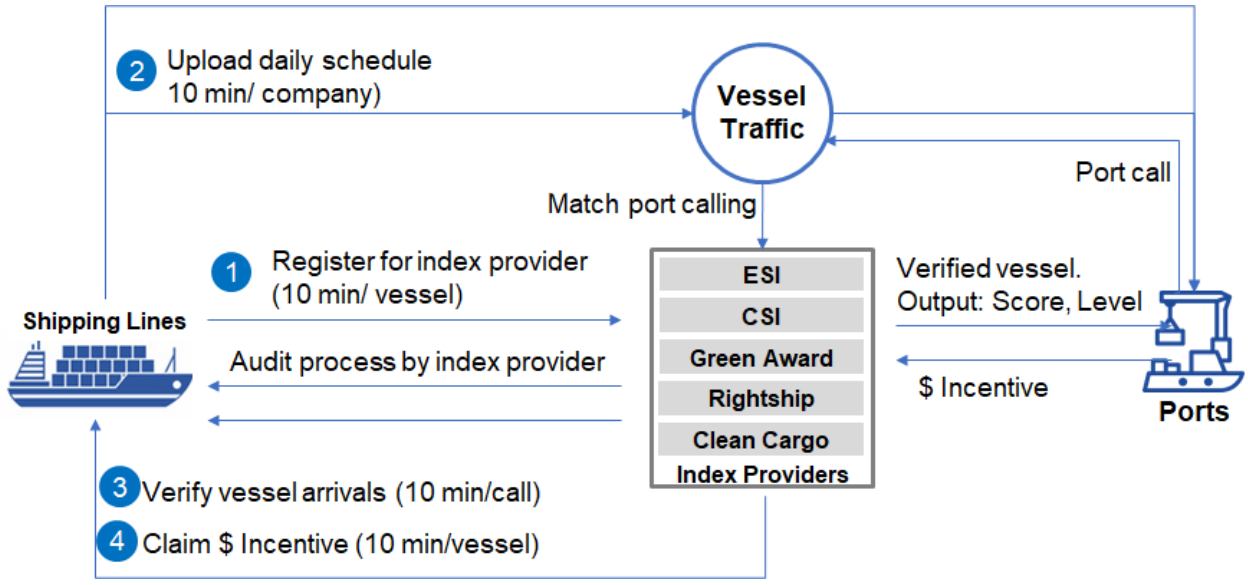

Figure V-3. Information Flow for Option 5

V.2. Analysis of Policy Options using Scoring System

This paper uses an ordinal scale (1-6) to score the six alternatives. Policy options are ranked in ascending order, such that a higher number score indicates greater fulfillment of the policy criterion. Each policy option will be assessed using the policy criteria.

[47] Carter Atkins, Port of Los Angeles, interviewed on January 08, 2018.

[48] Lee Kindberg, Environmental Specialist at Maersk, interviewed on January 23, 2018.

V.2.1. Criterion 1: Potential to Increase Share of Tier 2 Ships

Activities		1. Status Quo	Create a New Partnership		Join Existing Alliance		6. Join ESI (under IAPH)
			2. Pacific Partnership	3. Open Partnership	4. AAPA (Ports)	5. PMSA (Shipping Lines)	
a	Register to port programs	213					
b	Register to Index Provider (switch)						213
c	Register to Index Provider (optional), combine with Platform		51	62	51	62	
d	Register to Platform		213	256	213	256	
e	Upload daily dispatching schedule	18	18	21	18	21	18
f	Verify vessel arrivals/ port calling	842					842
g	Consolidate the Environmental Program in Association				18	21	
h	Collecting Incentive	213	18	21	18	21	18
	Total Administrative Hour	1286	300	360	317	381	1090
	% Change Administrative Hours Relative to Status Quo		-77%	-72%	-75%	-70%	-15%
	Assumption of Labor Cost/ Hour	$20	$20	$20	$20	$20	$20
	Annual Administrative Cost to Register in Environmental Program	$25,377	$5,913	$7,096	$6,259	$7,510	$21,512
	% Increase Tier 2 ships (Model III-1) *		**19.7%**	**18.5%**	**19.3%**	**18.1%**	**3.9%**
	Score	**1**	**6**	**4**	**5**	**3**	**2**
	* Based on calls at Incentive Provider Port by Mediterranean Shipping Company in 2016 (Administrative cost: $171,054)						

Table V-1. Scoring for Criterion 1 – Potential to Increase the Share of Tier 2 Ships[49]

Table V-1 shows the summary of administrative working hours for all options. Using the linear regression **(**Model III-1**)**, the percentage of administration hours can predict the increase in Tier 2 ship deployment.

Pacific Port Partnership (PPP): 6

Formalizing the working group is intended to promote regional cooperation among ports. This partnership — and the ease of using a centralized system to assess incentives — should increase the share of calls by Tier 2 ships because shipping lines will have complete access to information about ship incentives. The ease of accessing this information should

[49] Details of administrative hour of activities of each option, see Appendix 7

Data of hour evaluated by Renee Moilanen, Environmental Specialist at POLB, interviewed on February 9, 2018.

Assumption of labor cost/ hour: "Administrative Assistant Salaries", Glassdoor, accessed February 1, 2018, https://www.glassdoor.com/Salaries/administrative-assistant-salary-SRCH_KO0,24.htm

allow shipping lines to plan their routes with more consideration for potential incentives they would receive as a result of their vessel deployment decisions. Additionally, this option should ease the administrative burden placed on shipping companies because they would have centralized access to information about incentives and indices, whereas currently they must search for this information on separate port websites.

Open Partnership: 4

As with the PPP, an open partnership should lead to an increase in lower-emissions ships due to: (1) greater accessibility of information for shipping companies, and (2) more thorough incentive coordination across ports. We anticipate that the increase in Tier 2 ships would be lower with open membership than Pacific membership because of the diversity of port priorities around the world. Open membership would mean less regional focus on the Pacific strings and potentially less focus on the environmental standards that are standard practice for California ports.

AAPA: 5

There is no evidence to suggest that formalizing through AAPA would increase the share of lower-emissions vessel calls at POLB. Because this option would likely involve re-organizing incentive programs to accommodate AAPA and its pre-existing members, we anticipate that the proportion of Tier 2 ship calls would increase more slowly than the status quo. Working through a third party would potentially have a negative impact on the administrative work for shipping lines because AAPA would be another entity in between them and the ports at which they call.

PMSA: 3

As an organization representing shipping lines, PMSA's main goal is to advocate for the interests of terminal operators and shipping lines. While shipping industry cooperation is a necessary consideration in developing environmental programs, there would nevertheless

be a tension between shipping lines' financial priorities and ports' environmental goals. Organizing through PMSA would potentially increase the administrative work required of shipping lines for the same reasons as working through AAPA. Although PMSA represents shipping lines, it would remain as an additional intermediary contact between ports and shipping lines. However, this option is more favorable than working through AAPA because PMSA is directly associated with shipping lines. AAPA should organize the data with member ports before streamlining the incentive to the shipping lines.

ESI: 2

ESI is a popular index among ports, but imposing it as a standardized index for all concerned ports is likely to have a negative effect on the share of Tier 2 vessel calls. Switching to ESI would cause non-Tier 2 ships to qualify for incentives under ESI's scoring index. Currently, these ships are unable to receive benefits due to their higher air emission rates. Since ESI paperwork remains burdensome to fill out (i.e. must be done for each ship), this option would likely increase the administrative workload for shipping lines.

V.2.2. Criterion 2: Financial Feasibility

Financial Aspects		Status Quo	Create a New Partnership		Join Existing Alliance		5. Join ESI (under IAPH)
			1. Pacific Partnership	2. Open Partnership	3. AAPA (Ports)	4. PMSA (Shipping Lines)	
a	Create and maintain new organization		✔	✔			
b	Create and maintain new platform		✔	✔	✔	✔	
c	Membership payment to another organization				✔	✔	✔
d	Coordination and collaboration strategy with other organization members				✔	✔	
SCORE		**6**	**4**	**3**	**1**	**2**	**5**

Table V-2. Scoring for Criterion 2 – Financial Feasibility

PPP: 4

Creating a new organization and database system would require substantial financial investment toward both development and ongoing maintenance. Table V-2 uses the assumption that the cost to establish a new organization would be fixed, while coordination with other member ports or shipping line alliances would be more burdensome. These costs would be greatest at inception and would decline to some extent over time, although the overall costs would be substantially greater than maintaining the status quo.

Open Partnership: 3

This option has many of the same financial issues that the PPP would face. While a larger body of potential members would allow for pooling a greater amount of money into these expenditures, there would also be greater costs associated with broader database coverage and updates, as well as administrative collaboration across the world.

AAPA: 1

Although the AAPA politically represents port authorities, they do not currently have any mechanisms to represent port incentive programs. Coalescing under the AAPA would entail the development of a working group or other entity to address that, which would incur costs for both the ports involved and the AAPA as an organization. In addition to this development, ports would also need to pay membership fees to the AAPA, which might be increased by the expansion of services, as well as fees toward database development.

PMSA: 2

Like working with the AAPA, organizing under PMSA would likely be costly for both the ports and PMSA itself. These costs would come from restructuring the organization to accommodate port partnerships and incentive programs, as well as the technological investment in platform maintenance and the database. Since PMSA members outnumber the Pacific ports in AAPA, embedding the program within PMSA would eliminate the

coordination required to change the platform.

ESI: 5

Port registration with ESI requires occasional fees to cover the costs of ESI website maintenance, verification of vessel documents, and payment of administration fees to maintain liaisons between the shipping lines and ports.[50] Additionally, switching to ESI would require POLB to reconfigure its incentive program, which could result in a higher distribution of incentives than currently occurring. As discussed above, using ESI as the basis of the incentive program would likely increase the share of lower-emission vessel calls at the port, which would raise the total cost of the incentive program without the desired increase in Tier 2 ships.

V.2.3. Criterion 3: Political Adaptability

	Political Aspects	Status Quo	Create a New Partnership		Join Existing Alliance		5. Join ESI (under IAPH)
			1. Pacific Partnership	2. Open Partnership	3. AAPA (Ports)	4. PMSA (Shipping Lines)	
a	Autonomy and flexibility to change program criteria	✓	✓	✓	✓	✓	X
b	Differences in regulations, difficulties in monetary transfer			✓	✓	✓	
c	Existing organization, established members and rules		X	X	✓	✓	✓
d	Number of members/ stakeholders	0	9	11 or more (uncertain)	31 (all US ports)	56	53 (not interacting)
e	Potential hours of coordination needed with stakeholders (Formula IV-1)	0	36	55	465	1540	--
	SCORE	**6**	**5**	**2**	**4**	**3**	**1**

Table V-3. Scoring for Criterion 3 – Political Adaptability

[50] "Administration and Verification", Environmental Ship Index, accesed on January 28, 2018, http://www.environmentalshipindex.org/Public/Home/AdministrationAndVerification

PPP: 5

The intended plans for the new organization would allow individual ports to maintain their own incentive programs. Because ports would have this autonomy, they would keep the ability to formulate their programs in response to funding or regulatory needs. However, it should not be assumed that all ports in the Partnership would be eager to join - for example, POLA is a competitor to POLB that is focused on its collaboration with the Pacific Ports Clean Air Collaborative (PPCAC) and currently uses ESI as the basis of its incentive program.

Open Partnership: 3

Members of the open alliance would still maintain their own incentive programs at the individual port level. However, the burden of political coordination would be much greater with open membership than Pacific membership because there would be more regulatory and budgetary bodies brought into play. Although open membership would still allow for more political adaptability than the status quo, it would require more work than a Pacific-only group.

AAPA: 4

Given AAPA's place in the landscape of ports and shipping, working with them would give member ports more political power. This should enhance flexibility in responding to regulatory changes or other political issues. POLB is currently a member of AAPA, and managing a program through the AAPA could ease the burden on POLB with regard to monitoring and evaluation.

PMSA: 2

Working with PMSA would potentially allow ports to have a greater understanding of the shipping industry perspective, but this option has the lowest political adaptability score because it would focus on the needs of shipping lines over the needs of ports. These

contradicting political needs would mean that working through PMSA would offer less adaptability to regulatory changes or port environmental concerns

ESI: 1

Although ESI offers a convenient approach to port incentive organization, it lacks the necessary flexibility to adapt to changes in political circumstances. For example, one component of ESI's scoring formula considers a vessel's ability to connect to an on-shore power supply.[51] However, compliance with the State of California Air Resource Board (CARB), which began its port regulations in 2007, is largely fulfilled through shore power.[52] Thus ships that are complying with existing environmental standards would potentially be rewarded for this under ESI incentives. Additionally, the IMO's 2020 low-sulfur ship fuel limits will be lower than levels currently rewarded by ESI scoring, meaning if the scheme does not change it will be incompatible with global standards.

V.2.4. Criterion 4: Accountability

Accountability Aspects		Status Quo	Create a New Partnership		Join Existing Alliance		5. Join ESI (under IAPH)
			1. Pacific Partnership	2. Open Partnership	3. AAPA (Ports)	4. PMSA (Shipping Lines)	
a	Transparent information/ performance feedback easily tracked and monitored		✔	✔	✔	✔	✔
b	Maintain confidential information (financial, operation calling)	✔	✔	✔	✔	✔	✔
c	Proven and trusted methodology	✔					✔
SCORE		**6**	**4**	**3**	**2**	**1**	**5**

Table V-4. Scoring for Criterion 4 –Accountability

[51] "Formulation". Environmental Ship Index, accessed January 28,, 2018. http://www.environmentalshipindex.org/Public/Home/ESIFormulas

[52] "Shore Power for On Going Vessels". California Air Resource Board, accessed March 1, 2018. https://www.arb.ca.gov/ports/shorepower/shorepower.htm

PPP: 4

The Pacific Partnership's format would allow member ports to retain control of their own environmental programs, including ship incentives. Table V-4 shows comparisons between options, and is predicated on the assumption that the information-sharing platform would be safer and more confidential because there is only a single interaction between ports and shipping lines. This level of control and independence should allow for strong accountability.

Open Partnership: 3

As with the PPP option, individual ports within an open partnership would maintain control of their existing ship incentive programs. However, this option still has a lower score because more members in the system would require a stronger centralized platform to accommodate higher levels of usage.

AAPA: 2

Working through the AAPA would raise more accountability issues than the status quo because AAPA's organizational needs would be tied to port program functioning. Additionally, it would place ports in the position of answering to AAPA as well as more member ports.

PMSA: 1

Working under PMSA creates the worst potential for accountability because the organization exists to represent shipping lines, rather than ports. This would negatively affect ports' transparency because their interests would not be fully aligned by working with PMSA. Additionally, organizing through PMSA has the potential to harm transparency between ports and shipping lines because they would be competing for different interests under the same organizational purview.

ESI: 5

ESI is designed to be used in conjunction with port environmental programs, including ship incentive programs. In fact, many ports (including the Ports of Los Angeles, Vancouver, and Prince Rupert) use ESI as a basis for their incentive qualification. Because ESI is intended to be used by public entities for this exact purpose, standardizing to ESI would be unlikely to affect port accountability.

V.3. Criteria Weighting

As shown in Table **V-5**, four criteria were initially weighted at a baseline of 25% and then adjusted according to relative significance as indicated by stakeholders. POLB's main goal is to increase the deployment of Tier 2 and above ships, and they are primarily interested in how to motivate shipping lines to change their behavior while also improving the customer experience of Air Emission Program participants.[53] Because this is a high priority for POLB, we have weighted its representative criterion (Potential to Increase Share of 2 Ships) more heavily at 35%.

The next most important criterion is Financial Feasibility, which indicates how financially viable a policy option is. It is crucial that the policy options realistically consider POLB's budget restrictions. Therefore, Financial Feasibility is weighted 30%.

The remaining variables are Political Adaptability and Accountability. We have given Political Adaptability a weight of 20% because policy options that cannot adapt to political changes are likely to be eclipsed by those changes. Finally, Accountability has a weight of 15% because while it is important, it does not affect implementation viability as much as the other criteria.

[53]Renee Moilanen, Environmental Specialist at Port of Long Beach, interviewed on March 15, 2018.

Criteria/ Options for Collaboration Strategy		Weight	Score					
			Status Quo	Create a New Partnership		Join Existing Alliance		5. Join ESI (under IAPH)
				1. Pacific Partnership	2. Open Partnership	3. AAPA (Ports)	4. PMSA (Shipping Lines)	
1	Potential to Increase Share of Tier 2 Ships	35%	1	6	4	5	3	2
2	Financial Feasibility	30%	6	4	3	1	2	5
3	Political Adaptability	20%	6	5	3	4	2	1
4	Accountability	15%	6	4	3	2	1	5

Table V-5. Weight and Scores for Policy Options

V.4. Table of Policy Alternative Weighted Score

Table **V-6** contains a breakdown of our policy alternatives in relation to our criteria as well as their corresponding weighted scores. **Based on these results and the stated goals of our project, we recommend that POLB pursue the creation of a new partnership formed with current members of the Pacific ports working group, referred to here as the "Pacific Port Partnership."**

Criteria/ Options for Collaboration Strategy		Score (Weighted)					
		Status Quo	Create a New Partnership		Join Existing Alliance		5. Join ESI (under IAPH)
			1. Pacific Partnership	2. Open Partnership	3. AAPA (Ports)	4. PMSA (Shipping Lines)	
1	Potential to Increase Share of Tier 2 Ships	0.35	2.1	1.4	1.75	1.05	0.7
2	Financial Feasibility	1.8	1.2	0.9	0.3	0.6	1.5
3	Political Adaptability	1.2	1	0.6	0.8	0.4	0.2
4	Accountability	0.9	0.6	0.45	0.3	0.15	0.75
TOTAL SCORE		**4.25**	**4.9**	**3.35**	**3.15**	**2.2**	**3.15**

Table V-6. Weighted Score for Policy Options

CHAPTER VI.
RECOMMENDATION AND IMPLEMENTATION STRATEGIES

VI.1. Collaboration Format

VI.1.1. Vision and Mission

We suggest that POLB and other members of the informal working group formalize themselves through a Pacific Port Partnership that will coordinate environmental programs through enhanced communication with shipping lines. Based on our policy option criteria, the mission of this alliance should promote achieving environmental goals, increasing administrative and procedural efficiency, and maintaining accountability.

Our suggested mission:

"Providing high quality, efficient information exchanges to increase maritime industry awareness of and commitment to the implementation of environmental programs, while promoting long-term behavioral changes toward environmentally friendly port processes."

Suggested vision for the partnership:

"The most reliable platform for Pacific port environmental collaboration"

VI.1.1. Activities and Organizational Structure

The format of leadership positions would depend on how the alliance chooses to manage governing power. This could possibly be done with regularly scheduled rotations of leadership positions among ports, or based on the environmental program capacities of each port. Below we have outlined potential positions and their duties. In each case the person holding the position would be the head of their port's environmental department (or an equivalent), with the CEO belonging to the port currently leading the alliance.

1. *Chief Executive Officer (CEO)*

   The CEO would have the greatest authority over the system. They would set the alliance strategies and mission for their tenure; approve procedures, access, and feature changes; and oversee changes to collaborative programs.

2. *Deputy CEO*

   The Deputy CEO would maintain relationships among ports; track updates to port and index programs and procedures; and create and manage additional programs within the collaborative body including workshops and trainings.

3. *Stakeholder Liaison*

   The Stakeholder Liaison would maintain relationships with third-party maritime organizations such as the Marine Exchange, ESI, and IMO. These relationships would be crucial to ensuring updated information retrieval in the system database.

4. *Shipping Line Liaison*

   The Shipping Line Liaison would maintain relationships with shipping lines, including the promotion of alliance programs.

VI.1.1. Members and Stakeholder Management

PPP members would consist of the current informal working group, which includes the Ports of Long Beach, Los Angeles, Oakland, Portland, Seattle, Tacoma, Vancouver, and Prince Rupert. The partnership should maintain close contact with shipping lines and other stakeholders, such as index providers (ESI, CSI, etc.), schedule providers (e.g. Marine Exchange), and other organizations affiliated with the maritime industry--from shipping line advocates (PMSA) to port authority associations and collaborations (in this case: PPCAC, AAPA, NWSA).

Partnership membership should include ports in the same geographic region, as the similarity in major Pacific line strings demonstrates. This type of membership would ease the burden for shipping lines to submit data for vessels crossing the Pacific Ocean on a given string. In the future, additional ports along Pacific shipping lines could join PPP's member ranks and database, such as the Ports of Busan (South Korea) and Portland. (Due to time limitations in this project we were not able to assess their capacity to join this partnership.)

By contrast, the open membership option would result in more variation among port sustainability programs due to differing environmental priorities. In the future there could be the possibility of adding more members, but this would need to be done with consideration for how it would affect the data structure, system operations, and membership coordination. For example, ports in different countries may have different standards for environmental programs or data exchanges.

VI.2. Collaboration Format

We advocate for the creation of the "Pacific Environmental Portal" as a communication platform among Pacific ports and between ports and shipping lines. The basic information flow as shown in Figure VI-1 would facilitate minimal interventions as compared to business-as-usual. This platform would be an information portal for the Green Ship Incentive Program and similar environmental programs initially, with future integration of ports' other programs. Ports would release announcements about their environmental programs through the portal, allowing shipping lines to track incentive programs along Pacific lines. The portal would also function as a feedback mechanism through which ports could deliver non-monetary awards or other recognition to shipping lines for their work toward environmental goals.

In the interest of port autonomy the collaboration itself would not standardize the environmental program procedure among ports, although it would be necessary for the system to require a standardized format for data and document uploads. This would require an integrated repository system with real time information flow updates. The system should also be able to connect to stakeholder data platforms at scheduled intervals to update internal information.

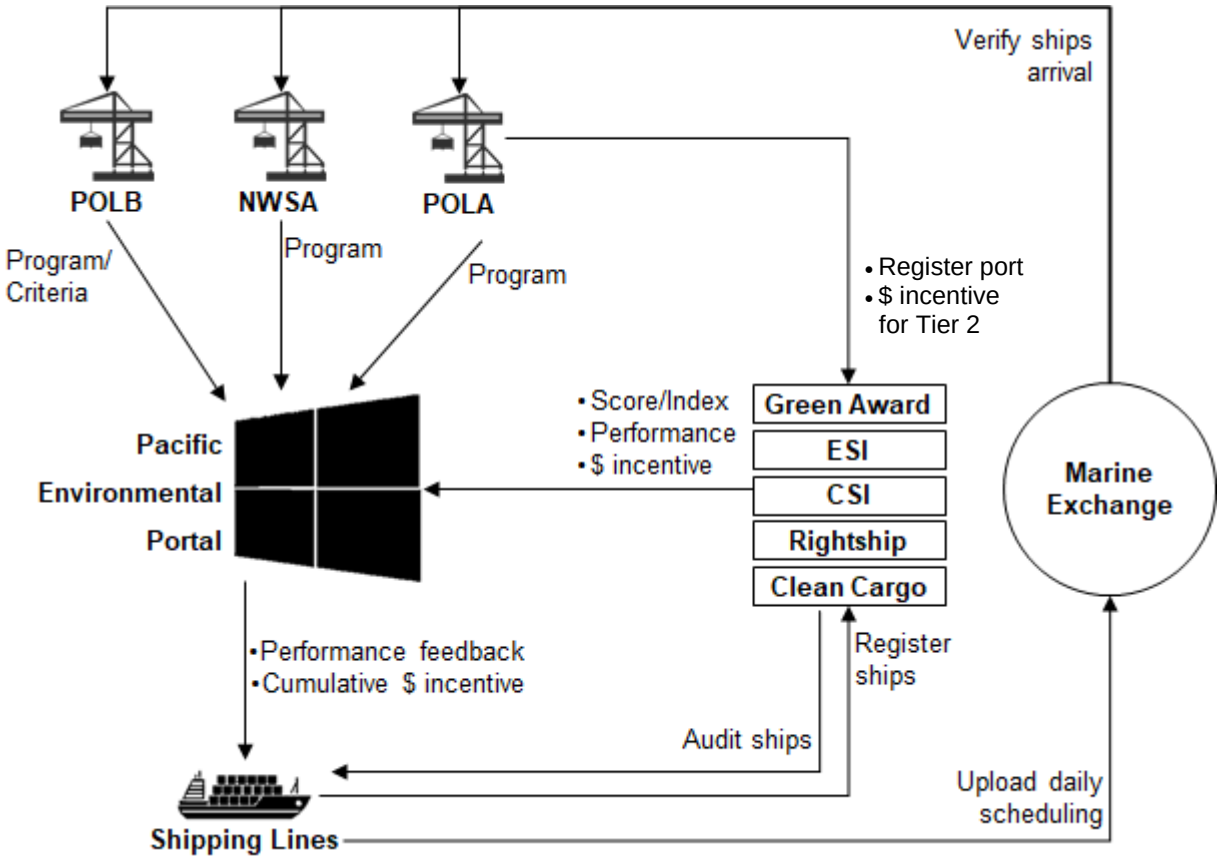

Figure VI-1. Pacific Environmental Portal

The portal should provide enhanced communication between ports and shipping lines, and should fill the current feedback mechanism gap between the two types of entities. For the shipping lines this would allow them to track their incentive processing and eligibility progress (currently not available through POLB), as well as incentives they have accumulated. For ports, the portal would allow them to communicate with shipping lines

about how they could improve their performance - such as providing feedback about ship retrofitting or how to integrate environmental and financial data into green ship schedules.

Flexibility in the portal is important for longevity. The system should allow for changes and additions to environmental program features (including documentation) as well as leaving the possibility of adding additional members. While at this time we would not recommend the Partnership have open membership we recognize that additional member ports may be sought out in the future.

As we mentioned in our *Accountability* criterion discussion, the portal should promote privacy by design. It should act as a black box for ports such that details about port-of-call, duration of call, and financial information would be confidential to entities outside of the port in question. At the same time, the portal should promote transparency of information — for example, by allowing shipping lines to view call data and incentive information throughout their interaction with each port rather than as just an end result.

Creating and implementing a data portal will require large investments of both time and money, but the culmination of this project should result in greater integration of environmental criteria, port incentives, and ship scheduling.

CHAPTER VII.
LIMITATIONS AND FUTURE WORK

VII.1. Challenges Using An Integrated Centralized Data Platform in the Public Sector

Developing and operating a central data system for ports and ocean carriers to use will require substantial financial investment and staff training. Currently there are varying levels of monetary resources and technological expertise across the industry. This means that implementation of a centralized data system could be difficult for ports and shipping lines that are not financially well-endowed or are lacking in technical expertise. Additionally, the sharing of data—even if protected by anonymity—may generate resistance from certain organizations due to differing legal and political concerns. In sum, our recommended policy alternative to adopt the Pacific Environmental Portal has a higher likelihood of success if the pertinent industry players are willing to contribute funding, knowledge, and information in an equitable manner, and are able to make certain accommodations and sacrifices for the greater mission of improved air quality.

Currently there are mixed opinions about applying information technology (such as an Environmental Management System) to the pursuit of environmental outcomes. Although some are supportive of the efficacy of feedback measurement, utilizing an information system for this work requires more supervision over implementation.[54] Thus it is likely there would be pushback from industry members about using an administratively-intensive platform to coordinate.

[54] Dagmara Nawrocka and Thomas Parker. "Finding the Connection: Environmental Management Systems and Environmental Performance." Journal of Cleaner Production 17 (2009): 601–607

VII.2. Potential Impact on Air Emission and Economic Activity

The potential positive impact of increasing Tier 2 ships would increase air quality around the cities where ports exist, and would eventually increase societal health and welfare.[55] However, there are potentially global emission reallocation implications. If the Pacific collaboration and environmental portal efforts are successful in pushing shipping lines to focus more on deploying greener ships to Pacific ports, it is possible that they might be deploying a larger share of high-polluting ships (Tiers 0 or 1) to other parts of the world. Consequently, ports in developing countries might bear the burden of this if they are unable to afford to incentivize shipping lines to change their behavior. Because this has global equity implications, we suggest that the Pacific Partnership monitor impacts on their own local air pollution as well as establishing communication about this issue with smaller ports outside of the Partnership.

Shipping lines have argued that stricter environmental regulations would have negative regional economic impacts, which in turn affect their deployment decisions. For these reasons we discourage POLB from promoting environmental restrictions without strong cooperation from other ports — they should not be a leader without followers so to speak. Although ship deployment is oriented around satisfying shipping demand, we recommend future research assess whether environmental programs have an impact on shipping lines' deployment decisions, especially as they relate to POLB and other partner ports.

[55] Enrico Moretti and Matthew Neidell. "Pollution, Health, and Avoidance Behavior - Evidence from the Ports of Los Angeles", http://jhr.uwpress.org/content/46/1/154.full.pdf+html, Accessed in March 18th, 2018.

VII.3. Analyzing Ship Deployment Factors

Although it has been established that current port incentives are not enough to offset the operational costs of ship deployment, POLB and other partner ports can still impact behavior by addressing deployment strategies in their environmental criteria. Presently we know that ship deployment typically depends on the ship size, the route in question, associated costs, and shipping demand. In our project we were not able to access relevant data (including operational costs, TEU efficiency, and number of ports called per ship) for all Pacific ports, which presented limitations in addressing these issues as they relate to behavioral changes on the part of shipping lines. Therefore, we would recommend that POLB and other Pacific partners examine these data in detail, especially ship size. We suspect that providing incentives based on TEU efficiency rather than Tier level would address the issue of shipping lines' ship deployment decisions and would hopefully motivate shipping lines to deploy greener ships.

VII.4. Tapered Incentives

While we recommend the PPP and its associated data portal as the policy option with the most potential, we also suggest POLB consider smaller-scale adjustments to its Green Ship Incentive Program. As we have discussed in our *Framework for Policy Engagement* section, switching to a tapered incentive scheme could be beneficial for POLB because it could potentially save money and put pressure on shipping lines to change their behavior over time. Furthermore, our regression does not indicate that providing incentives has a statistically significant effect on the share of Tier 2 ship calls.

If the port were to implement this, it would need to gradually decrease financial incentive amounts over time in relation to forecasted increases in the number of cleaner ship calls. For example, the current 2018 incentive for Tier 2 ships is $2,500; this could be lowered to $2,000 in 2020, $1,500 in 2025, and $1,000 in 2030. This is merely one example - the speed and dollar amount of reduction would be up to POLB.

CHAPTER VIII.
CONCLUSION

Based on the scoring system and criteria, as well as the feasibility of implementation, **we recommend that the port create a new formalized partnership with other Pacific ports through the creation of a Pacific Port Partnership, including the joint creation of a centralized data platform to improve communication among alliance members and with shipping lines.** This option has the highest score based on our criteria, followed by the option to form a port partnership with open membership.

Part of what differentiates the Pacific Port Partnership from other options is its potential reduction of administration costs through adaptation of the Pacific Environmental Portal, as well as its potential to increase Tier 2 ship deployment. Furthermore, this option fulfills our political feasibility criterion due to the manageable number of stakeholders located within the same territory who share the same interest in streamlining port environmental programs. These criteria are better met by the Pacific Port Partnership option because limited membership would facilitate better coordination among members and would allow ports the flexibility to change their environmental programs. The presence of these ports along the same or similar shipping strings should provide the greatest potential for member cooperation.

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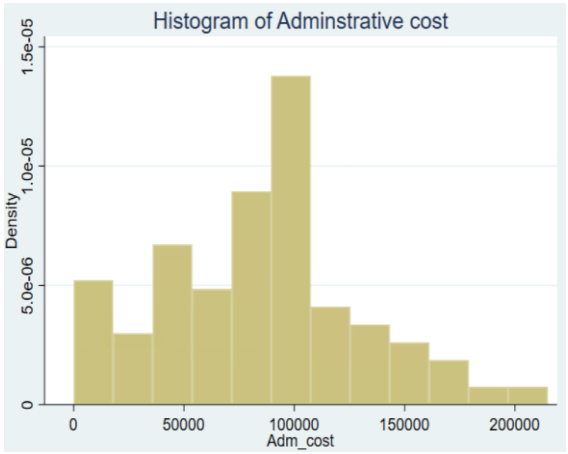
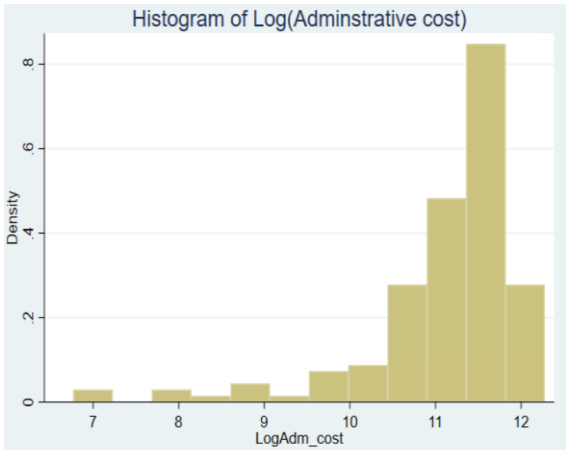
Appendices

1. Histograms to support using a logarithm for Incentives and not using a logarithm for Administrative Cost

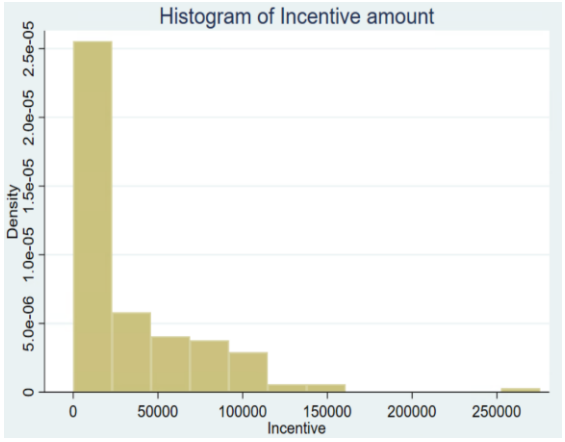
Histogram of Administrative Cost (raw data) **Histogram of Log(Administrative Cost)**

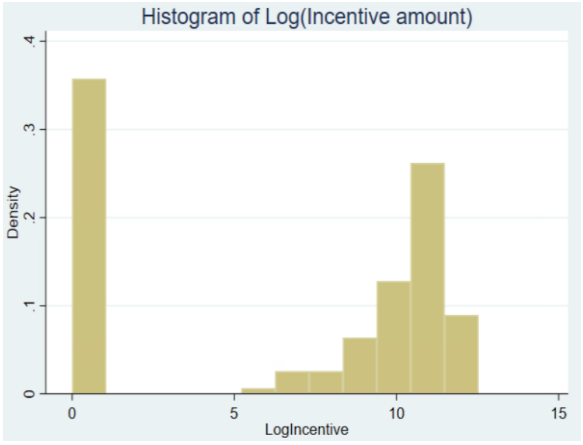




We did not use the Log(Administrative Cost) because using a logarithm for Administrative Cost will make the distribution left skewed.

Histogram of Incentive Amount (raw data) **Histogram of Log(Incentive Amount)**





The raw Incentive Amount data is right skewed, so we have used a logarithm for the Incentive Amount variable.

2. Regression results without using a logarithm for Incentives and with using a logarithm for Administrative Cost

Variables	Percent of Tier 2 ships *Coefficent (Std. Error)*	Percent of Tier 2 ships *Coefficent (Std. Error)*	Percent of Tier 2 ships *Coefficent (Std. Error)*	Percent of Tier 2 ships *Coefficent (Std. Error)*
Port type				
Free rider 1	0.156	- 0.001	- 0.010	0.097
	(0.097)	(0.069)	(0.087)	(0.071)
Free rider 2	0.105	- 0.058	- 0.045	0.064
	(0.094)	(0.037)	(0.035)	(0.055)
Log (Incentive Amount)	0.017			0.011
	(0.013)			(0.009)
Incentive Amount		- 4.84E-7	- 2.38E-7	
		(0.4.62E-7)	(3.66E-7)	
Shipping Line's Administration Cost	- 1.50E-6***	- 1.48E-6***		
	(4.52E-7)	(4.46E-7)		
Log (Shipping Line's Administration Cost)			- 0.076*	- 0.076*
			(0.046)	(0.046)
Tier 2 Calls made by Shipping Lines	0.008***	0.010***	0.009***	0.008***
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	0.032	0.179***	0.896*	0.794
	(0.071)	(0.060)	(0.528)	(0.484)
Observation	150	150	150	150
Groups	51	51	51	51
R-square	0.5016	0.5243	0.5587	0.5452

*** p<0.01, **p<0.05, *p<0.1

Source: OpCost, 2018

Ship call data from Port of Los Angeles (year 2012-2017), Port of Long Beach (2012-2017), Port of Oakland (2016-2017), Port of Tacoma (2016), Port of Seattle (2016)

Table above shows the regression results of every combination of Incentive Amount with and without using a logarithm, and Administration Cost with and without using a logarithm. According to the table above, every p-value of the coefficient of Incentive Amount or Log(Incentive Amount) is more than 0.1 in each combination, so the coefficient is statistically insignificant at the 90% confidence level in each combination. The table also shows that every p-value of the coefficient of Administration Cost or Log(Administration Cost) is less than 0.1 in each combination, so the coefficient is statistically significant at the 90% confidence level. Therefore, we can conclude that the total administrative cost has a statistically significant correlation with the shipping lines' deployment behavior, while the amount of financial incentives provided by ports does not have such a correlation.

3. Regression results with time-fixed effects supporting Policy Criteria 1

Variables	Without Time-Fixed Effect Percent of Tier 2 (or above) ships *Coefficent (Std. Error)*	With Time-Fixed Effect Percent of Tier 2 (or above) ships *Coefficent (Std. Error)*
Port type		
Free rider 1	0.156	(omitted because of collinearity)
	(0.097)	
Free rider 2	0.105	(omitted because of collinearity)
	(0.094)	
Log (Incentive Amount)	0.017	0.016
	(0.013)	*(0.014)*
Shipping Line's Administration Cost	- 1.50E-6***	- 1.21E-6**
	(4.52E-7)	*(4.59E-7)*
Tier 2 Calls made by Shipping Lines	0.008***	0.006***
	(0.001)	*(0.001)*
Year Effects		
2012		
2013		0.031
		(0.031)
2014		0.064*
		(0.036)
2015		0.074*
		(0.037)
2016		0.105**
		(0.050)
2017		0.135**
		(0.067)
Constant	0.032	-0.003
	(0.071)	*(0.091)*
Observation	150	150
Groups	51	51
R-square	0.5016	0.4765
Prob>chi2	0.0000	Prob>F 0.0000

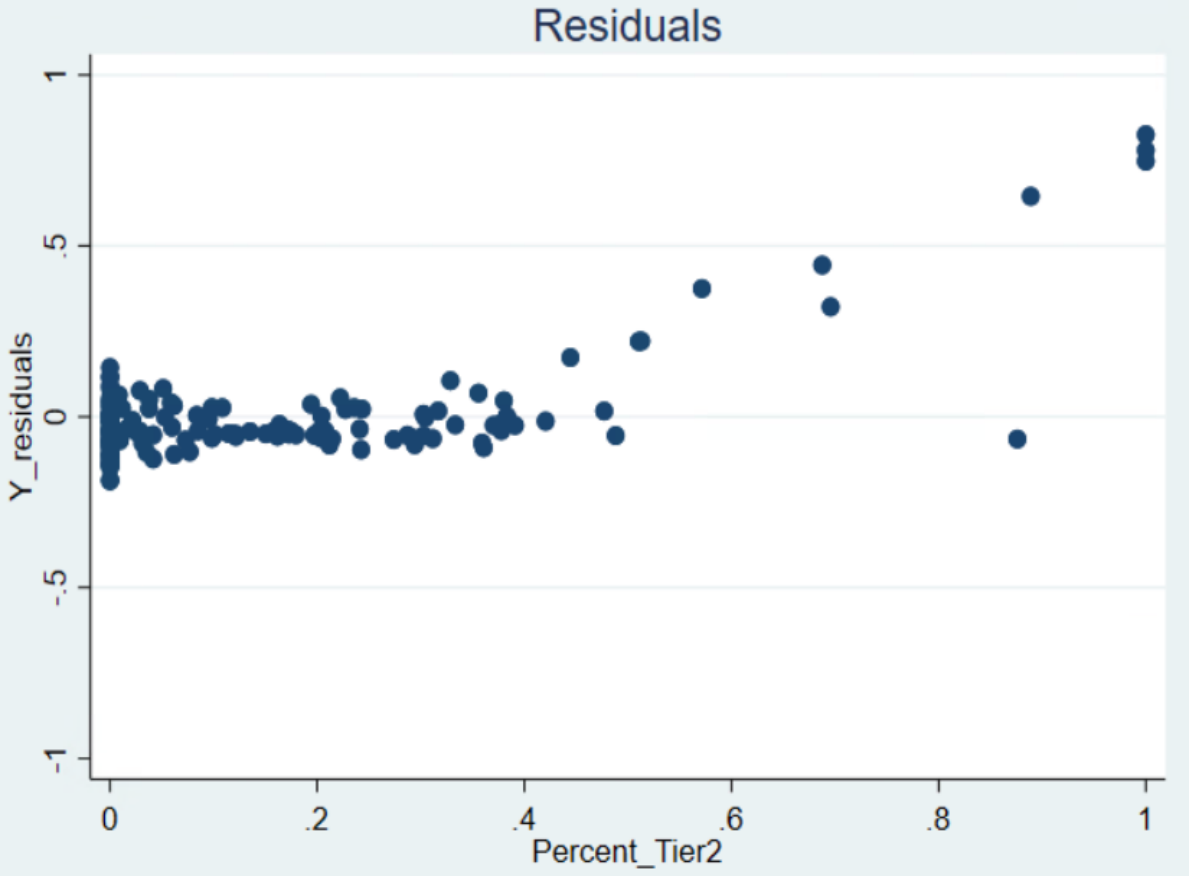
*** p<0.01, **p<0.05, *p<0.1

Ship call data from Port of Los Angeles (year 2012-2017), Port of Long Beach (year 2012-2017), Port of Oakland (year 2016-2017), Port of Tacoma (2016), Port of Seattle (2016)

Due to limited data access, measuring the relationship between variables in the regression Model III-1 is limited. Our regression measured several variable inputs' impacts on the percentage of Tier 2 ships deployed to ports, and the results of this analysis are in some cases counterintuitive. The regression results indicated that ports designated as "Non-Providers" (ports that do not have incentive programs, such as Oakland) have no statistically significant difference in their share of share of Tier 2 calls as compared to "Incentive Provider" ports such as Long Beach and Los Angeles. One possible explanation for this outcome is that Tier 2 ship calls at these ports were affected by the incentive programs provided by other, geographically proximate ports along the same shipping strings - specifically the Canadian Ports of Vancouver and Prince Rupert. These ports both offer incentive programs with multiple opportunities for eligibility, which may affect ship deployment decision-making. Indeed, Prince Rupert's program is viewed by some as a mechanism for drawing business away from American West Coast ports.[56] It is possible that POLB and POLA's proximity to Latin American ports that do not offer incentives could factor into this, although ships are typically emptied at the Southern Californian ports. Unfortunately, we were not able to acquire data about all of the ship strings that interact with West Coast ports, which could have provided insight into the relationships between Non-Provider ports and Canadian ports vs. their relationships with POLA and POLB.

[56] Thomas Jelenić, PMSA, interviewed March 14, 2018.

4. Residuals Check of the Regression Model (While some outliers are observed, the residuals are roughly not biased.)



5. Regression to determine that each independent variable has no strong collinearity with the dependent variable (indicated by low R-squared value)

```
. reg Percent_Tier2 Tier2calls
```

Source	SS	df	MS	Number of obs	=	150
				F(1, 148)	=	85.00
Model	2.55460095	1	2.55460095	Prob > F	=	0.0000
Residual	4.44779323	148	.030052657	R-squared	=	0.3648
				Adj R-squared	=	0.3605
Total	7.00239418	149	.046995934	Root MSE	=	.17336

Percent_Ti~2	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Tier2calls	.0072806	.0007897	9.22	0.000	.0057201	.008841
_cons	.0599105	.0180383	3.32	0.001	.0242646	.0955564

```
. reg Percent_Tier2 LogIncentive
```

Source	SS	df	MS	Number of obs	=	150
				F(1, 148)	=	9.57
Model	.425226365	1	.425226365	Prob > F	=	0.0024
Residual	6.57716782	148	.044440323	R-squared	=	0.0607
				Adj R-squared	=	0.0544
Total	7.00239418	149	.046995934	Root MSE	=	.21081

Percent_Ti~2	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
LogIncentive	.0105019	.0033951	3.09	0.002	.0037929	.0172109
_cons	.0956209	.0277629	3.44	0.001	.0407579	.1504839

```
. reg Percent_Tier2 Adm_cost
```

Source	SS	df	MS	Number of obs	=	150
				F(1, 148)	=	4.54
Model	.208615852	1	.208615852	Prob > F	=	0.0347
Residual	6.79377833	148	.045903908	R-squared	=	0.0298
				Adj R-squared	=	0.0232
Total	7.00239418	149	.046995934	Root MSE	=	.21425

Percent_Ti~2	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Adm_cost	-8.26e-07	3.88e-07	-2.13	0.035	-1.59e-06	-6.03e-08
_cons	.2327838	.0371144	6.27	0.000	.1594412	.3061263

6. Regression to determine that each independent variable has no strong collinearity with other independent variables (Indicated by Variance Inflation Factors (VIFs)).

```
. reg Tier2calls i.PortType LogIncentive Adm_cost
```

Source	SS	df	MS	Number of obs	=	150
				F(4, 145)	=	12.77
Model	12553.5824	4	3138.39559	Prob > F	=	0.0000
Residual	35640.5776	145	245.797087	R-squared	=	0.2605
				Adj R-squared	=	0.2401
Total	48194.16	149	323.450738	Root MSE	=	15.678

Tier2calls	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
PortType						
Non-Provider_1	16.31951	6.318625	2.58	0.011	3.831008	28.80802
Non-Provider_2	16.84391	5.91492	2.85	0.005	5.153306	28.53451
LogIncentive	2.610756	.5362872	4.87	0.000	1.550806	3.670705
Adm_cost	.0000664	.0000321	2.07	0.041	2.89e-06	.00013
_cons	-13.5322	5.229928	-2.59	0.011	-23.86894	-3.195454

```
. display "tolerance = " 1-e(r2) " VIF = " 1/(1-e(r2))
tolerance = .73952067 VIF = 1.3522272

. reg Adm_cost Tier2calls i.PortType LogIncentive
```

Source	SS	df	MS	Number of obs	=	150
				F(4, 145)	=	11.69
Model	7.4534e+10	4	1.8634e+10	Prob > F	=	0.0000
Residual	2.3104e+11	145	1.5934e+09	R-squared	=	0.2439
				Adj R-squared	=	0.2231
Total	3.0557e+11	149	2.0508e+09	Root MSE	=	39917

Adm_cost	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Tier2calls	430.6442	208.3922	2.07	0.041	18.76539	842.523
PortType						
Non-Provider_1	-10274.5	16431.34	-0.63	0.533	-42750.38	22201.39
Non-Provider_2	30997.98	15259.52	2.03	0.044	838.1636	61157.8
LogIncentive	3999.95	1434.833	2.79	0.006	1164.06	6835.839
_cons	47449.3	13037.16	3.64	0.000	21681.89	73216.72

```
. display "tolerance = " 1-e(r2) " VIF = " 1/(1-e(r2))
tolerance = .75608238 VIF = 1.3226072
```

```
. reg PortType Adm_cost Tier2calls LogIncentive
```

Source	SS	df	MS	Number of obs	=	150
				F(3, 146)	=	117.27
Model	70.2435255	3	23.4145085	Prob > F	=	0.0000
Residual	29.1498078	146	.199656218	R-squared	=	0.7067
				Adj R-squared	=	0.7007
Total	99.3933333	149	.667069351	Root MSE	=	.44683

PortType	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Adm_cost	2.55e-06	8.91e-07	2.87	0.005	7.92e-07	4.31e-06
Tier2calls	.0057009	.0022974	2.48	0.014	.0011604	.0102413
LogIncentive	-.1485534	.0082654	-17.97	0.000	-.1648886	-.1322181
_cons	1.183461	.0805302	14.70	0.000	1.024305	1.342616

```
. display "tolerance = " 1-e(r2) " VIF = " 1/(1-e(r2))
tolerance = .29327729 VIF = 3.4097423
```

7. Calculation for Administration Hours

STATUS QUO

Steps	Activities	Actors/Stakeholders	Value	Unit	Annual Hour
1	Register vessel/prepare documentations for port programs	Shipping lines (Operation) to Port (Operation)	10	mins/vessel	213
2	Upload daily dispatching schedule	Shipping lines (Operation) using Marine Exchange website	10	mins/company	18
3	Verify vessel arrival/ port call	Downloaded through Marine Exchange website, with Port (Operation) verification	10	mins/call	842
4	Collect incentive per vessel	B2B Financial Agreement with Port (Finance)	10	mins/vessel	213
				TOTAL ADM HOURS	**1,286**

OPTION 1. CREATE NEW PARTNERSHIP -- PACIFIC PORTS WITH CENTRALIZED PLATFORM

Steps	Activities	Actors/Stakeholders	Value	Unit	Annual Hour
1	Register vessel to Index Provider (optional)	Shipping lines (Environment) to Index (ESI)	10	mins/vessel	51
1	Register vessel to Platform	Shipping lines (Environment) to Platform	10	mins/vessel	213
2	Upload daily scheduling	Shipping lines (Operation) using Marine Exchange website	10	mins/company	18
3	Collect incentive	Shipping lines (Finance) download from Platform	10	mins/company	18
				TOTAL ADM HOURS	**300**

OPTION 2. CREATE NEW PARTNERSHIP -- PORTS AROUND THE WORLD (120% ADMIN WORK) **360**

OPTION 3. MERGE THE PLATFORM WITH EXISTING ALLIANCE -- PMSA (SHIPPING LINES)

Steps	Activities	Actors/Stakeholders	Value	Unit	Annual Hour
1	Register vessel to Index Provider (optional)	Shipping lines (Environment) to Index (ESI)	10	mins/vessel	51
1	Register vessel to Platform	Shipping lines (Environment) to Platform	10	mins/vessel	213
2	Upload daily scheduling	Shipping lines (Operation) using Marine Exchange website	10	mins/company	18
3	Collect port call data for the shipping lines with the same string lines	Alliance sorting out the port call data from the platform	10	mins/company	18
4	Collect incentive	Shipping lines (Finance) download from Platform, after Alliance approval	10	mins/company	18
				TOTAL ADM HOURS	**317**

OPTION 4. MERGE THE PLATFORM WITH EXISTING ALLIANCE -- AAPA (PORTS) (120% ADMIN WORK) **381**

OPTION 5. SWITCH TO ESI

Steps	Activities	Actors/Stakeholders	Value	Unit	Annual Hour
1	Register vessel to Index Provider	'Shipping lines (Environment) to Index (ESI)	10	mins/vessel	213
2	Upload daily scheduling	Shipping lines (Operation) using Marine Exchange website	10	mins/company	18
3	Verify vessel arrival/ port call	Downloaded through Marine Exchange website, with Port (Operation) verification	10	mins/call	842
4	Collect incentive per vessel	Shipping lines (Finance) download from ESI	10	mins/company	18
				TOTAL ADM HOURS	**1,090**

Option 3 is calculated at 120% of Option 2, with the assumption that Option 3 has more work than Option 2. The 120% was calculated from 9 ports in the members of Pacific Ports Partnership per 11 members of current working group, representing the degree of coordination required. Option 5 is calculated as 120% of Option 4, with the assumption that AAPA has more bureaucracy steps that are less favorable to shipping lines. For option 5, the same 120% increase of option 4 was used because the increase in administrative work for offline and online work would be the same using the platform.

8. List of Interviews

Name	Position	Date(s) Conducted
Renee Moilanen	Manager of Air Quality Practices, The Port of Long Beach	October 31, 2017 November 14, 2017 December 11, 2017 February 09, 2018 March 15, 2018
Morgan Caswell	Environmental Specialist Assistant, The Port of Long Beach	October 31, 2017 November 14, 2017 March 09, 2018
Rusty Mahakian	Business Development Manager, The Port of Long Beach	December 01, 2017
Randy Smith	Port Trade Analyst, The Port of Long Beach	February 13, 2018
Carter Atkins	Environmental Specialist, The Port of Los Angeles	January 08, 2018 January 16, 2018
Lisa Wunder	Marine Environmental Manager, The Port of Los Angeles.	January 08, 2018
Christine Rigby	Environmental Specialist, The Port of Vancouver	October 31, 2017 February 08, 2018
Jason Scherr	Environmental Sustainability Manager, The Port of Prince Rupert	February 21, 2018
Hitoshi Nakamura	Section Head, Policy Coordination Department, Port of Yokohama	March 14, 2018
Lee Kindberg	Environment & Sustainability Director, Maersk Line	January 23, 2018
Bruce Anderson	Principal, Starcrest Consulting Company	January 26, 2018

Kris Fumberger	Environmental Sustainability Manager, RightShip	March 06, 2018
Reed Passafaro **Michael Meyran**	Massachusetts Port of Authority (Massport)	March 05, 2018 March 06, 2018
Thomas Jelenić	Vice President, Pacific Merchant Shipping Association	December 20, 2017 February 19, 2018
Michele Grubbs	Vice President, Pacific Merchant Shipping Association	December 20, 2017
JR DeShazo	Professor of Public Policy and Director of Luskin Center, University of California, Los Angeles	November 09, 2017 November 21, 2017 December 05, 2017
Meredith Phillips	Professor of Public Policy, University of California, Los Angeles	February 20, 2018
Michael Dukakis	Visiting Professor of Public Policy, University of California, Los Angeles	February 21, 2018
Zachary Steinert-Threlkeld	Associate Professor of Public Policy, University of California, Los Angeles	February 27, 2018 March 07, 2018

9. Survey Forms

Customer Experience Survey: Clean Ship Incentive Programs

We are UCLA students conducting our Applied Policy Project with West Coast ports as our clients. Our research goal is to increase the deployment of greener ships and to consult them about their current Ship Incentive Program. This program gives incentive approximately USD $2,500 per call to the shipping lines which send Tier 2+/ ESI Level 40/ CSI Level 4 ships.

This questionnaire will assess your company's work complying with port programs offering monetary incentives or fee discounts for deploying vessels that emit less air pollution, i.e. Tier 2 ships and above. We hope this questionnaire can increase your experience as clients in west coast ports.

The contact information you provide is confidential. Based on your answers to this survey, you may be contacted for additional questions.

Please provide your company name* and your contact *

Short answer text

1a. Which factors influence which ships your company chooses to deploy to given strings? *

	Least Important	Less Important	Somewhat Important	More Important	Most Important
Agreements or Alliances with Other Shipping Companies	○	○	○	○	○
Cost	○	○	○	○	○
Ship Availability	○	○	○	○	○
Ship Size	○	○	○	○	○
Route	○	○	○	○	○
Port Incentive Programs	○	○	○	○	○
Other	○	○	○	○	○

1b. If you responded "Other" to the question above, please elaborate on additional factors affecting your company's ship deployment decision-making.

Long answer text

2a. Which clean ship incentive programs related to port air emissions do you currently participate in? *

- [ ] Clean Shipping Index
- [ ] Environmental Ship Index
- [ ] Green Award
- [ ] Green Marine
- [ ] Rightship
- [ ] Other

2b. If you responded "Other" to the question above, please list the additional emissions incentive programs in which you participate as complete as possible)

Short answer text

3. How does your company learn about ship incentive programs? *

Long answer text

4. What documents do you typically submit to index providers and ports? Please explain the administrative activities and cost entailed to this program *

Long answer text

5. How user-friendly is the current process of enrolling in ship incentive programs? How do you think that process could be improved by ports, index providers, and associations? *

Long answer text

6. Describe the importance of monetary incentive amount to your company's decision to participate in port-based incentive programs. What dollar amount per call would incentivize your company to join an emissions reduction incentive program? *

Long answer text

7a. What are your criteria to buy a new ship? *

	Least Important	Less Important	Somewhat Important	More Important	Most Important
Demand	○	○	○	○	○
Size/Capacity	○	○	○	○	○
Depreciation value	○	○	○	○	○
Machine efficiency	○	○	○	○	○
Environmental friendly	○	○	○	○	○
Other	○	○	○	○	○

7b. What is your company doing with the old vessels? Do you have a program to recycle them? *

Long answer text

Please submit additional comment if necessary. Thank you for your answers!

Long answer text

10. Survey Responses

Respondents	Shipping Lines	Question 1a. Decision to Deploy Ship						
		Agreement	Cost	Ship Availability	Ship Size	Route	Incentive Program	1b. Other
1	Hapag-Lloyd	5	5	5	5	5	2	On Shore Power Capable
2	Maersk Line	4	5	5	5	5	2	--
3	Mitsui O.S.K Lines Ltd	2	2	5	3	4	3	--

Respondents	Shipping Lines	Question 2. Clean Ship Incentive Program					
		CSI	ESI	Green Award	Green Marine	Rightship	Other
1	Hapag-Lloyd	0	1	0	0	0	0
2	Maersk Line	0	1	0	0	0	Clean Cargo Working Group
3	Mitsui O.S.K Lines Ltd	1	1	1	0	0	

Question 3: How does your company learn about ship incentive programs?

1. Hapag-Lloyd: Participation in ESI in other Ports
2. Maersk Line: Port personnel, research on web sites, PMSA and similar organizations
3. Mitsui O.S.K Lines Ltd: In many cases, the company gets to know via public notices from each port, or maritime industry journals and papers.

Question 4: What documents do you typically submit to index providers and ports? Please explain the administrative activities and cost entailed to this program.

1. Hapag-Lloyd: ESI Online Maintenance from Headquarters
2. Maersk Line: This varies significantly by port and by program. ESI requires NOx certificate and input of bunker delivery notes. CCWG has 30 datapoints per ship and is third-party verified. CSI has a different questionnaire and separate verification. VSR programs send us AIS speed data for verification. Long Beach dockage waiver program wants the quarterly CARB shore power compliance report.
3. Mitsui O.S.K Lines Ltd: --

Question 5: How user-friendly is the current process of enrolling in ship incentive programs? How do you think that process could be improved by ports, index providers, and associations?

1. Hapag-Lloyd: Acceptable
2. Maersk Line: Streamline and batch -- don't make us key in ship by ship and item by item.
3. Mitsui O.S.K Lines Ltd: --

Question 6. Describe the importance of monetary incentive amount to your company's decision to participate in port-based incentive programs. What dollar amount per call would incentivize your company to join an emissions reduction incentive program?

1. Hapag-Lloyd: Important
2. Maersk Line: Money is very important in this business. in the thousands we participate is minor effort is required. in the tens of thousands we will participate and work to meet requirements. However these amounts are not enough to cause us to change ships we buy or charter, or how they are deployed.
3. Mitsui O.S.K Lines Ltd: We don't have any clear thresholds. The participation in the incentive program is important only when the client determine which shipping line the client will use and which ship the client will use. The incentives from ports or discounts of port fees are just side effects.

Respondents	Shipping Lines	Question 7a. Criteria to Buy New Ship				
		Demand	Size/ Capacity	Depreciation value	Machine efficiency	Environmentally friendly
1	Hapag-Lloyd	5	5	5	5	5
2	Maersk Line	5	5	3	5	4
3	Mitsui O.S.K Lines Ltd	5	5	5	5	5

Question 7b. What is your company doing with the old vessels? Do you have a program to recycle them?

1. Hapag-Lloyd: Hapag-Lloyd Recycling Policy
2. Maersk Line: Working with a shipyard in ALANG India to develop capacity to do responsible recycling.
3. Mitsui O.S.K Lines Ltd: --

11. Summary of Meetings

SUMMARY OF MEETING

Meeting : POLB Office, 5th Fl. Date: October 31, 2017
Discussion: Introduction to POLB
Attendees : POLB: Renee Moilanen, Morgan Caswell. UCLA: APP Team

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- POLB will provide background paperwork and cargo contracts to help APP define policy problems
- POLB already give incentives for ships, which are intended to lower rates of SO2, CO2, greenhouse gas emissions
- Benchmarks and research in other countries which are doing incentive programs based on collaboration
- Incentive programs focus on the end users (shipping lines). Given the lack of communication, the experience of the shipping lines should be improved to maximize the efficiency of the incentive program
- Possible research questions: How to make the incentive programs more effective, motivate effective communication among shipping lines and ports. Christine Rigby (Port of Vancouver) wants to know for the program that they are doing right now (informal working group), decide how to maintain it, who to lead it, etc. Currently four ports with incentives programs — how to do their jobs in a coordinated way?
- Incentive programs of each port are based on different environmental standards; different ports have different priorities, and each port runs based on its own finance, structure
- Ports are also restricted by their financial situation as they operate ports independently, receive different shipping lines, hold different contracts, issue different incentives
- Collaboration: if ships call multiple times, they will get more $?
- Business interaction: shipping companies are the customers of ports
    - Improve the customer experience for shipping companies and facilitate their participation in incentive programs, reduce ships' impact in this area

SUMMARY OF MEETING

Meeting : POLB Office, 5th Fl. Date: November 14, 2017
Discussion: Introduction to POLB/ Possible Research Questions
Attendees : POLB: Renee Moilanen, Morgan Caswell. UCLA: APP Team

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General Information

- Some ships are eligible but do not know about the program; some ships are not eligible but still try to get payment from the program
- Some ports do not have their incentive programs — lack of funding, not their priority
- POLB has tax information of all the ships that come to the port, and include standards relating to program qualification
    - easy for the port to know about the information of ships (including Tier) and decide whether they are qualified for the incentive program
- Compliance level of incentive program: only 75% ships meet the standards to get the payment. Tier 3: not expected until 2030. Currently about 25% of calls are Tier 2 (they will provide the inventory of shipping lines)

Possible Research Questions

- Figuring out which incentive programs are offered by the ports is really critical — different characteristics of ships, different dollar amounts, which ports the shipping lines are calling
    - focus on west coast and Asia
- "Ways to improve communication" — different ports have different standards and incentive programs.
- "Provide ship lines with a better experience" — to make it easy and simple for these ships to know about what different incentive programs are, and thus they can make better choices about which ship to deploy
    - Make more shipping lines aware and increase participate in all environmental programs so they can deploy cleaner ships. If they do not appreciate the incentive amount they can get, they might reduce their participation.
- Explore option of having website — currently have none. There is an international harbor organization, but no official coalition for the west coast, so all the ports are decentralized, some are in collaborative groups but some are not
- Some ports do not have incentive programs
- Way of communicating with the shipping lines to easily understand all of the ports along with their strengths, what incentive program are being offered
    - for example, a website not only organized by one port — all of the ships could quickly understand what all of the incentive programs are and their differences, and all the ports are in some way to committed to updating the website with program changes

SUMMARY OF MEETING

Meeting : POLB Office, 5th Fl. Date: December 15, 2017
Discussion: Discuss the list of questions for the stakeholders
Attendees : POLB: Renee Moilanen (Phone Call). UCLA: APP Team

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Our list of questions:

- How do shipping companies find out about incentive programs?
- How does your company approach environmental issues? (What are their concerns?)
- Are environmental issues important for you? (Yes or No)
- What are your criteria criteria for deploying ships? (Ask PMSA how they bring in and get rid of these ships)
- What are your company's hopes/expectations when calling at certain ports? (Told this was too vague, need to ssk PMSA what they want to get from these programs or actions)
- What are the criteria to join/ not join? What are the benefits/ incentives? (Ask PMSA how people decide to join the association, and how companies choose their membership)
- Certifications — ask ports (POLA, Vancouver, etc.) how they decide the criteria of the incentive program ($, cost, indices)
    - Renee can help reach out to these ports

Advice/ Additional Questions

- We should ask only one question about how much money they receive and how much would be enough to change their behavior (How much $ to persuade them to deploy new ships?)
- Should be specific about the program, not just "incentive program" in order to be clear about environmental objectives - gas? air quality? Green Flag?
- Before asking questions, add some background information to explain, don't use too much jargon, sort all the questions into several groups
- Some companies joined some incentive programs but not others? Why? Are they not aware of it?

Revisions

- Terminologies: association/alliance, certification provider
- Adopt some multiple choice for these questions?
- Survey completion time of 8 minutes or less is best
- Conversation is the better way rather than interview/ asking direct questions. Discuss and receive their feedback on their expectations for incentive program and what affects their green ship deployment

SUMMARY OF MEETING

Meeting : PMSA Office. Date: December 20, 2017
Discussion: PMSA Roles in Incentive Program
Attendees : PMSA: Thomas Jelenic, Michelle Grubbs. UCLA: APP Team

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- Administrative cost: "How much work are they willing to tolerate to apply for incentives?" Meaningful incentives are relative to asset value (ships make money when they're full). Ideal incentive program needs to be simple and provide enough money. In the last 18 months: went from 20 major shipping lines to 12 (lots of administrative cuts)
- Rail infrastructure + SoCal population = empty ships. California focusing environmental money onto Green trucks, less investment in port incentives

Suggested we analyze vessel calls from POLB, POLA, and Port of Oakland

- Focus efforts on regularly scheduled calls — 4-5 common ports on these routes
- Recommended: third party managing incentive program with ports pooling incentive funds; structured similarly; ports with the most calls (POLB, POLA) are best targets for this
- However, POLB and POLA identities come before cooperation, have always had some conflict. They are world leaders — there aren't necessarily existing programs that meet their objectives. They want to be able to promote their own programs. "Franchise program" means any cooperation would need to be specifically focused

Recommendation: Analyze each port's program:

- list of participating shipping lines
- Ask about importance of recognition! (e.g. Green Flag), though obviously money wins out
- Incentives should be able to change over time to reflect what's going on in the industry

Interest in green ships

- International laws: by 2020 all vessels need to burn <5,000 SOx ppm (less bunker fuel). Tier III ships can operate as Tier II, turn Tier III on and off. Ocean carriers: fuel is 60% of costs. Bunker fuel = poor quality diesel fuel; expected move to marine gas/diesel oils
- All carrier companies want to brag about sustainability. Sustainability is related to efficiency
- Cargo owners are the ones who pay, don't want to pay for something that isn't win-win
- Rates are low now because the industry is in flux - which companies will last?
- CA guidelines vs. incentives: Scale of industry and asset investments means change happens slowly. Vessels that were modified to be compliant with (California's) shore power regulations are bigger investments - retrofitted older vessels are sometimes what they're sending to CA, so they don't want to get rid of them
- Issues of siting LNG facilities - community pushback (look into Jones Act)

SUMMARY OF MEETING

Meeting : Conference Call. Date: January 8, 2018
Discussion: Introduction to Port of LA/ Maersk Line
Attendees : POLA: Carter Atkins, Maersk: Lee Kindberg. UCLA: APP Team

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- Both ports have emission reduction programs, including Vessel Speed Reduction
- POLA uses Environmental Ship Index (ESI)
  - Points accrued based on engine ratings, fuel used, shore power capacity
  - Ships can report additional measures
  - 50 ports, 6,000 ships enrolled in ESI
  - ESI lists vessels and scores them - they DO NOT have auditors BUT ports can opt to become auditors and audit vessels that call there
  - ESI information is updated every 6 months - must be done manually
    - "administrative burden"
    - refueling = receipts, lists fuel information
    - they do not keep fuel data for older vessels
    - they only register vessels they think will qualify
    - the working group is looking for an automated way to update this information
- Incentives go from ports to vessel operators using the databases - ESI doesn't distribute incentives
- Right now emission benefits have to be surplus to regulation and in this region (LA)
- State of California responsible for all air emissions

- 2M: Maersk and MSC alliance
  - alliances are common between shipping companies
  - this alliance impacts where calls are made because they have committed to their alliance partner(s) about which vessels are going to be deployed and when. Alliance impact includes whether calls are made to POLA and POLB

- Marine Exchange: entity to coordinate ships
  - traffic service
  - examines transponder codes and radar (and EIS data?)
  - has all call information
  - need port or shipping lines authorization to log in

- POLB's dockage waiver program affected Maersk's behavior as a company
  - vessel speed changes
  - no changes to vessel deployment
- No programs have resulted in vessel deployment changes
  - "big driver is what do customers need and what will the cost be"

Type of Data	Source of Data	List of Questions	Output/ Data Processing
Matrix of environmental program	Christine (Port of Vancouver) - via email	Matrix of environmental program on each port of alliance	To know environmental program (particularly in reducing air pollution) in each port
Environmental program to reduce air pollution of each port	Team meeting with environmental program of port alliance	circumstances on communication with the shipping lines. Information/ data-flow between port and shipping lines	Communication (IT system) and data (documentation, forms) used between ports and shipping lines
		What is the current procedure for shipping lines to join the environmental program in each port	Flowchart. Compare the procedure and possibility to merge procedure
		How many shipping lines are eligible but not yet receive the incentive	Motivate increased program participation
		How many shipping lines who never send green ships? How many of these ships should be facilitated to our programs?	Number of shipping lines/ strings that should we target specifically for this program
		Indicator and mechanism of program evaluation. (Ex: How to recognize the Tier 2+)	Compliance data. Possibility in reducing current programs if participating in Green Ship
		Funding source, funding mechanism, funding proportion of each programs, and # companies involved for incentive based programs	Threshold for participating in Green Ship program
		Budget ($ amount or percentage) for each program	C/B in current or upcoming environmental programs
		$ incentives and non monetary incentives to the shipping lines. Compliance level?	Most attractive form of incentive
		How do you think the incentive from your ports relatively to other ports and index provider	Check if there is any comparison for incentive

		Collaboration with other ports. Is your port join groups/association/ alliance to work on environmental programs. What are the benefits and problems?	To know if collaboration is beneficial for business and environmental port's programs. Check association for the details
Business development strategy of each port	Team meeting with business development and operation of port alliance	What are the concerns of port's business development in participating in one environmental program (environment cost per operation cost ratio)	Financial constraints of the program at PoLB
		How environmental program benefit/ harmful to the port business/ image	Decrease and increase of ship docking after environmental regulation
		Current collaboration level with other ports. Willingness to collaborate/ have integrated data with other ports	Explore what kind of collaboration is helpful. Current status of communication
		Communication platform used for collaborating with other ports, including number of IT systems and whether systems are centralized	Understanding methods and limitations of tech-based communication between ports
		Would it be helpful to combine operation and environmental programs to collaborate within port	Possibilities to collaborate business/environment within port
		Association concerned/ parties that can be easily targeted for disseminating the environmental programs	Possibilities to ask collaboration with freight forwarders, business association
Operation details of each port	Team meeting with business development and operation of port alliance	Documents used to enter port/ required to operate within the ports	Possibility to integrate operation data with environmental data
		Criteria and mechanism of port calling the ships per terminal, type of ship involved (tier 2+)	Clustering container ships based on shipping line companies, tier, ship size for recipient of incentive
		What are the shipping lines preference in calling POLB vs POLA? Is differences in environmental programs/ procedures matter?	Other port calling criteria beside terminal availability

		How long are the ships usually harboring at ports (derive from type of ships/ quantity of containers/ trade value)	Quantify air emission while the ships are docking at the port, eligibility in receiving incentive
		Ship strings	Possible port collaboration, proxy how long the trip for 1 bound per ship
General information of port	Internal research	Number of terminal, terminal size; shipping lines and country/ port strings involved	Proxy the number of containers and ships, trade value
		Compare strings in Pacific bound with the rest of the world	Share of trade value using container == ratio of shipping lines service in Pacific bound
IT	All Ports and shipping lines	How sensitive is the data-flow between shipping lines and companies	Possibility in integrating data between ports
		What is the IT system used for communication with external parties (shipping lines, other ports, port authorities)	Possibility in using portal based IT system
Index Provider	Internal research, possible to ask questions via email	What are the indicators or measurements used for calculating the index?	Know how different the requirements from BAU
		What is the mechanism of assessing current emission relative to baseline?	Know if the baseline submission is voluntarily/ not
		What are the financial sources? Fees? Members?	
		What is the procedure for shipping lines to join the index?	Understanding documents and processes used by authoritative organizations
		What communication platform (IT system) with shipping lines to help them submit the data required for index and to claim the incentive?	
		Have you ever conduct customer satisfaction while doing index calculation? What are the main concerns?	What concerns are shipping lines have while participating in environmental program

		What are the benefits to join the program?	Effectiveness of monetary and non-monetary incentives
		How members participate/ collaborate with the association program. What kind activities/program anticipated	Details of ports/ shipping lines/ city governance involvement. Main purpose of shipping lines join
		Documents/ Communication platform used, availability of IT system	Understanding technology used for communication
		Environmental concerns to the association, what are the hot topics about air pollution	How the green ship programs would be beneficial to possible collaboration
		Is there any awards on environmental/ best practice business? What is the mechanism of the awards and what is the incentive?	Benchmark the practice of collaboration using incentive
		Have you ever conduct customer satisfaction while doing index calculation? What are the main concerns?	Concerns of shipping lines in communication/ collaboration
		What makes additional member beneficial to the association's general outcome	To know what the shipping lines contribution are other than participation fee
Case study on EV Rebate	Internal Research, Meeting with Advisor	How customers experience rebate claims and how this could be improved	Framework of rebate system
		Parties connected in each process (PIC in federal, state, including the dealership)	How each party has value chain in contributing to disseminating rebate information, accountable for financial transfer
		Financial and information flow from federal/ state level to the end customer	Communication relationships between private and public entities. Fiscal Relationship
		What is the evaluation mechanism for people who claim rebates?	Evaluation method/information flow

Shipping lines environmental preference in line with operation	Questionnaire/ FGD with shipping lines companies (Merchant Pacific Lines)	How does your company approach environmental issues? (What are their concerns?)	To know if the shipping lines have preferences in environmental issues in the operation
		Distribution of Tier0/1/2/2+/3, their participation in environmental programs, and their shares in receiving incentive	What kind of ships currently participate in environmental programs and receive incentive
		Does your company have strict policy in recycling old ships/ make old ships retired after year depreciation ends?	To know what happens after the new Tier 3 ships are coming with respect of older ships
		What is the cost of shipping line per company/ day, per ship/ day?	Percentage of current incentive to the current shipping cost
		What are the criteria to send ships?	Considerations that might be included in the green ship programs
		What are the criteria to use strings and docking at certain ports? Especially if the ports are adjacent to each other	
		What are your company hopes/anticipation while harboring into certain ports	Possibility in giving facilitation incentive
		What criteria must be met to participate in the programs? How much is the incentive and what are the non-monetary incentives?	Shipping line motivations in respond to incentive
		What is the most attractive environmental program in the port?	Benchmark best practice of incentive and application in ports
		Is incentive number is biggest factor to join the environmental program at ports? How much $ incentive / percentage of operation cost that could be attractive enough to join the program?	Incentive amount that can drive changes in behavior to the desired outcomes
Shipping lines communicatio		Are you aware of the environmental programs in the ports? what programs are you joining now and how do you find out?	Find out how to communicate between ports and shipping lines

n and collaboration preferences with ports		What are the documents required and who is preparing the documents? Is it requires extra work?	
		How many times in a year data/ documents should be prepared to prove your participation in the environmental program	
		What is your company doing to receive incentive, including communication type and procedure	
		Is it possible that enforcing environmental procedure would discourage ship lines to participate/ sharing data	
Shipping lines participation in index provider using 3rd party, or participation in associations	Internal research	Is your company using a certification provider? What are the criteria to join/ not join? What are the benefits/ incentives?	Compare how easy to participate in provider/ alliance. To know whether it is easy
		Is your company associated with associations/ alliances? What are the criteria to join/ not join? What are the benefits/ Incentives?	Understand what criteria to join/ not join environmental program. What are the most attractive part of the environment program.
		Do you find it useful to collaborate with other entities in the associations? What are the example of collaboration?	
		Who is your representative in the association? How do you communicate with other members of association?	
		What are the most attractive programs they have? What is your most important contribution to the collaboration?	
		What is the procedure for shipping lines to participate in the association/ index provider?	Information gap between shipping lines and index providers, what can be improved from this gap

SUMMARY OF MEETING

Meeting : Conference Call Date: January 16, 2018

Discussion: Details of Questions with POLA

Attendees : POLA: Carter Atkins. UCLA: APP Team

Strategies to get Tier III to call at POLA

- Forecast study: POLA doesn't expect Tier III penetration until 2030+
- Getting newer ships depends on market, volume required to provide service to commercial cargo owners — Who would pay for newer ships?
- **Sulfur fuel cap (.5%) will go into effect in 2020**
  - Creates potential for alternative fuels -- LNG, methanol
  - Need for alternative fuels could mean Tier III are built sooner to accommodate this
- Problem with LNG
  - LNG uncertain; there hasn't been momentum toward LNG projects at ports
  - More of these LNG projects are for ships that have routes just in the US

Tier III awareness

- Participants are very aware — Maersk only registers ships where they know they can get incentives)
- Ship owners who charter vessels → those who are chartering the vessel might not know about ESI even if the ship owner does
  - Crew composition varies
  - Owner might enroll in ESI but charter might not know that it is an ESI-registered vessel — less common with container ships

POLA Incentive Program

- Business development and other parts of the port cooperate
- They have met with/talked to shipping lines about ESI
- They send an "incentive report" with all arrivals and departures from POLA, ESI score, column showing incentive eligibility — he thinks it would be more challenging to do incentives per call
- Sent to ship operator, who then verifies vessel call information accuracy, assigns operators, and so on
- Operator then sends the verified report back with an invoice (along with W-8), must have business tax registration form on site in POLA
- Increasing Port Monetary Incentives — depends on budget but unlikely
- Started by looking at vessel speed reduction amounts
- Looked at distribution of container ships calling the port with good ESI scores
  - Analyzed scores of existing ships and looked at budget from there
  - Starcrest made them a calculator (2005?)
  - Starcrest is well-connected with regulators and policymakers about emissions inventories

Participation with ESI

- POLA receives quarterly ESI updates; ports pay but it's free for shipping lines
- Biggest change you can make is to buy cleaner fuel – this has been the biggest change in behavior
  - Cleaner fuel means more points
  - New fuel regulations might mean more fuel behavior changes
  - Continual increase of ship enrollment in their incentive program
  - They want more ships enrolled and more "incentive providers" enrolled too – ports in other countries
- ESI Administrative Work
  - To achieve a sulfur score: provide fuel receipts of quantity and sulfur content of fuel by quarter
  - It is laborious to manually write this information in for 100s of ships
  - ESI is working on an automatic upload – anticipated rollout 2018
- Intermediary Data Entity
  - ESI does serve as intermediary since shippers upload information to ESI, which is then accessed by ESI and "married" to activity data from Marine Exchange (arrivals, departures)
  - Also "married" to Lloyd's (IHS), which has ship information including build, engine model, etc.

Collaboration

- Platform -- Partnered with international ports through IAPH
- West Coast Collaboration
  - Multiple efforts to collaborate over the years
  - Many ports are in ESI or IAPH
  - His opinion is that there should be a worldwide rather than regional approach
- Joint Fund
  - He thinks this would need to be at a state or federal level
  - Incentive benefit would need to be surplus to regulation
  - The benefit would need to be in the San Pedro Bay ("LA harbor area")
- Idea on Centralized Platform
  - Anything that is easily verifiable is easier to use for environmental rewards
  - We should look into shipping line feedback about the platform
  - It would be challenging because of the big data aspect, which would require administrators to verify and maintain data

Other Issues

- Shore power allows more monitoring of ship behavior
- Each port must have its own program to avoid collusion
- New York has an ESI program and a vessel speed reduction (which adds points to ESI score)
- Some ports structure rewards by top 25 cleanest ships, others have a minimum that needs to be reached – it varies a lot by port
- The major cost for shipping lines is fuel
  - This is where they are trying to save money
  - This is also where there might be more of a leap toward Tier III

SUMMARY OF MEETING

Meeting : Conference Call. Date: January 23, 2018
Discussion: Environmental Programs at Maersk Line
Attendees : Maersk: Lee Kindberg. UCLA: APP Team

Maersk Overview

- Maersk is headquartered in Copenhagen, 7 marine operations groups around the world
- India houses Maersk vessel data
- Own half their vessels, charter other half — just acquired company with 150 vessels

Interaction with Ports

- Run on standard schedule, have service loops to different ports
  - POLB route is 7 week trip with 7 vessels on the string (TP8); different ship each time; used to be 12, now 7; after years of this string functioning
  - Strings change regularly - vessels come in and out depending on route service needs
  - Every 3 years "major network change"
- POLA and POLB do emissions inventory every year while many ports don't do one or do one every 5 years, depending on cost

Participation in Environmental Index

- **Clean Cargo Working Group** does vessel by vessel environmental impacts
  - "It's a big picture thing - does not drill down to this level of detail"
  - They publish CO2 averages for entire industry every year, about 25 different trade lines
- ESI has standard scoring system.
  - In CA, speed program is separate from other programs. (vs. New York where low administrative burden)
  - Incentive schemes in ports are too complicated and complex to understand fully.
  - Concept of ESI, centralized platform, is great idea
  - ESI: 31% of scoring is based on, 10% is based on CO2.
  - A number of us try to influence ESI, pretty detailed and complicated.
  - "$2,500 / call is not enough (because a ship consumes 200 tons of fuel a day);" Fuel cost is the largest cost ← see published data
  - Energy efficiency as well as Tier level
- Pool port's incentives into joint fund; ports compete each other, though (negative)
- Increasing individual port monetary incentive; incentive program at POLB did changed Maersk's behavior (10 times)
- Waiver value increases are enticing

Incentive Programs

- Administrative cost to enroll incentive programs?
  - Time consuming, don't have time to enroll every vessel
  - **Centralized data system is preferred**
- Ship incentive programs have "a little" impact on which ships are deployed

  - Green Flag program was effective: Dollar amounts are so small compared to operating cost that they have little impact — operating costs are "Orders of magnitude bigger"
  - Dockage waiver program is considered when choosing ports
- Onus on Maersk to find out if vessels on strings are certain Tiers
  - People making deployment decisions don't necessarily know Tier levels or ship characteristics
  - Higher Tier vessels must be registered, which is an additional task
  - Scheduling completely unrelated to ESI
- Vessel lifetime: 35 years
  - Operated for 20-25 years
  - Market, technology, operating costs always changing
  - 45% reduction in emissions since 2005?

Tier III Ships

- "Technology is not there yet".
  - Engines have been getting cleaner, so some older vessels are close to Tier levels
  - "It's brand new and it's somewhat problematic"
  - Hard to retrofit ships
  - Head engineer at Maersk came from one of the largest engine manufacturers in the world
- Tier II & III rules set up like truck standards
  - Yearly standard deadlines - engines manufactured by a certain date must comply with certain standards
  - Date of compliance: when keel of vessels built; related to ballast regulations and part of why a lot of companies laid keels before Tier III standards kicked in
- Vessels must survive weather in north Pacific + north Atlantic in winter
- There aren't that many Tier II ships out there either

SUMMARY OF MEETING

Meeting : Conference Call Date: January 26, 2018
Discussion: Initial of Port's Incentive Programs in the US West Coast and Canada
Attendees : Starcrest Consulting: Bruce Anderson. UCLA: APP Team

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Ports Overview in giving Incentive

- POLB data supplemented through inventory and vessel boarding
- Port set dollar amount by looking at data from previous years and estimating for future
  - Dollar amounts pretty much exclusively set by ports because they need to consider their funding capacities and their board
  - Starcrest gives ports calculations and scenarios
- Shipping alliances set up service routes
- Shipping lines deploy a given amount of ships based on trade projections and capacity
- This is based on business — where can they get the most bang for their buck with the deployment
- There are not a lot of strings that go from China to Canada to US; ships on those routes are part of larger pool of ships.
- They aren't trying to send large, mostly empty vessels just to collect incentives
- Incentive behavior changes are within the past 4 years
- **"Anything below five figures is a nominal fee"**
  - Unlikely to move vessels between strings because of smaller incentive amounts
- POLB free parking largest incentive of any port
- Equity and leakage problem: "Dirtier ships don't get scrapped - they go to other ports"
  - Shipping lines wonder about indirect impact on ports without incentives. These can be outside of US but not necessarily

Interaction between POLA and POLB

- Number one incentive to send ships is the cargo volume at these ports -- This is the biggest driver of getting newer ships
- They tend to get "cleaner hand-me-downs" from other lines -- from Europe-Asia lines
- Other ports (New York, Savannah) are starting to compete by handling higher volumes of cargo. This will affect who receives hand-me-downs
- Other ports in US tend to get POLA and POLB's leftovers
- "TEU throughput is critical for POLA and POLB to do a lot of what they've done"
- Since 2005 they have been getting fewer ships, bigger ships, newer ships
- Ships have 30 year life

Port money should be spent on develop incentivizing programs or their websites

- Double edged sword. A lot of big shipping lines - largest container ships - have internal programs to identify and claim incentives
- Challenge: making sure these resources are updated
  - Need to handle staffing and program changes. Need entity to make sure things are up to date

- A website would be beneficial for medium and small operators to track incentive programs
  - Might need to analyze cost of starting and maintaining that compared to the impact of potential change that could occur
- There isn't really data that is shared across all programs/platforms
- Another challenge of centralized database: how is data protected and who gets to see it
  - Concerns from ship owners : they don't usually share data outside of environmental programs
- If we created "data warehouse" we would need to consider
  - Anonymity, freedom from FOIA, data protection
  - He thinks IAPH (World Ports Climate Initiative) can tackle some of this problems — they exist as an information working group
- ESI is globally successful because they have ports and incentive providers everywhere
- A big problem: websites get built with momentum from a few people, but there are issues with them actually being maintained
  - Another barrier: "not another one"
  - Shipping companies won't be interested unless an administrative burden is lifted
- Each port's incentive program is trying to tackle that port's "drivers" — as you expand a working group to include other ports, more drivers pop up
- **"Incentive programs don't have an impact on when ships leave the system - at all"**
  - It's based on regulation and business needs

Clean Air Action Plan

- Includes report forecasting Tier IIIs, discussion of ships with keels laid before 2016
  - Problem: a lot of Tier II have been built, Tier I aren't that old
  - Tier III cost and operating costs much higher. Size: usually 8,000 TEU
  - Bigger Tier II ships will go to where cargo is -- POLA and POLB's market position is good
- Forecast includes analysis of world fleet

2 Strategies for Emissions Reduction

1. Ship-based (often technology)
   - Port's perspective: Expensive, uncertainty about ship's returns to port (infrequently or never)
2. Port-based
   - More stable because "it doesn't matter who shows up"
   - More certain, business case is more beneficial
   - Emissions reductions at berth. Only 50% of total emissions
   - Downside: doesn't clean ship when in transit or near dock, just while docked

- Other ports encouraged to participate in technological advancement programs but most other ports don't have the revenue to afford it
  - POLA and POLB are like Exxon and Mobil. But grant money can help with that
  - Easier opportunity: grants across multiple ports
  - Can strategize to apply for grants for the groups

International Collaboration

- Pacific Ports Clean Air Collaborative - led by Shanghai and Los Angeles
- Europe is fundamentally different from US and China: US and China do inventories to assess emissions; Europe doesn't do as much analysis, they just set goals?
  - Rotterdam (largest petrochemical complex in Europe) is an example -- Trying to be carbon neutral, including tenants
  - Europe came up with ESI

Incentive schemes by third party are all looking at different things

- ESI, CSI, RightShip, Green Award
- Large ports need to be able to quantify benefits for legal reasons
  - Public money to private entity; programs need to be auditable and quantifiable
- Vancouver has an "inclusive" program
  - "Can I legally give money to this program if I can't quantify the benefits?"

    → For POLB the answer is usually no
- "Everyone agrees" manual entry for program participation isn't optimal -- ESI is working on this

SUMMARY OF MEETING

Meeting : Conference Call Date: February 7, 2018
Discussion: POLA Collaboration Strategies for CAAP
Attendees : POLA: Lisa Wunder. UCLA: APP Team

PPCAC Membership

- Developed first with POLA and Shanghai in 2005 as an agreement between the two ports
- Agreed to work on environmental programs, including PPCAC
- POLA, EPA, Port of Shanghai, MARAD
  - POLB has worked with EPA contacts
  - EPA: Office of International and Tribal Affairs
  - Friendship agreements POLA and Port of Shanghai -- worked together on shore power
- Smaller ports can ask to join
- Meetings and conferences: all ports on Pacific Rim invited
  - EPA will be bringing some regulators from China to discuss vessel incentive programs in a smaller group
  - EPA has another office that works with another working group on local community work
  - Their meetings include discussion of port collaboration
  - There is not a formal membership process focused on green shipping lanes, improving air quality on Pacific Rim
- Conferences have been hosted by Shanghai or LA — paid for by ports, invitation only
  - Focused on work between port staff, terminal operators, shipping lines, regulators
  - Avoid vendors to avoid marketing nonsense
- Working groups — not ongoing in last few years
- AAPA

Big Ticket Items:

- Emission control areas (ECAs) will take up first day
  - At request of US EPA
  - China, US, CA, MX
  - How to enforce compliance
- Ship emission reductions
  - At berth, Incentive programs
- Port efficiency — terminals and vehicles
- Water focus
  - Incentive programs, Ship retrofitting
- Zero emission
  - Technology (incl. Tesla)
  - Ports and regulatory agencies discussing equipment

West Coast Ports Working Group

- Discuss in PPCAC meeting and Christine (Port of Vancouver) will be doing presentation
  - In October Vancouver will unveil more info
  - "All of this is kind of for a website, a shipping portal"

  - A lot of projects build nice websites - will people use them?
- How to formalize collaborations
    - Green Ports working group
  - Right now there are a lot of groups and a lot of overlap - but should be trying to avoid overlap or doing what someone else is doing
- Consolidation?
  - Differing interests in different types of membership. Smaller working groups can be more effective for getting specific tasks done
- "Green shipping route" = providing incentives at multiple ports
- There are lots of groups being developed

World Ports Sustainability Program (IAPH): Mechanism to work with ports around the world on ESI

- Developed ESI
- ESI has meetings twice a year for ports who are and are not members
- Global Ports Vessel Initiative: Incorporated into PPCAC
- POLA likes ESI -- POLA wants to continue meeting with them

- Curious that POLB doesn't use it — ESI is flexible and ports can use what they want to
- ESI: cleaner fuel or retrofitting means an improved score
- ESI "created by the ports, for the ports" — a lot of similar entities are for-profit or looking for money
- They don't see the point of joining another program or creating a fund to do something else

Equity Issue

- POLA and POLB have been in talks with Chinese ports about incentive programs
- China has reduced marine emissions in their 5 year plan
- She doesn't think routing is based on environmental incentives so there's no term for incentive programs influencing this behavior
- Shore power and fuel switching change more behavior
- CA Sustainable Freight Plan.. Includes provisions for international cooperation -- large scale regulations mean more people need to abide by them

Cooperation

- California Tidelands Trust
  - Land not owned, land is managed with authority — any money generated (locally?) has to be used by POLA
  - "Pooling our money with other ports… isn't going to work"
- Friendship agreements as model for collaboration?
  - Possibility of MoU between ports on given enviro issues
  - She likes the model of ports distributing their own incentives
- Status Quo & Informal Collaborations

Chinese Ports' Strategies on Increasing Green Ship Calls

- Focused on doing this themselves
- Haven't implemented yet, cooperating with POLA and learning about it

SUMMARY OF MEETING

Meeting : Conference Call Date: February 8, 2018
Discussion: Introduction to Port of Vancouver and Collaboration Strategy
Attendees : Vancouver: Christine Rigby. UCLA: APP Team

History of Working Group/ Incentive program since 2007

- "Most flexible program in the world" in terms of different ways to reduce emissions
- Every 2 years, they will review the EcoAction Program
- ESI overview: the scoring system to decide their ship types
- Incentive programs are more about recognition than behavioral change at this point
- It's not adding up to really mean behavior changes
- Christine thinks pooling incentives would mean the money adds up, makes it more worthwhile
- Pooled money could be closer to what shipping lines need to improve fleets
  - "Potential for manufacturers of vessels" : Competition between bids, and ability to get incentives could be part of bidding process

Discounts vs. Incentives

- Several years ago noticed discrepancies in who was receiving discounts -- people receiving discounts vs. people eligible
- Incentive: application submitted for discount -- local shipping agent deals with this
- Realized it would be easier to put info in one place - as easy as Expedia -- and began conceptualizing central data management system
  - Started talking with other ports about this idea, globalizing it
- Framework about discounts
  - Fee on which they offer discount is based on size of vessel
  - Fee discounts don't necessarily equate to incentive amounts given by ports like POLB

Centralized Platform

- "ESI is one of many rating systems" - each one is different and brings different value
  - Just air vs. air and water vs. crew safety etc.
  - "I don't think it's right to try to reduce the number of rating systems [...]" -- Rating systems have tried and failed to merge before
  - If all info in one place, multiple rating systems could use it and ports and shipping lines could make right decisions for them
  - If non-flexible ports only go with ESI, going to miss giving discounts because shipping lines are with CSI, etc.
  - Christine sees it as an issue that they're not providing the discounts when ships are eligible because the shipping lines could be using the money
- Have budget they need to recover annually,
  - Know which vessels will call, anticipate their calls and configure rates and fees to be revenue neutral with the program -- use fees and rates to offset discount given to cleaner vessels
  - Incentive programs do not want 100% of vessel calls to get a discount. This is not sustainable and continuously bump up criteria if something becomes more normalized
- Northwest Seaport Alliance doesn't offer incentives
- Shipping lines have trouble keeping track of regulations and programs offered by ports
- "End goal" would not be for one port to manage things, it would be to have a third party managing the information platform

- She thinks in the end there would be multiple ports buying in and funding it.

Vancouver programs
- Require more administrative work to track more
- Join 6-7 different rating systems
- Agents must know details of systems -- which is why a broader, integrated system would hopefully be easier for everyone

Competition Among Ports
- Northwest Seaport Alliance sets strategy example
- Results-based targets that each port can work toward
- Competition is going to happen, regardless of how they talk about incentive programs
- If incentive programs can affect behavior in the industry, everyone should benefit from it
- All they want to do is maximize existing programs by spreading awareness
- Discussion began with West Coast ports with incentives but it has grown since then. Getting large ports on board with this type of program raises profile "The more the merrier"

Vancouver in process of identifying companies to develop a refined work plan for their idea for collaboration. Idea: step-by-step approach
1. Joint communications and promotions of programs and infrastructure at ports along with 3rd party rating systems
2. Route planner - shipping lines enter their route plans and vessel information, receive info about cumulative discount estimate for given vessels -- separate application required
3. Ports can access information on route planner, meaning shipping lines don't have to register for discounts at individual ports
4. (Final) Raw data that goes into calculating these scores is entered into system - End goal is the centralized data management system that allows for ESI, CSI, etc. calculations by the system

Potential organization format
- Core working group: funders, those actively involved
- User group: shipping agents, etc. - checking ideas on the ground
- Advisory group: broader group of stakeholders
- This collaboration is too big for just one port to manage
- Without a lot of ports and shipping lines involved, there's little benefit to doing it
- Small-scale data management system not worth time or money
- An NGO tried a few years ago - "it didn't go far enough to make it helpful"
  - Sustainable Shipping Initiative
  - Formatted to provide program information to shipping stakeholders

SUMMARY OF MEETING

Meeting : Conference Call Date: February 9, 2018
Discussion: Confirmation of Policy Options
Attendees : POLB: Renee Moilanen, Morgan Caswell. UCLA: APP Team

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- Interested in centralized platform -- have been in talks with Port of Vancouver about from where Christine got website funding so POLB won't need to take lead role on this
- How to administer something including multiple ports in the alliance?
  - "There's nothing binding about them"
  - Collaboration agreement between stakeholders about making a certain idea come to fruition
  - "It gets dicey when you're talking about money / sharing data" == This is where third party would be good and Working Group would need a lot of rules
  - Centralized system managed by third party would be most expensive option
- Second option would be feasible without a third party
  - Options 2 and 3 would need to be combined
  - "Formal centralized entity" must be managed by third party, maybe ports pay fee?
- AAPA option worth analyzing
  - One of the negatives would be that this is outside of AAPA's "normal scope of services". Their core business is advocacy and information sharing
  - This one would cost less than the centralized, third party-managed options
  - Added service? Included in membership dues. Not everyone is a member
  - Add PMSA as an option?

Standardized index provider

- Many European ports are not happy with ESI and POLA doesn't understand ESI's core issue
  - ESI provides centralized scoring mechanism. If your ship has a score, the dollar amount by each port is still unclear
  - ESI is going to be "largely irrelevant very soon"
    - Right now ships get benefits for using cleaner fuel == 2020 global fuel rules changing
    - ESI will need to adjust their scoring system for this change or it won't be relevant == A lot of what's in ESI will become a requirement very soon
    - ESI is a "significant burden for shipping lines." With ESI, even Tier I ships using clean fuel qualify for incentives
    - **A lot of ESI's components are already California regulations.** e.g. shore power gets extra points, but it's mandated by state law
- The ultimate goal is Tier III ships for POLB because they represent the most significant difference
- Renee says we're looking at the West Coast ports because looking at the whole world gets complicated: IMO meetings get complicated

Non-monetary incentives

- "Tough to orchestrate": Not really practically applicable == Recognition of non-monetary incentives is important: Centralized system means more centralized recognition

- “Worth looking at” recognition for shipping lines with more “green” ships
  - This would be good for us to explore
  - Some POLB Business and Finance people feel uncomfortable with comparing customers

SUMMARY OF MEETING

Meeting : Conference Call Date: February 13, 2018
Discussion: Financial Transfer Between Ports and Shipping Lines
Attendees : POLB: Randy Smith. UCLA: APP Team

Shipping Line Costs: - Capital (Vessel) - Financing (Vessel) – Operating.

- If ship is chartered, charter costs include crew costs
- Every ocean carrier operates differently; every charter or lease setup is difference
- Costs are a function of how ownership is set up
  - If you charter or lease, you have daily payments. Chartering or leasing allows quick adjustment of trade capacity, not needing to wait for ship to be built
  - If you own a ship, you just have to cover regular operating costs

Terminal Costs

- Those who own have lower costs
- Marketplace
  - Some carriers still own terminals
  - Some have sold ownership in terminals to other infrastructure partners -- Now those partners are trying to turn a profit
- Look at bunker fuel diagram IF-380 that Rusty sent - heavy bunker fuel.
- Fuel is biggest operating cost. Consumption related to ship size, speed, engine
- Terminal costs largest cost related to freight handling
- Throughput Cost: Includes most of terminal costs
- Some costs are terminal-to-carrier, others just to carrier
- Tariffs: - Dockage - Water - Piloting
- Wharfage (found in LB tariff)
- Terminal handling costs incurred by terminal
- Port costs are port administration costs

POLB is “landlord port”

- Marine terminal property leased to marine terminal operators
  - Operators have to go find business -- ultimately up to terminal operator to secure business
- POLB becomes third party
  - Tries to bring operators and carriers together -- help with communication
- POLB wants it to be as attractive to potential renters as possible
  - Track market, public perception, business desires
  - Always looking at environmental factors, what the industry can afford
- Because POLB is public entity, can’t “discriminately” give incentives
  - Available to anyone who meets conditions
  - Part of their job is to communicate incentives to carriers
  - Ports that “discriminate” might have things in shipping contracts - difference between landlord port and operating port -- West Coast tends to have more landlord ports

Other Incentives/ Discounts

- Green Call Program / Free Parking - must do both:
  - VSR
  - Shore power
- All incentive programs are discounts "off of existing revenue streams"
- Question of who should receive incentives? -- operator vs owner

ECA on both coasts of US
- Low sulfur fuel -- almost twice as expensive as regular fuel
- ECA ends at Mexican border
  - Ships can bypass ECA this way
  - They need to go down entire coast to be more effective
  - A lot of ships that operate in ECAs prefer LNG
- 2020 Sulfur regulations will affect fuel prices
- Port of Portland does not have a lot of containerized business -- no containers in last 6 months
- Randy doesn't think we'll have a lot of industry people able to respond to our questionnaire because they're more focused on operations than policy

Carrier Deciding on a Port
- Terminal space is top concern
- With container ships:
  - Is it worth it for ocean carrier to put cleaner ships into rotation to begin with?

Collaboration
- Do incentives offset other costs? -- Collaboration between ports needs to get up to the higher ups
- Harder on the "break bulk side"
  - Might not see value because they might not be returning to port
- Incentive programs can be competitive advantages
- Terminals can't communicate with one another outside of certain circumstances - usually need a lawyer
- Currently, incentive programs are paid for through port revenue
- Federal regulations create limitations on some of this
- "There's no reason why one organization couldn't be the administrator"
- Issue with collaboration:
  - What makes sense for one/some ports might not make sense for others in terms of type and size - both within the US and internationally
  - Not "one size fits all"

SUMMARY OF MEETING

Meeting : Conference Call Date: February 21, 2018
Discussion: Introduce Policy Options to the Port of Prince Rupert
Attendees : Port of Prince Rupert: Jason Scherr. UCLA: APP Team

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- Issue with collaboration:
  - What makes sense for one/some ports might not make sense for others in terms of type and size - both within the US and internationally
  - Not "one size fits all"

Green Wave
- Started in 2013
- Looked at other ports' incentive programs (CA, US, EU)
  - Vancouver's model made the most sense -- multiple ways vessels can qualify
- Tiered approach to incentivize greener ships but using different criteria

Participation in Environmental Shipping Index
- Small fraction of world ships participate in ESI
  - ESI: focused on local air pollutants (NO_x)
  - RightShip: GHG emissions. Originally developed as risk rating system. Some companies won't charter ships with poor ratings
- Before launching program, modeled vessel stream within 3 years of vessel calls
- Looked at ESI + RightShip, what costs would be
  - Same challenge with not knowing if they'll see individual ships again
  - Container lines with regular calls are more reliable
- Most ports in Europe use ESI but it has a "limited scope in assessing the vessel"
  - Recommends having multiple ways to environmentally assess ships

Collaboration
- POLB and POLA are part of ECA. SO_x "essentially gone as a contaminant" but NO_x is an issue
- Working group "past that stage" re: being informal
- Wanted Prince Rupert and Vancouver to have similar feel for shipping companies
- Strong engagement with local ship agents -- strengthen awareness, streamline vessel application process
- Last 3 years: increased discussion about cooperative expansion to US, Europe, Asia
- Larger ports don't necessarily know which vessels will qualify for their programs, but smaller ports do, so they can reach out to those vessels
- How can ports put out the proper information for ship owners to use to know about participation?
- Used local ship agents to engage shipping lines; port reached out to container lines more directly
- Thinks our centralized IT system idea is good
- New third party could be helpful

Incentives

- If vessels qualify for more than one incentive program, vessels usually end up in same program tier -- if they differ, the vessel receives the higher tier reward
- With tiers, they can change the levels for each tier
- Can change percentage for each level, can add or remove criteria
- Last year added underwater noise – Prince Rupert and Vancouver are the only ports that incentivize quieter ships
- They removed sulfur content from incentive criteria when ECA became a regulation
- They've raised EEDI performance standards over the years
- Anything that becomes regulation gets removed from reward program

Discount

- Discount looks better than giving the shipping lines direct payment transfer
- Not sure how "giving them a wad of cash" would work, in terms of optics

SUMMARY OF MEETING

Meeting : Conference Call Date: March 6, 2018
Discussion: Introduction to Massachusetts Port Authority
Attendees : MassPort: Reed Passafaro, Michael Meyran. UCLA: APP Team

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Port Overview

- "Quasi-public agency"
  - Board of directors (7) - 6 appointed by Governor
  - Financially self-sustaining for operations
  - Receive grants and other external funding for capital projects
- 3 areas
  1. Aviation
  2. Commercial real estate -- South and East Boston
  3. Maritime
     - $4.6 billion in economic impact, 7000 jobs, 50,000 including indirect and induced
     - owner and operator of container terminal and cruise, as well as seafood processing
       - Private operator that imports subarus for NY, exports old vehicles to Western Africa
       - 20 cruise lines that call
       - Seafood processing: Boston is one of the big seafood areas of the country
       - Auto port: 80,000 cars processed -- facility has 10 other maritime businesses on property
     - Weekly shipments from ⅓ of New England-bound cargo -- Most still goes through Port of New York and New Jersey
     - Top importers and exporters: Jordan's Furniture, BJ's Wholesale, Christmas tree shops, international forest products
     - High volume -- 270,000 TEU in 2017. Growing above forecast level

General

- Massport website has guidelines on environmentalism (he will send this to us)
- They do not have Long Beach's industry influence (volume, necessity of calling at POLB, etc.) - difficult for Massport to negotiate, especially on own
- Not clear if PoNYNJ is helpful for negotiation
- Top priority: safety and security. Next priorities: economic power, "need to be a good neighbor"
  - Spent $75m to build new freight corridor to avoid going on residential South Boston street
  - Replaced old route with park, noise barrier, new road
  - "Butler Freight Corridor"
  - Economic development: getting infrastructure in place trying to deepen harbor (dredging); project to build new berth, cranes
  - Capital Programs, Environmental Office

Greener Ships (Tier 2)

- Trend for more larger ship construction
- What is the marginal benefit of Tier 2 and 3 ships?

- $6,000 per call is not enough.
- New ship building program first port can get big ship.
  - We should look at age of the ships -- Lifespan of ship is 15 years.
  - Shipping lines (SLs) are scrapping small ships.
  - Organic pathway.
  - SLs manage deployment plan based on ships they have -- big ships usually are new ships.

Details in Ship Deployment

- Paperwork for process of deployment
  - Formal: contracts cover 3 or 5 years.
  - Informal: emails or phone calls from ocean carriers to ports re: updates to routes
  - Money drives a lot of behavior.
  - Massport runs terminals, unlike LA or Long Beach
- Terminal operation at Massport
  - Easier
  - We can technically wrap up incentives.
  - The other angle, which could motivate SLs' behavior, is a public ranking (of better deployment of green ships).
- Administration works on shipping lines when participating in environmental programs
  - He agreed that the process is burdensome (process flow)
  - Consider benchmarking ports according to administrative burden and air emissions per container
  - EPA sets the general guideline for calculating emissions.

Discussion on Policy Options

- Centralized platform system
  - Concern about Ports getting together -- is money (e.g. rates) involved?
  - Monopolistic point of view
  - Create leverage for shipping lines
  - Federal Maritime Commission regulation
- Involvement of EPA and federal maritime commission
- Industry association (AAPA)
  - AAPA is an industry group – Massport has a very strong collaboration.
  - Environmental Working group exists.
- Shipping association
  - Suggestion: NAPA, North Atlantic Ports Association
  - PMSA, mostly labor, its primary function is to negotiate

SUMMARY OF MEETING

Meeting : Conference Call Date: March 6, 2018
Discussion: Introduction to Third Party Index Provider
Attendees : RightShip: Kris Fumberger. UCLA: APP Team

Overview

- Benchmarking & clean air strategy work
- Formed to improve safety of ocean going vessels and work with charters a lot
- Started 6-7 years ago, answer questions about clean air
  - Led to development of GHG rating
  - Use IMO guidelines for all ships
  - Process: shipowners verify ships
- What it does: measures CO_2 emitted from point A to point B
  - Compares ships of same size and type
  - Rating A-G (most to least efficient)
  - "Ship specific" - looking at vessels rather than shipping lines
- 55 charters move 20% of the world's freight

Collaboration

- 300 companies worldwide use RightShip
  - Charterers, banks, shipping companies, insurance
  - Most are charters or ship owners
  - Work with ports on a voluntary, not-for-profit basis -- Free service
- RightShip is an incentive provider through Port of Vancouver and Port of Prince Rupert
- Ports of Vancouver and Prince Rupert trying to give a wide range of options for incentives - working in last 3-4 years
- The ones that use it are mostly on East Coast of Canada and some in Australia. Australia has some private ports built by mining companies
- Hard to work with US ports because they don't have the same sustainability drive as Canadian ports. US ports with sustainability focus more concerned with NO_x than CO_2 emissions
- Trying to get more ports to use it. Wants to be connected with someone at the Port of Shanghai

Comparison

- RightShip capacity to manage environmental programs -- They work with ESI
  - Ports should focus on NO_x
  - They're trying to work with as many industry stakeholders and participants as possible
  - Some ports have had to roll back incentive schemes because of results fudging
- Focus on quality control in operating their platform - 2016 review of system, processes, outputs
  - Implemented suggested improvements
  - They have the capacity to update around the clock because they have offices in US, UK, AU
  - "Robust and rigorous" approach to data system
  - Website for ship owners allows them to update data and information
  - Try to be as transparent as possible

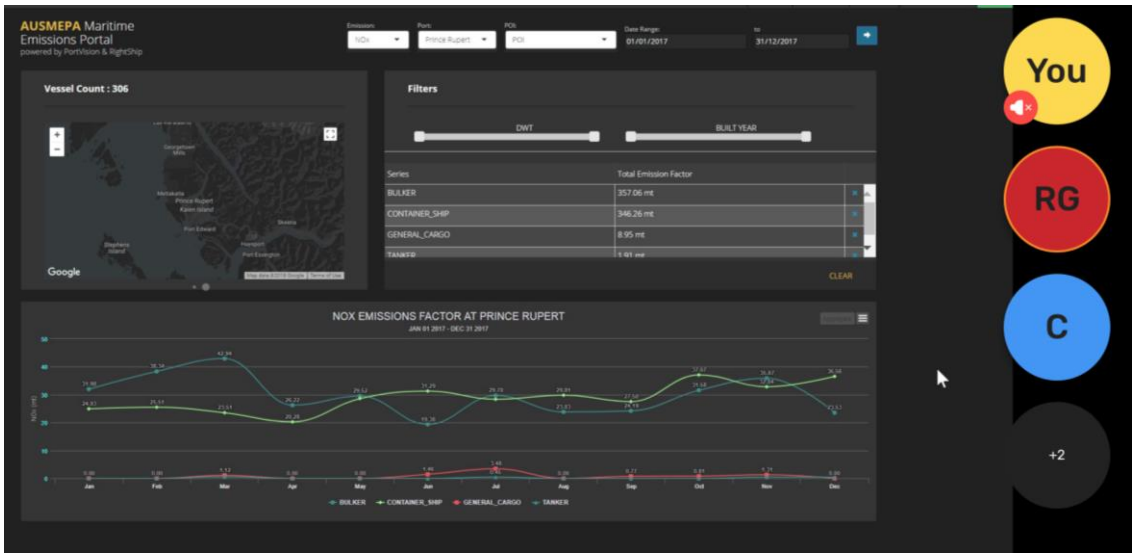
- ESI is "basically a NO_x rating", engine tier
- CSI is combination of Clean Cargo Working Group (CCWG) and ship data
- CCWG look at trade and container ships
- MEPA - Marine Environment Protection Authority
  - Working with them on tracking and managing port emissions -- work on database

Details of RightShip Operation

- Collect data from various (30,000) sources
  - Try to work with ship owners
  - They put environmental information for all ships onto one website
- "A couple of hours" to add data to system about ship models
- To get info, they either use information from tests underwent by ships when they are first built, or they collect information directly
  - They use design data whereas ESI uses operational data
- Their portal includes listing of incentive providers -- trying to work more closely with them
- Currently ports get free access to system -- access is meant to be open and transparent
- Shippingefficiency.org
- Likes the concept of portal as "one stop shop" for shipping and incentive information
  - Thinks this would be beneficial to both shipping lines and ports - they want a "one stop shop"
- 3rd party management
  - Need to figure out how management and instruction (?) are set up
  - Question of how independent an entity is - this relates to financial accountability

RightShip system

- Used Join.me/rightship to look at the portal through his screen
- Portal made with Google funding to track port emissions
  - Maritime Emissions Portal
  - uat360.portvision.com
  - Filter ships -- Pick emission type, pick port, pick point of interest (terminal, etc.)
- Important: using the data in the right way, understanding what the numbers mean
- Information submission is easy, only takes 30 minutes per shipping lines



SUMMARY OF MEETING

Meeting : Conference Call Date: March 14, 2018
Discussion : Initial of Port's Incentive Programs in the US West Coast and Canada
Attendees : Port of Yokohama: Hitoshi Nakamura. UCLA: Takuma Matsubayashi

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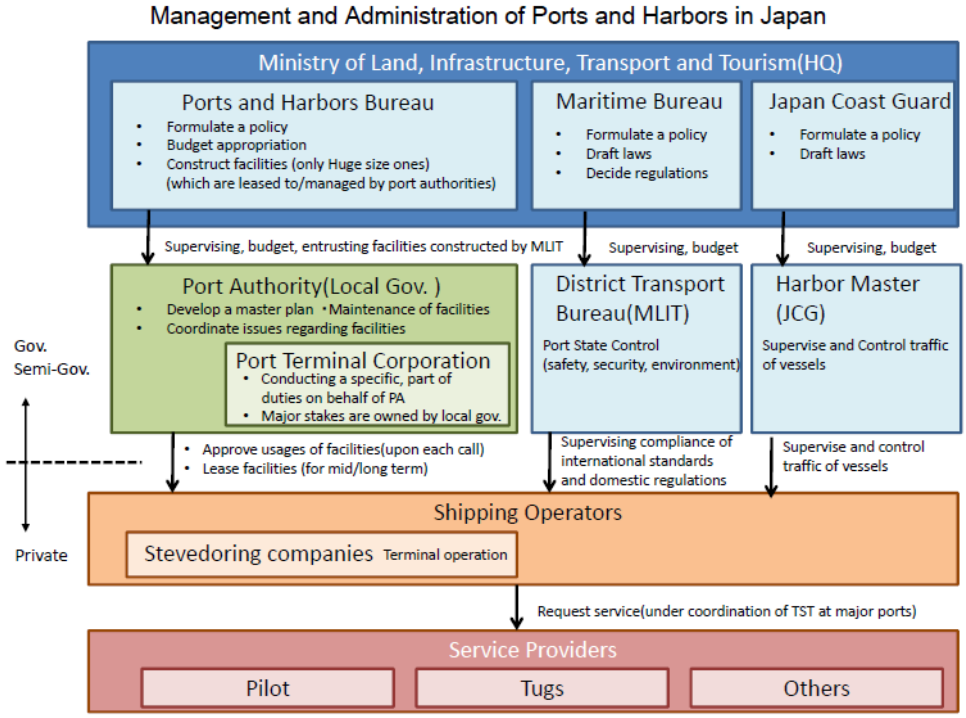
Structure of Japan's maritime governance

- Ports in Japan are governed by MLIT (Ministry of Land, Infrastructure, Transportation, Tourism)
- Ports and Harbors Bureau in charge of each port authority (like Port of Yokohama). However, the bureau is in charge of facilities in ports, like building, berth, piers.
- Environmental Emission Regulation is in charge of MLIT's maritime bureau. Because of such separate governance structure, Maritime Bureau does not have effective influence on port authorities. Thus, each port is not motivated to set its own emission regulations like financial incentive programs



Incentive Programs ($1 = JPY107)

- Only Ports of Tokyo and Yokohama have financial incentive programs to shipping lines.
- The port thought the program might decrease the city's income (about JPY 10 million down)
- **The port explained to the Yokohama City Council that the discount could induce shipping lines to deploy more ships to the port, so the discount would be compensated.**
- **However, Mr. Nakamura thinks the discount will not induce shipping lines to deploy more ships to the port, so the discount will not be compensated. For him, the incentive program is like a "noble obligation". If the port did not implement such program, the port would be less competitive**

Procedures to get Incentive

- Financial incentive for environment-friendly ships at Port of Yokohama
  - 15% discount on entrance fee of port dues
  - Applicable vessels
    - 30 points or more on the ESI score
    - Green Award Certified
- Required documents
  - The copy of certification (ESI or GA)
  - Application form of the discount on entrance fee
  - (Entrance Notice for calling at the port)
- Application Method
  - Submit the application form (with the copy of certification) with the Entrance Notice
    - Each shipping line has to submit these three documents to get discount every time its ships call at Port of Yokohama.
    - Bylaws: discount without applications (automatic discount related to IMO-Lloyd number) is not allowed.
    - According to IAPH, only Japan and another country have the same policy in terms of "application".
  - **These documents are submitted via fax; the port does not have an automatic system like POLB.**
    - If the port gets a larger budget, they want to establish an automatic IT system and do away with faxing
    - At the POY, because of fax and paper documentation, considerable administrative burdens are imposed on shipping agents (like Norton Lilly) and Port Terminal Corporation
    - There is no administrative burden to the local government (Port of Yokohama)
    - Same procedure **is also implemented in Port of Tokyo**

Discussion about policy options

- Collaboration: No collaboration between the port and other ports in terms of environmental emission regulations; POY is involved in a network among ports (Mr. Nakamura knows Christine at Vancouver).
- **Tapered incentive and increase in $ amount of incentive will not induce shipping lines to deploy more environmentally friendly ships** because shipping lines does not care much about amount of financial incentives

- **Participation in the Centralized IT system will benefit Port of Yokohama**
  - They can use IT system without developing such system by themselves
  - For another reason, due to IMO regulation in 2020, ships using LNG fuel (instead of current ships using heavy oil) will be promoted
  - However, LNG fuel ships have a weakness in that they require more ports for fueling because LNG has a greater volume and requires more energy than heavy oil
  - When POY announced that the port launched LNG facilities, it was really important that the port was also involved in a collaboration for air emissions
- Centralized system under IAPH is preferred, and centralized system open to world ports is preferred to one exclusive to west coast ports
- **If the system has merit, the cost should not be too high for POY**
- Non-monetary incentive program is just for PR, not for improving deployment of cleaner ships.
- Too harsh regulation on shipping lines may induce shipping lines to deploy more ships at ports other than Japan (like Korea and China); this means that Japan will lose in international competition among ports

SUMMARY OF MEETING

Meeting : Conference Call Date: March 14, 2018
Discussion: Introduce Policy Options to Shipping Lines Association
Attendees : PMSA: Thomas Jelenic. UCLA: APP Team

Overview on Greener Ships

- "Single driving issue" for past decade: unit swap costs
  - How much does it cost to ship a container from one port to another?
- Vessels have tripled in capacity — operating costs per container drop when vessels are larger
  - "Arms race" among ocean carriers to have large ships — if one has a large ship, another needs it
    - Economies of scale
  - "Only thing that matters" is how much it costs to move a container from one port to another; cargo owners base their decisions on this
  - "You want the largest vessel you can deploy within a specific trade line" and you want the vessel to be full — keeping it full is how you maintain the cost structure
  - Vessel sizes decreased during recession because less cargo was being shipped
- 2 factors that drive deployment of capital:
  1. "As big as possible"
  2. Deploying right size vessel in a trade line
     - "If you're operating 60% full, you're losing money"

     → Like airline industry: half full flights mean lost money (planes need to be full because moving people is expensive)
- "The incentives that any one port can give are generally too small to overcome the cost structure inherent in picking the right sized vessel"
  - Only way to have incentive large enough is with multi-port collaboration
  - "Right" incentive amount is unknown; "it's going to be a lot"
- Today's vessel incentives change vessel deployment "maybe at the margin"
  - It varies by incentive, carrier, world region
  - VSR has been very successful and effective because it's an "operational change within existing vessels" and deployment route, but it doesn't affect vessel deployment

Policy Options

Pacific Alliance

- "Such things are useful but not sufficient"
- If port is serious about incentives, issue of administrative burden
  - Low burden = higher participation; sometimes more important than incentive amount
  - "I've had ocean carriers tell me [...] they don't apply for the funding because the burden to apply for a small amount of funding [...]" doesn't make up for hours spent applying — port and carrier both lose out
- Certificate/ Documents engine ratings
  - If ocean carrier doesn't own this, they won't have easy access; vessel owner may not have incentive to provide them with this information so getting it becomes harder
    - Is there another way to get this information without dealing with third party owners? Would keel laid date be sufficient?

- "The whole issue" with charter ships is issue of getting data
  - There's issue of timeliness in acquiring this documentation
- ESI is seemingly convenient because you submit everything once ("Sounds fundamentally more efficient")

Worldwide Alliance

- "Broader is better"
- Ships are usually in loop between a number of ports
  - Have same vessel calling same ports for several years before redeployment
  - Incentives anywhere on that string, especially in Pacific Rim, would be good
- California is only place that requires shore power
  - So that investment doesn't go to use in other ports
  - If they switch ships out, there's a period of time where the new (not brand new) non-retrofitted ship doesn't comply
  - If more ports had shore power, more SLs would be incentivized to retrofit their ships for it
- Who is the target we're trying to get and what are the ports that are in common for that target?
  - Should be looking at West Coast ports, China, other East Asian ports

Tax/Fees/Disincentives

- "We are in a global business" - competitors are in Texas, Georgia, Prince Rupert
- If you "create disincentives" you need to weigh economic impacts considering the environment is competitive
  - "West Coast ports have been losing market share for a decade"
  - How much pollution being cut (environmental effects) vs. other impacts (such as decline in employment) — hits blue collar workforce
- "Make sure in any discussion on disincentives," negative effects are discussed; California people assume things will carry on without issue
  - He thinks California is disincentivizing "dirty jobs" such as manufacturing and construction
  - Non-physical businesses are most successful in California
  - On California: "you are only a leader if other folks follow" and people aren't following California's lead right now
  - "No port in this country has a meaningful clean trucks program"
  - A lot of ports following POLA/POLB lead are doing it as PR stuff rather than actual implementation — Port of New York and New Jersey (PONYNJ) has been delaying implementation of clean trucks program
  - "Time" is seen as a program for clean trucks due to changes in environmentalism of trucks over time
- In many places, "The contribution of local port emissions to the environment is tiny" so people don't want to jeopardize "economic engine" with "California style policies"

Other Policy Options

- Tapered Incentives
  - "I think a time limit on incentives is something that can be very successful"

  - Issue is how to place boundaries on time limit - "if you can figure out time boundaries it is a great idea"
  - Need to find point where behavior is actually being incentivized
- Monitoring/ Specified Funding — you can't control how they spend money they already have
- Recognition: Santa Barbara Channel has environmental recognition awards - basically every shipping line attended
  - It's important to them that they receive those accolades, including "culturally as a business"
  - "You can easily understate the value of recognition"

PMSA as a Potential Manager of Pacific Shipping Alliance

- Pick a word other than "alliance": in maritime industry, it refers to alliances between ocean carriers for liner routing collaboration
- PMSA to manage – possible, because ocean carriers know PMSA, glad to carried out as long as there is funding
- A challenge: PMSA is a nonprofit, with revenue derived from membership
  - Anything beyond that would need its own independent revenue stream. This is an issue other organizations would experience too (probably including AAPA)
- With third party administrator you either have:
  - Delayed incentive payment: Third party manager would authorize payment, port authority would pay it
  - Need to pre-fund third party manager through port authority: Ports might not want to "frontload payment for incentives"
- Having third party manage it is a good idea because it wouldn't have just one port's name attached
  - Potential problem: third party wouldn't have existing operating structure
  - Would need one full-time person, maybe two (1.5 full time equivalent)
  - It would depend on how active the program is, how much paperwork, how many ports involved and carriers participating

Other Issues

- "The view of ocean carriers on Canadian ports …"
  - Prince Rupert exists solely to take cargo from California ports -- 1 million TEU, still growing
  - Canada environmental programs are seen as competitive to California's
- 2017 was first year shipping industry exceeded recession levels — too many large ships
- "You can never assign cargo routing decisions to any single factor, ever" re: California's regulations
  - Cost differential between shipping to California and elsewhere in the US is shrinking
  - Most California cargo is going to the Midwest
  - So shrinking differentials means … more attention to rail rate? (how much it costs to send supplies by rail to Midwest)
- Focus on vessels vs. cargo handling equipment
  - He sees cargo handling equipment emissions as almost negligible compared to vessels
- Infrastructure is expensive
  - POLB + POLA have spent $2m
  - $10k incentive won't change behavior when vessels cost $160m

SUMMARY OF MEETING

Meeting : Conference Call Date: March 15, 2018
Discussion: Discussion on Final Draft
Attendees : POLB: Renee Moilaneen. UCLA: APP Team

Policy Options

- Formal alliance is "perfectly reasonable recommendation" — no issues with that. Formalized alliance should demonstrate increased clean ship deployment from shipping lines
- We should talk about incentives in the new alliance
- Our scoring system should have higher weight on financial feasibility

Simulation on administrative work hours

- IMO database is automated
- POLB doesn't launch program to attract the shipping lines; maybe 1 hour a month is spent notifying the shipping companies
- No significant administrative time difference for ports using ESI vs. those not using it; shipping lines have to upload bunker notes and data
- POLB doesn't see administrative difference between ports program that do and do not use ESI; they pull info, calculate who is getting what
- POLB has computer system that automatically pulls vessel data and calls - including tier level
  - End of quarter: download ship calls that qualified
  - And then they go through financial procedures to write checks
- They know which shipping lines call
  - Let new lines know about program when they come in
  - Maybe 2 hours a year spent on that
- And they know the vessels that call because their system collects it
  - Then automated system matches whether ships that call qualify for incentives
  - Only difference: shipping lines send W-9 – estimation around 2-3 hours a year
- "I think these numbers really inflate the ports without [an] index"
  - Could be different for ports without automated system
  - Numbers for ports with and without index should be very similar
- There would be an administrative difference for shipping lines between entities with or without indices

Perspective on administrative burden/ regression

- "Administrative burden is not the issue [...] It is one aspect."
- Decreasing administrative burden for ports is not their priority or why they brought us on
- Administrative burden is more important for shipping lines
  - We suggest administrative costs are reason why there aren't more Tier 2 ships, but it's the price of vessels
  - We need to refine administrative costs
  - No port perspective difference between POLB and POLA
  - ESI is most popular despite high administrative costs

Centralized System/ "West Coast Portal"

- Centralized system argument needs to be better articulated - why is it increasing ship deployment?
  - Administrative burden vs. ship cost
  - We should highlight communication (about incentives and otherwise) and route planning benefits
- Discuss more: value of centralized system in coordination and communication about all programs – she doesn't see this as related to administrative costs
- Centralized IT platform will be very expensive - "setting up something like that is going to be a lot of money"
- Cost estimate: $300,000-$500,000 (outside of incentive costs)
  - POLB budget: ~$2,000,000 annually
  - Ports offering incentives most interested in contributing to it. Free riders could chip in money even if they don't have incentives
  - Big upfront cost
  - Difficult to maintain, ports would need a formal agreement
  - Something the ports might have to do anyway in the future, we just need to address complications
- Instead of focusing on administrative cost, focus more on problems of coordination and communication
- AAPA and PMSA wouldn't be taking lead in organizing or running central platform, but it would be easy for them to communicate
- It takes a lot of work for Maersk etc. to figure out how the programs work

Incentive vs Disincentives

- CAAP: 2025 begin putting fee on dirty ships
- Maybe look into increasing incentive amount
- Non-monetary incentive is a "very good thing to suggest" – just don't go too far off into different direction because there isn't really financial feasibility
- We shouldn't be raising discussion about incentive rates or taxes because those are different directions
- **We can say we made the assumption, based on port input, that increasing the incentive amount is not an option because they are paying as much as they can**

We don't need to answer all implementation issues

- We should address the issue of potentially creating more bureaucracy
- They're willing to pay for environmental benefit, we just need to address implementation more. How will the system increase penetration of cleaner ships?

Other issues

- Disagree with PMSA that regulation would drive away business –it's ok to say that industry has concerns about increased regulation driving cargo out of SoCal, which is why it's important to make incentive programs more effective. If incentive programs effective enough, we don't need the regulations
- **Container ships are the only ones that run in strings, while non-container are hit or miss**
- No discussion of POLB taking over terminals, getting rid of operators. There has been talk of the state taking over ports, and of combining POLA and POLB