2022 杭州湾大气污染与温室气体协同控制研讨会，亚洲清洁空气中心，2022年8月12日

发达国家港口减污降碳实践

彭传圣 研究员

交通运输部水运科学研究院

彭传圣

交通运输部水运科学研究院研究员，首席研究员，“新世纪百千万人才工程”国家级人选，长期从事水运技术研究、标准和政策制定工作，持续参加政府组织的各项水运技术与政策国际交流与合作。科研成果获得过国家科技进步二等奖；负责编制了《“十二五”水运节能减排总体推进实施方案》和绿色港口等级评价指南，推动了我国靠港船舶使用岸电和设立船舶排放控制区的工作；发表论文400多篇；担任国际航运硫控制专家组、国际港口协会(IAPH)可持续港口报告工作组以及国际航运协会（PIANC）内河航运脱碳基础设施工作组专家。

内容

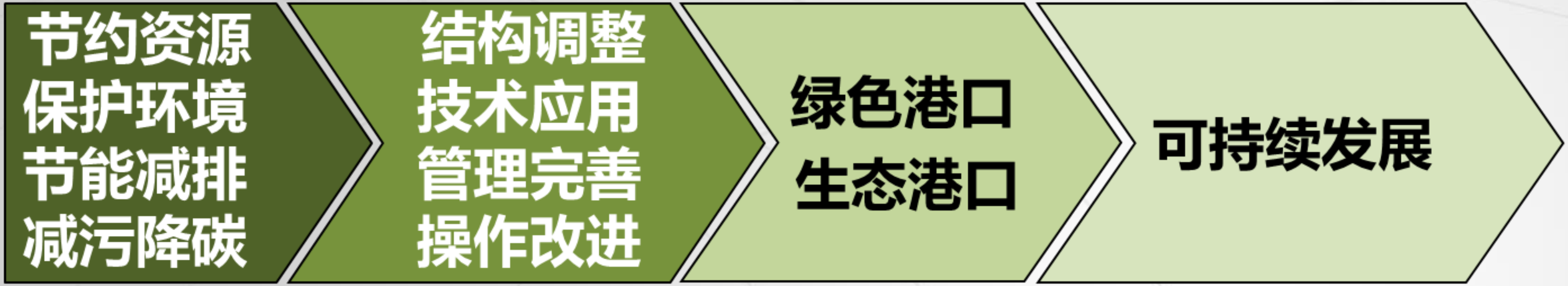
1 路径措施

2 典型实践

3 经验借鉴

措施 → 路径 → 结果 → 目标

不同国家减污降碳的路径、结果和目标是类似的



节约资源
保护环境
节能减排
减污降碳

结构调整
技术应用
管理完善
操作改进

绿色港口
生态港口

可持续发展

措施分类

港口重要性认识、环境保护水平以及技术发展水平→不同国家采取措施的时间差异

	完善管理		
大气污染物	优化结构	节约能源 减少排放	脱硫脱硝除尘 （EGCS、SCR、DPF）
气候污染物			碳捕集、封存和利用 （CCSU）
	源头控制	过程管理	末端治理

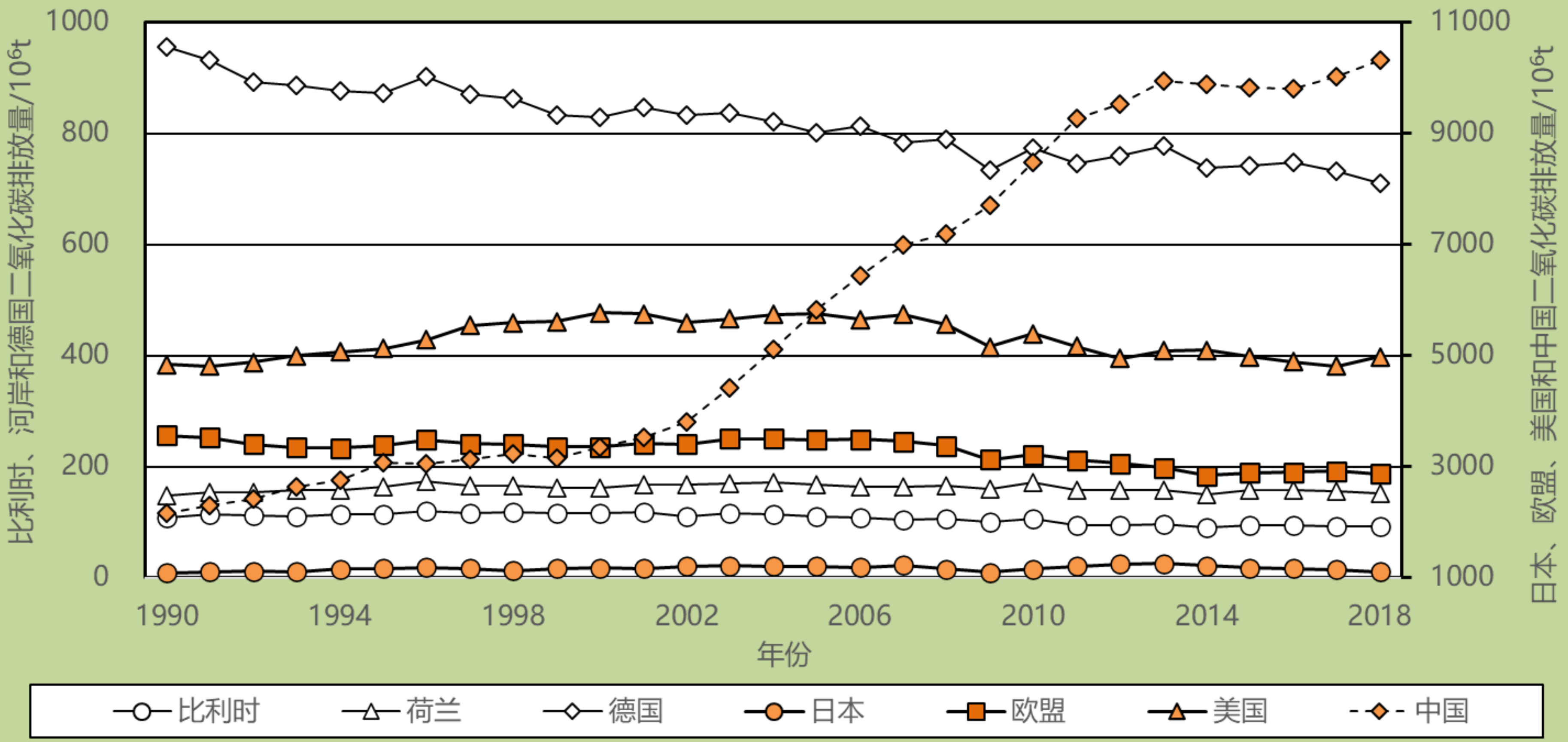
所选港口涉及发达国家温室气体控制状况

日本在节约能源方面做了很多努力，其他国家自然达峰

港口	国家	碳达峰年	2030年国家自主贡献承诺	计划碳中和年
洛杉矶港 长滩港	美国	2005	相对于2005年减排50%-52%	2050
安特卫普港	比利时	1979	相对于1990年减排55%	2050
鹿特丹港	荷兰	1979		
汉堡港	德国	1979		
东京港 横滨港	日本	2013	相对于2013年减排46%	2050

所选发达国家或地区温室气体减排状况

处于平台期或下降期



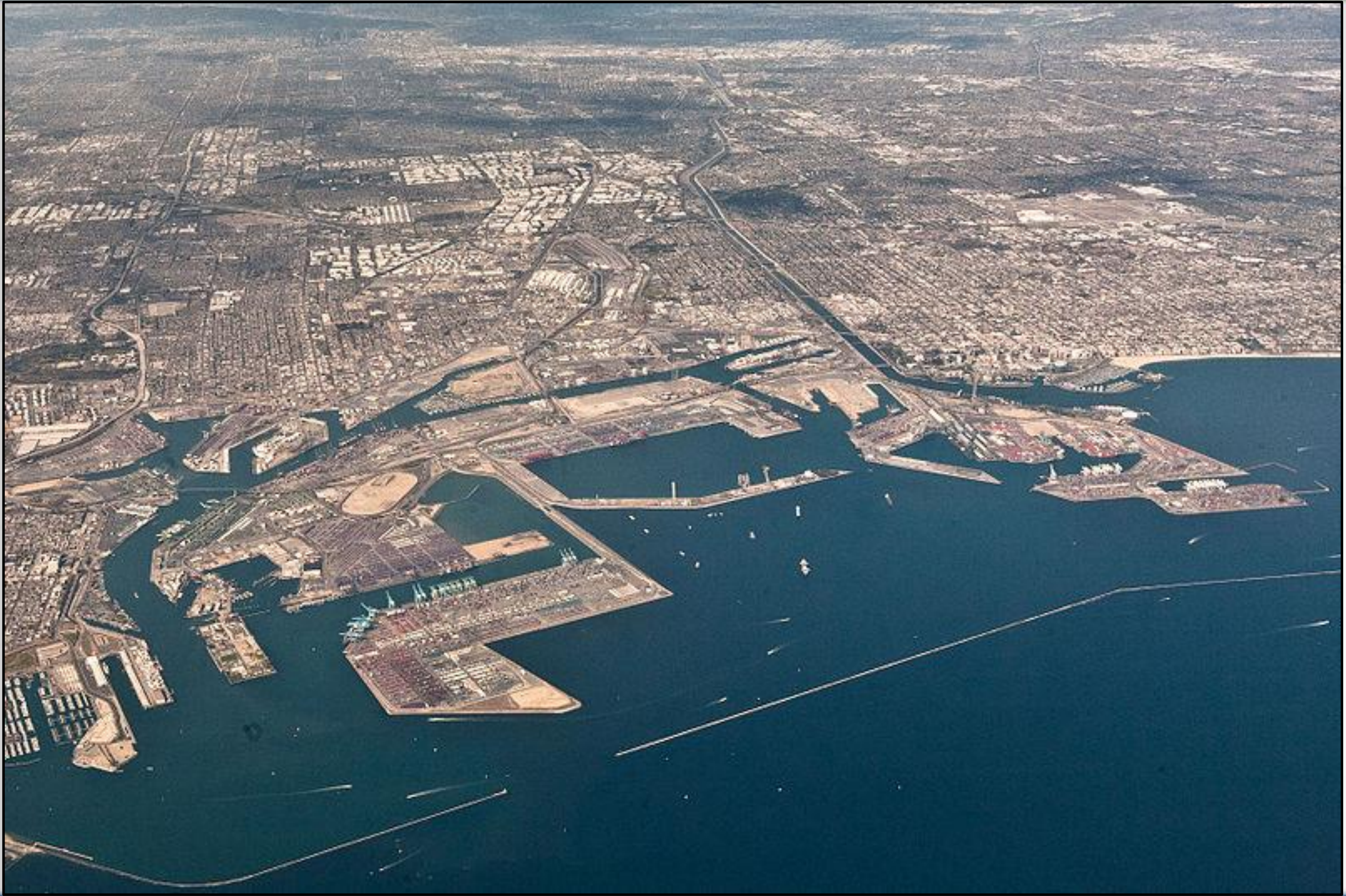
内容

1 路径措施

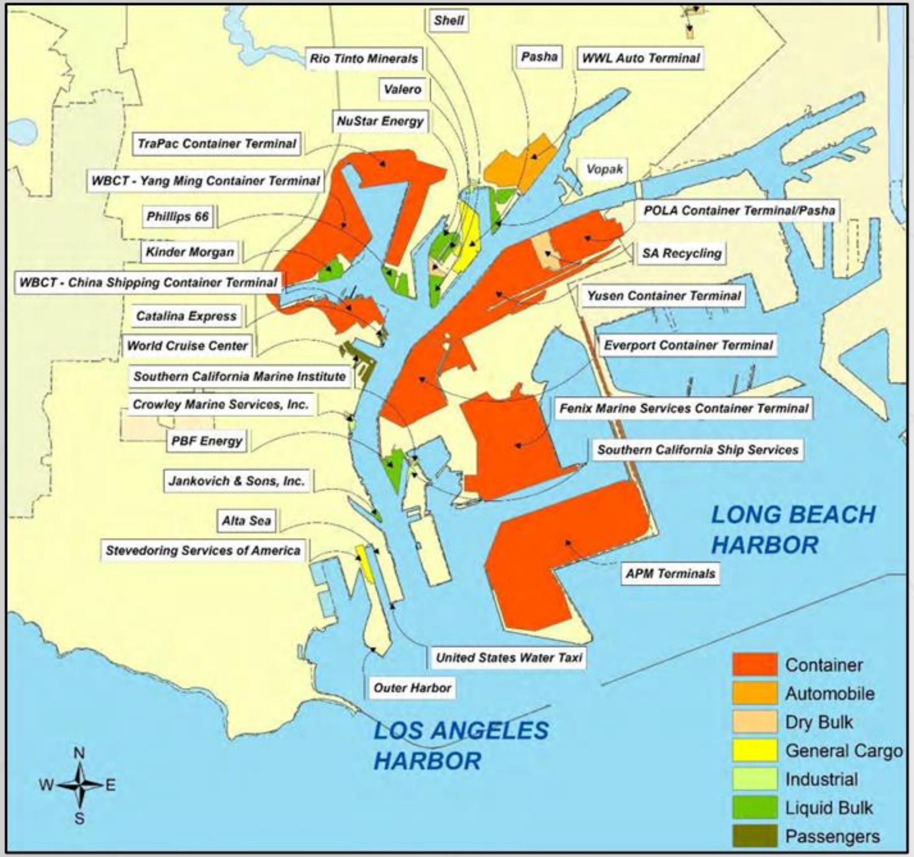
2 典型实践

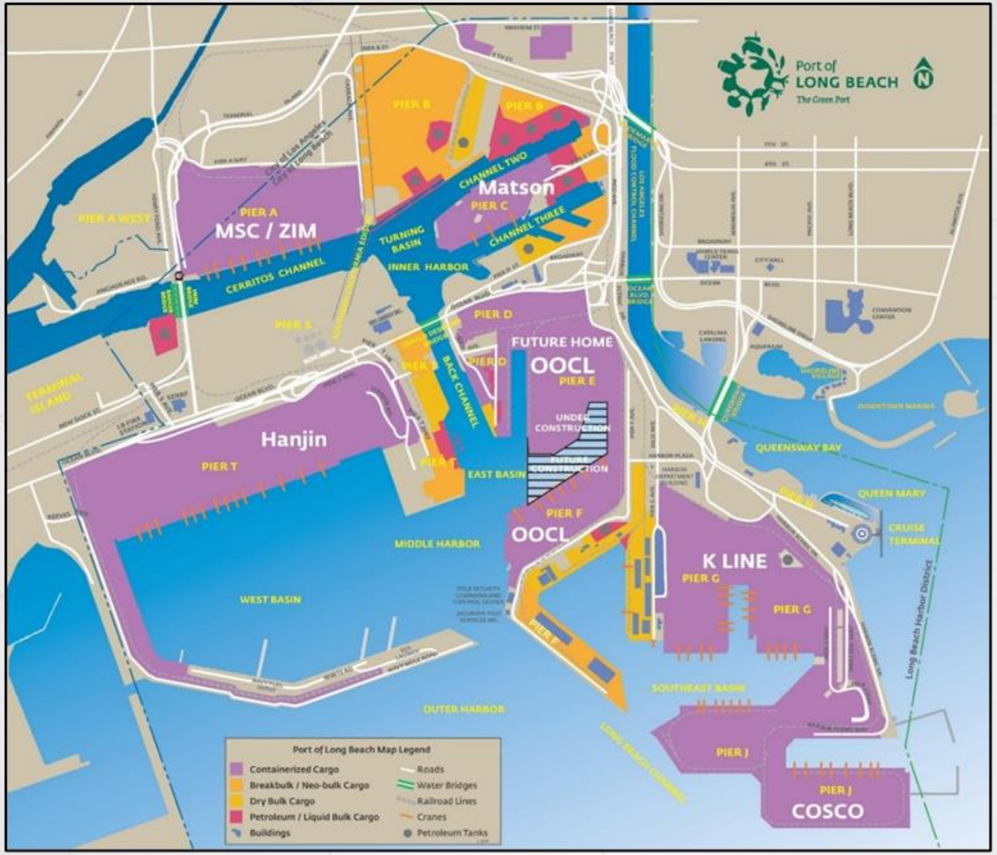
3 经验借鉴

美国加州圣佩德罗湾港口



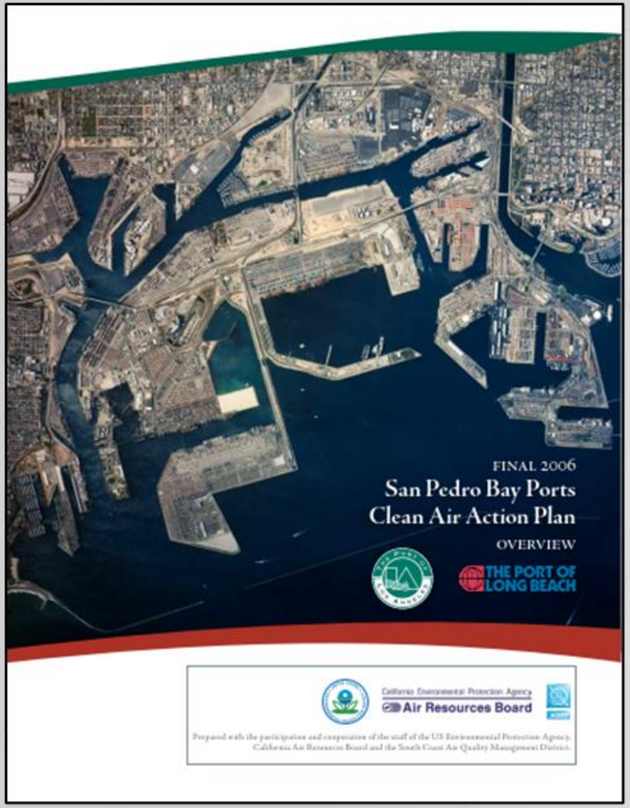
美国加州圣佩德罗湾港口


Shell
Rio Tinto Minerals
Pasha
WWL Auto Terminal
Valero
NuStar Energy
TraPac Container Terminal
Vopak
WBCT - Yang Ming Container Terminal
POLA Container Terminal/Pasha
Phillips 66
SA Recycling
Kinder Morgan
WBCT - China Shipping Container Terminal
Yusen Container Terminal
Catalina Express
World Cruise Center
Everport Container Terminal
Southern California Marine Institute
Crowley Marine Services, Inc.
Fenix Marine Services Container Terminal
PBF Energy
Southern California Ship Services
Jankovich & Sons, Inc.
Alta Sea
LONG BEACH HARBOR
Stevedoring Services of America
APM Terminals
United States Water Taxi
Outer Harbor
LOS ANGELES HARBOR
N
W
E
S
Container
Automobile
Dry Bulk
General Cargo
Industrial
Liquid Bulk
Passengers


Port of LONG BEACH
The Green Port
N
PIER B
PIER B
CHANNEL TWO
Matson
PIER C
CHANNEL THREE
PIER A WEST
PIER A
MSC / ZIM
TURNING BASIN
INNER HARBOR
CERRITOS CHANNEL
City of Los Angeles
City of Long Beach
PIER S
PIER D
FUTURE HOME
OOCL
PIER E
PIER D
BACK CHANNEL
TERMINAL ISLAND
Hanjin
PIER T
UNDER CONSTRUCTION
FUTURE CONSTRUCTION
EAST BASIN
PIER F
OOCL
MIDDLE HARBOR
WEST BASIN
K LINE
PIER G
PIER G
PIER F
SOUTHEAST BASIN
OUTER HARBOR
PIER J
PIER J
COSCO
QUEENSWAY BAY
QUEEN MARY
CRUISE TERMINAL
DOWNTOWN MARINA
LONG BEACH CHANNEL
Long Beach Harbor District
Port of Long Beach Map Legend
Containerized Cargo
Breakbulk / Neo-bulk Cargo
Dry Bulk Cargo
Petroleum / Liquid Bulk Cargo
Buildings
Roads
Water Bridges
Railroad Lines
Cranes
Petroleum Tanks

美国加州圣佩德罗湾清洁空气行动计划

2017年版本开始设定降碳目标，之前主要是减污



FINAL 2006

San Pedro Bay Ports

Clean Air Action Plan

OVERVIEW

THE PORT OF LONG BEACH

California Environmental Protection Agency

Air Resources Board

Prepared with the participation and cooperation of the staff of the US Environmental Protection Agency, California Air Resources Board and the South Coast Air Quality Management District.

Port of LONG BEACH

The Green Port

LA THE PORT OF LOS ANGELES

San Pedro Bay Ports Clean Air Action Plan

2010 Update

Port of LONG BEACH

LA THE PORT

SAN PEDRO BAY PORTS

CLEAN AIR ACTION PLAN 2017

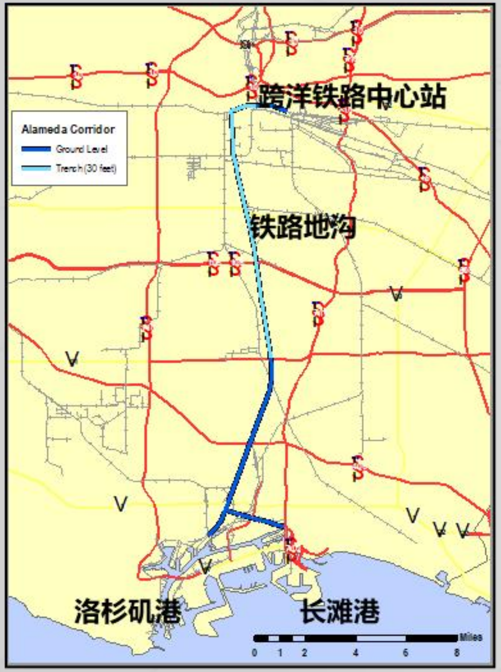
Final

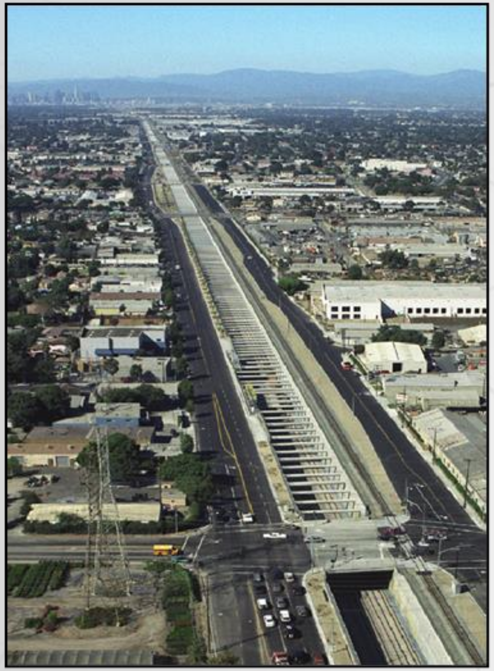
Clean Air Action Plan Update

NOVEMBER 2017

(1)加州阿拉美达走廊

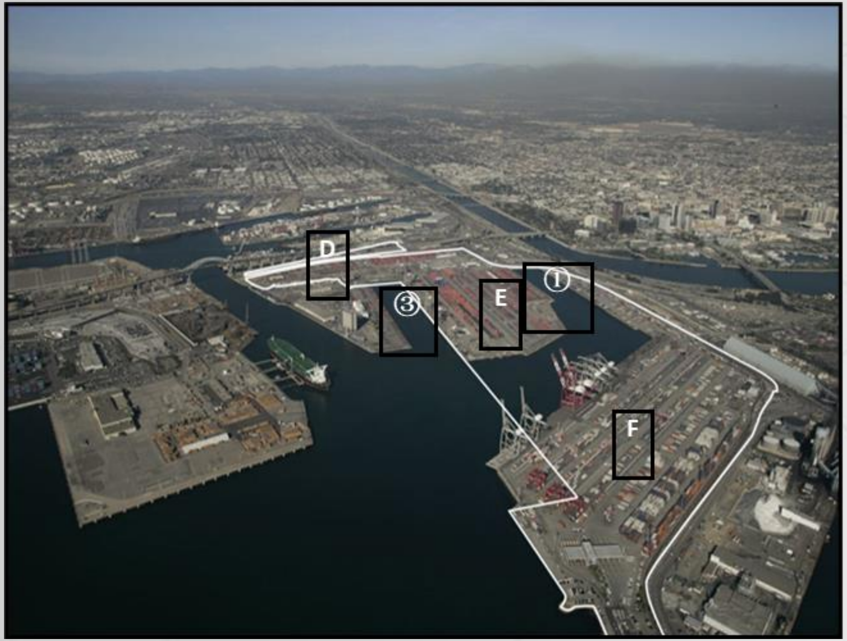
2002:24.3亿美元


跨洋铁路中心站
Alameda Corridor
Ground Level
Trench (30 feet)
铁路地沟
洛杉矶港
长滩港
0 1 2 4 6 8
Miles

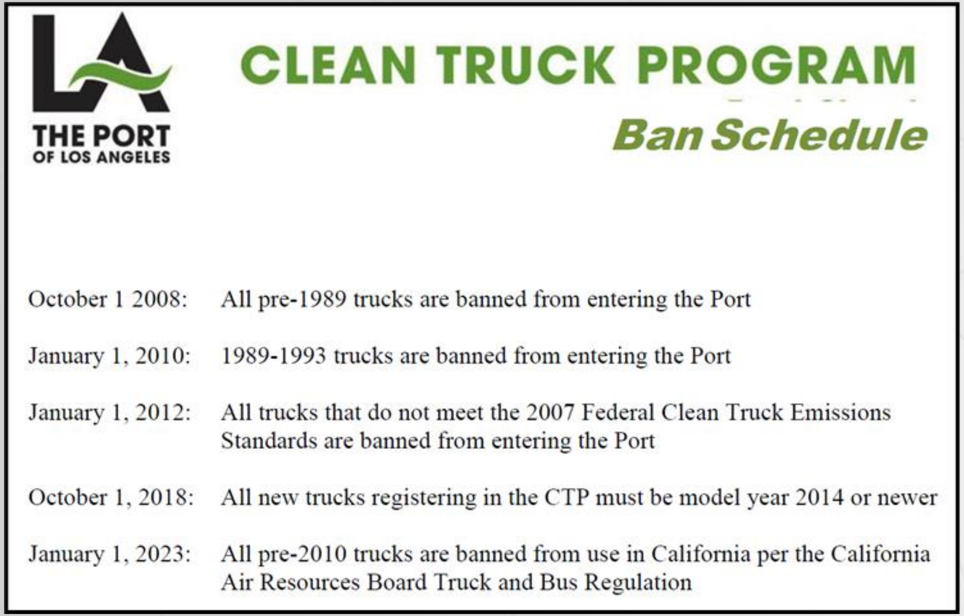


(2)长滩港集装箱码头改造

2016：船舶大型化、环境保护、通过能力：能源替代



(3)湾区港口清洁卡车计划



THE PORT
OF LOS ANGELES

CLEAN TRUCK PROGRAM

Ban Schedule

October 1 2008:	All pre-1989 trucks are banned from entering the Port
January 1, 2010:	1989-1993 trucks are banned from entering the Port
January 1, 2012:	All trucks that do not meet the 2007 Federal Clean Truck Emissions Standards are banned from entering the Port
October 1, 2018:	All new trucks registering in the CTP must be model year 2014 or newer
January 1, 2023:	All pre-2010 trucks are banned from use in California per the California Air Resources Board Truck and Bus Regulation

(4)湾区港口排放清单

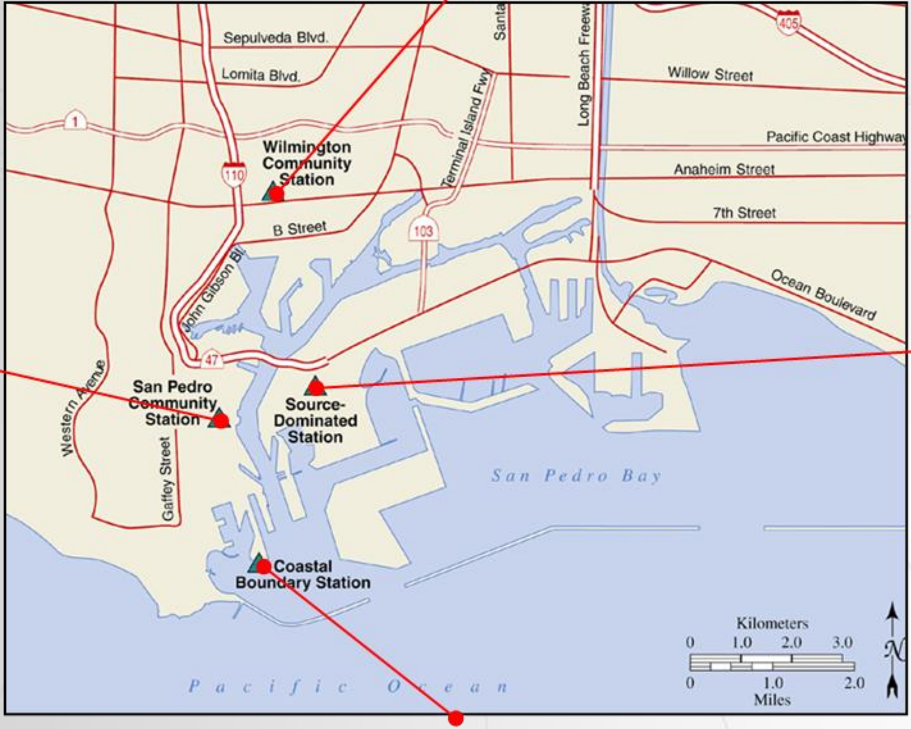
来源	2020年洛杉矶港大气污染物排放份额（%）							
	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC	CO_2
远洋船舶	44	44	35	49	92	14	48	23
港作拖轮	21	20	25	12	1	28	31	7
货物装卸	5	5	4	6	2	33	25	18
货运火车	25	25	30	14	1	10	17	7
重型卡车	5	6	6	18	4	15	16	44
总计	100	100	100	100	100	100	100	100

湾区港口排放清单→美国加州不遗余力控制船舶排放

实施时间	措施	强制性要求
2009年1月1日	盈利性港作船舶规则	使用硫含量不大于15ppm的低硫柴油并执行严格的发动机排放控制标准
2009年7月1日	远洋船舶燃料规则	在加州水域及距加州基线24nm范围内活动远洋船舶执行严格的燃油类型和硫含量控制标准
2012年8月1日	北美排放控制区	按照IMO要求控制燃油硫含量和发动机排放控制标准
2014年1月1日	靠港船舶规则	靠港船舶使用岸电

(5)洛杉矶港空气质量监测

陆域与威明顿社区交界处监测点


Sepulveda Blvd.
Lomita Blvd.
Santa
Long Beach Freeway
405
Willow Street
1
Pacific Coast Highway
Terminal Island Fwy
Wilmington Community Station
110
Anaheim Street
7th Street
B Street
103
John Gibson Bl.
Ocean Boulevard
47
San Pedro Community Station
Source-Dominated Station
Western Avenue
Gaffey Street
San Pedro Bay
Coastal Boundary Station
Pacific Ocean
Kilometers
0 1.0 2.0 3.0
0 1.0 2.0
Miles
N

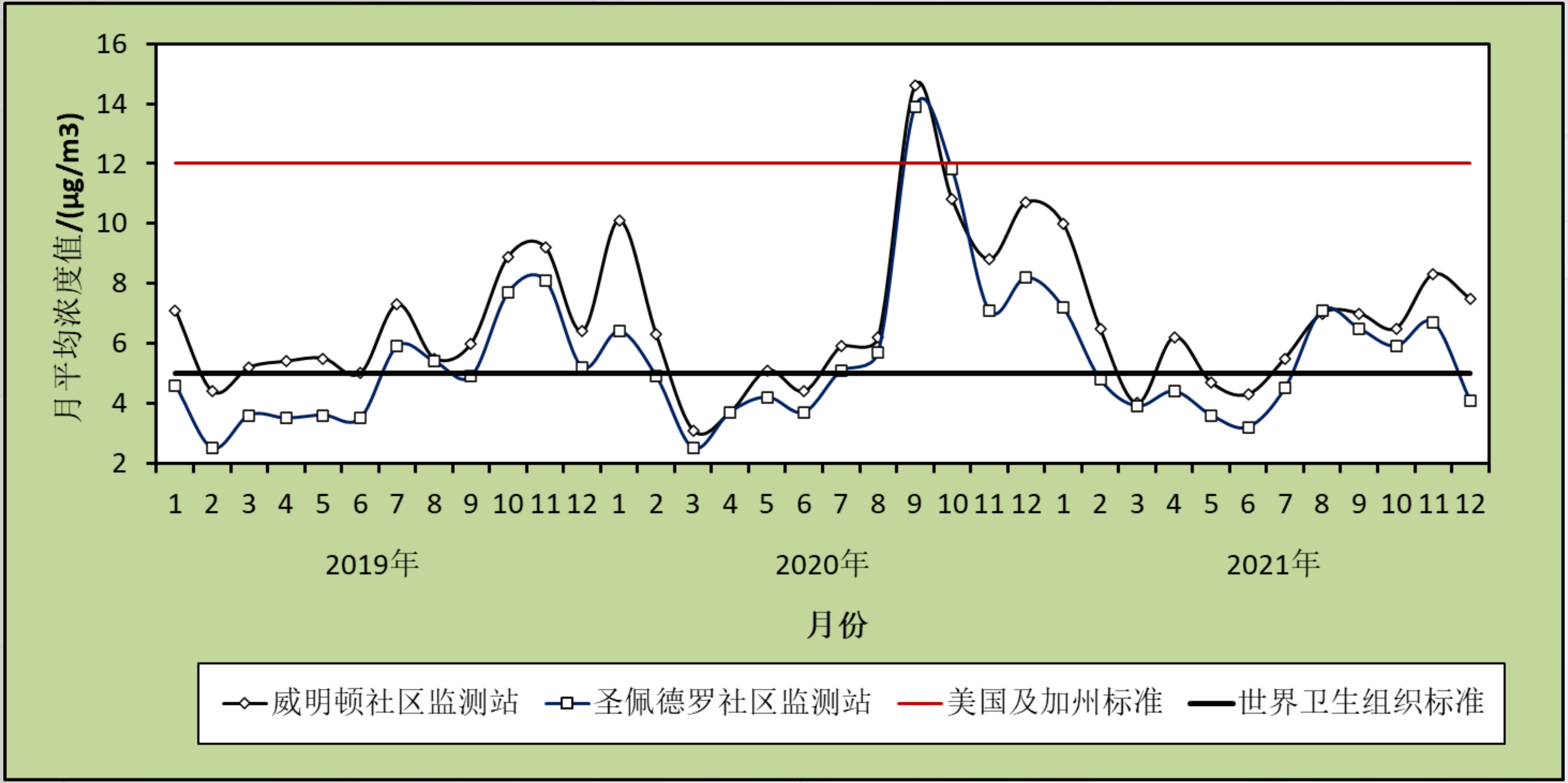
陆域与圣佩德罗社区交界处监测点

港口内细颗粒物主要发生区域监测站监测点

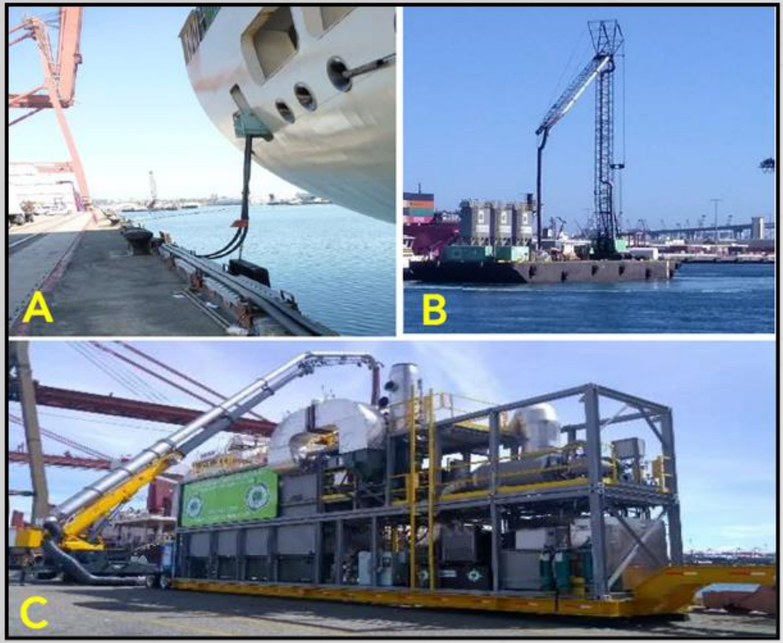
海测监测点

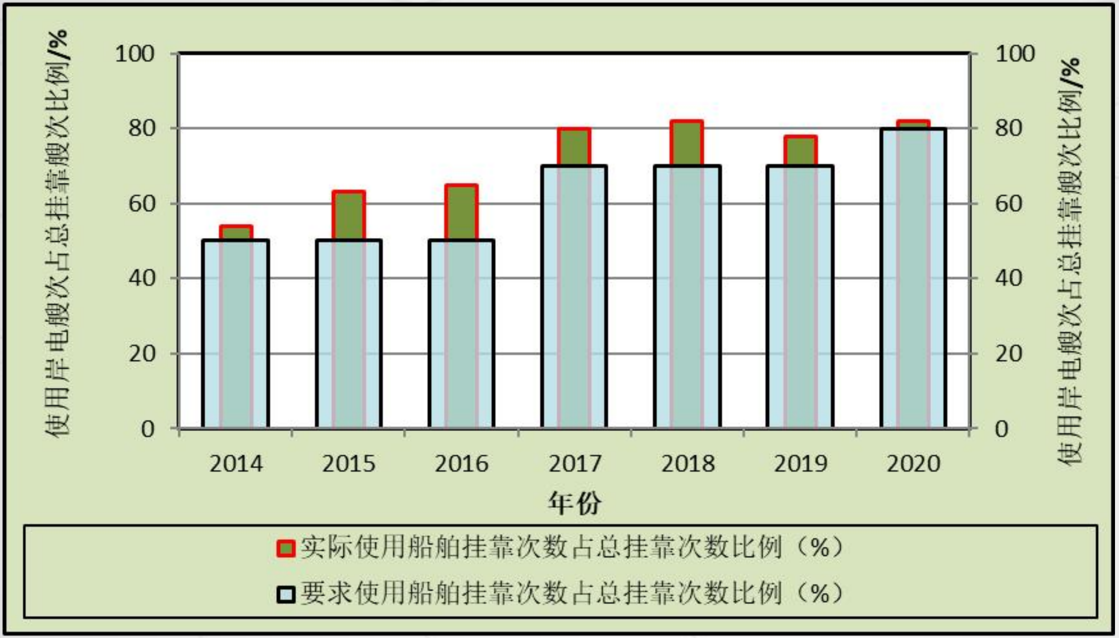
洛杉矶港实时排放监测报告

$PM_{2.5}$



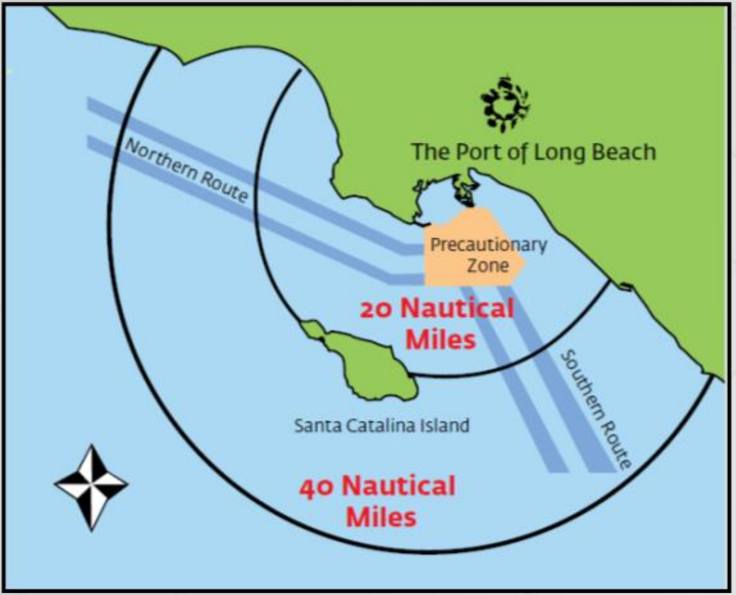
(6)加州靠港船舶使用岸电

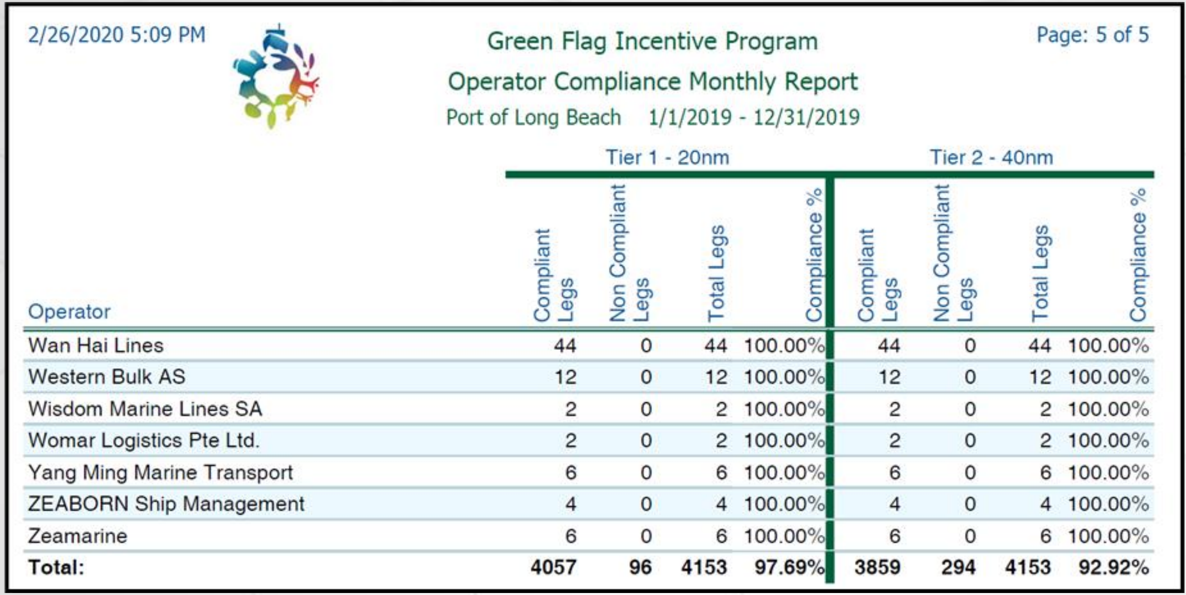




(7)港区港口港区船舶减速航行

2006年始实施绿旗奖励计划：节约能源、排放控制


The Port of Long Beach
Northern Route
Precautionary Zone
20 Nautical Miles
Southern Route
Santa Catalina Island
40 Nautical Miles


2/26/2020 5:09 PM

Page: 5 of 5

Green Flag Incentive Program

Operator Compliance Monthly Report

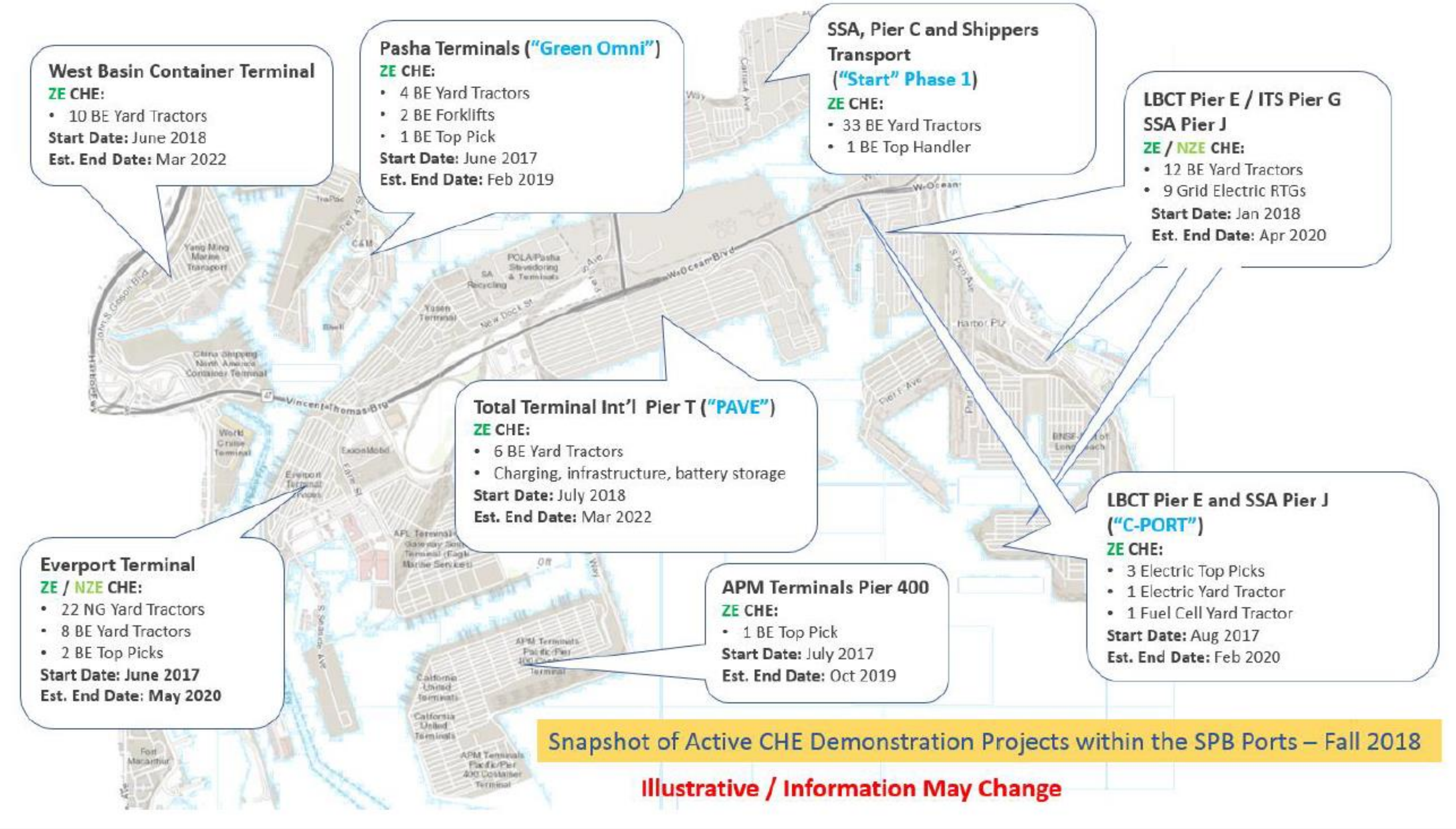
Port of Long Beach 1/1/2019 - 12/31/2019

	Tier 1 - 20nm				Tier 2 - 40nm			
Operator	Compliant Legs	Non Compliant Legs	Total Legs	Compliance %	Compliant Legs	Non Compliant Legs	Total Legs	Compliance %
Wan Hai Lines	44	0	44	100.00%	44	0	44	100.00%
Western Bulk AS	12	0	12	100.00%	12	0	12	100.00%
Wisdom Marine Lines SA	2	0	2	100.00%	2	0	2	100.00%
Womar Logistics Pte Ltd.	2	0	2	100.00%	2	0	2	100.00%
Yang Ming Marine Transport	6	0	6	100.00%	6	0	6	100.00%
ZEABORN Ship Management	4	0	4	100.00%	4	0	4	100.00%
Zeamarine	6	0	6	100.00%	6	0	6	100.00%
Total:	**4057**	**96**	**4153**	**97.69%**	**3859**	**294**	**4153**	**92.92%**

(8)湾区港口港口机械电动化

2018：洛杉矶港、长滩港
零排放、近零排放港机示范应用

BE：Battery Electric
ZE：Zero Emission
NZE：Near Zero Emission
NY：Natural Gas
CHE：Cargo Handling Equipment



Vincent Thomas Brg
W Ocean Blvd
New Dock St
Harbor Plz
Pier F Ave
John S Gibson Blvd
Harbor Fwy
Yang Ming Marine Transport
China Shipping North America Container Terminal
World Cruise Terminal
ExxonMobil
Everport Terminal
Yusen Terminal
POLA/Pasha Stevedoring & Terminals
SA Recycling
TraPac
C&M
APL Terminal
California United Terminals
APM Terminals Pacific Pier 400 Container Terminal
Fort MacArthur
BNSF - Port of Long Beach

West Basin Container Terminal
ZE CHE:
- 10 BE Yard Tractors

Start Date: June 2018
Est. End Date: Mar 2022

Pasha Terminals ("Green Omni")
ZE CHE:
- 4 BE Yard Tractors
- 2 BE Forklifts
- 1 BE Top Pick

Start Date: June 2017
Est. End Date: Feb 2019

SSA, Pier C and Shippers Transport ("Start" Phase 1)
ZE CHE:
- 33 BE Yard Tractors
- 1 BE Top Handler

LBCT Pier E / ITS Pier G SSA Pier J
ZE / NZE CHE:
- 12 BE Yard Tractors
- 9 Grid Electric RTGs

Start Date: Jan 2018
Est. End Date: Apr 2020

Total Terminal Int'l Pier T ("PAVE")
ZE CHE:
- 6 BE Yard Tractors
- Charging, infrastructure, battery storage

Start Date: July 2018
Est. End Date: Mar 2022

Everport Terminal
ZE / NZE CHE:
- 22 NG Yard Tractors
- 8 BE Yard Tractors
- 2 BE Top Picks

Start Date: June 2017
Est. End Date: May 2020

APM Terminals Pier 400
ZE CHE:
- 1 BE Top Pick

Start Date: July 2017
Est. End Date: Oct 2019

LBCT Pier E and SSA Pier J ("C-PORT")
ZE CHE:
- 3 Electric Top Picks
- 1 Electric Yard Tractor
- 1 Fuel Cell Yard Tractor

Start Date: Aug 2017
Est. End Date: Feb 2020

Snapshot of Active CHE Demonstration Projects within the SPB Ports – Fall 2018

Illustrative / Information May Change

湾区港口港口机械电动化

EVERGREEN
EVERGREEN
ZLC976
TH0230

(9)洛杉矶港光伏发电

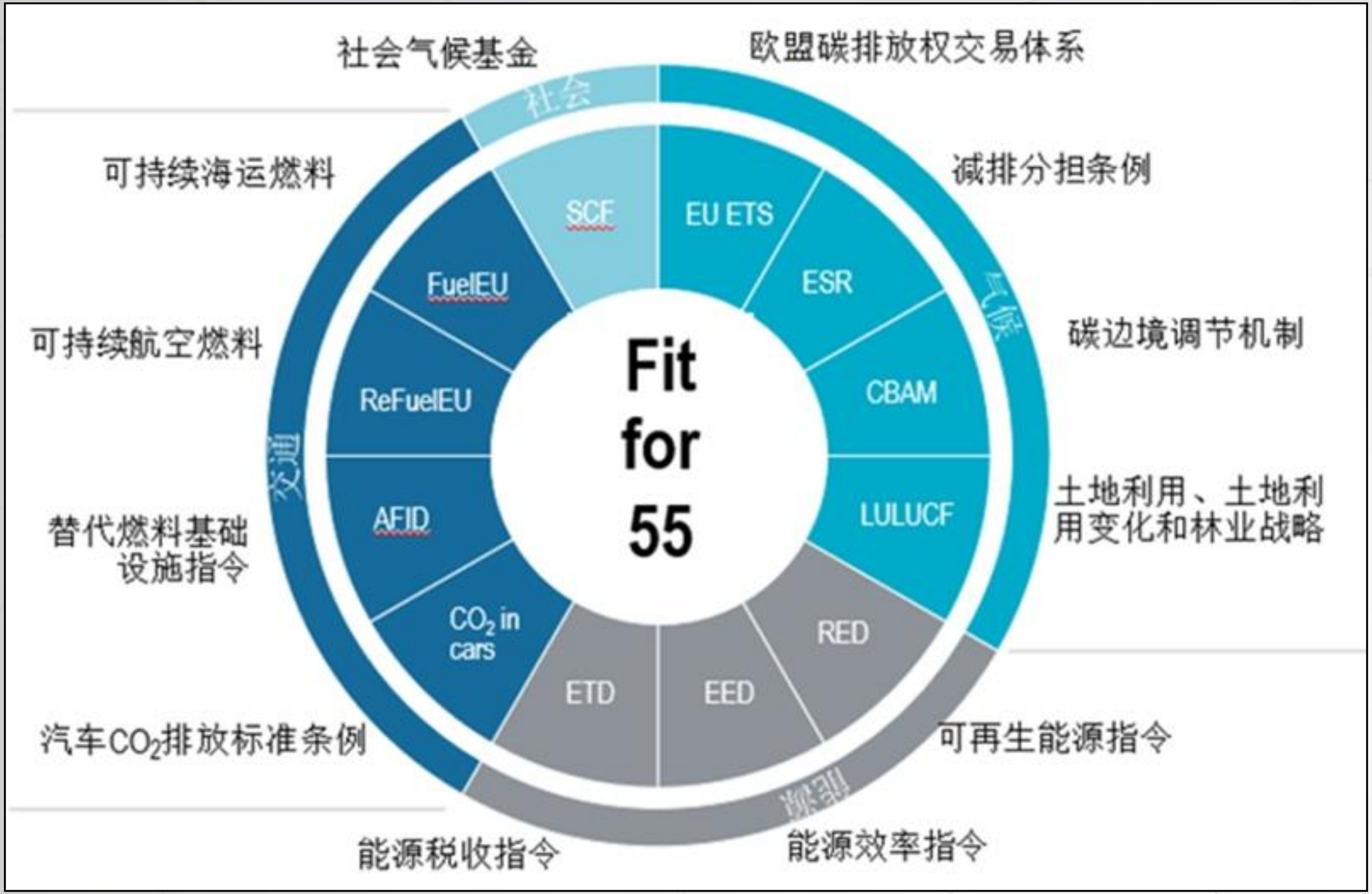
2015：邮轮码头3MW；另外规划12个地点，
10MW：满足港口用电量1/6或2500家庭用电

欧洲港口

欧盟议会
欧盟委员会
欧盟理事会

2030年相对于1990年温室气体减排55%

主要港口采用欧盟同样目标


社会气候基金
欧盟碳排放权交易体系
社会
可持续海运燃料
减排分担条例
SCF
EU ETS
FuelEU
ESR
气候
可持续航空燃料
碳边境调节机制
ReFuelEU
CBAM
Fit
for
55
交通
土地利用、土地利用变化和林业战略
AFID
LULUCF
替代燃料基础设施指令
CO_2 in
cars
RED
ETD
EED
汽车CO_2排放标准条例
可再生能源指令
能源
能源税收指令
能源效率指令

(10) 安特卫普港发起先锋联盟

先锋联盟代表着领先的港口、码头和运输运营商、货代、知识机构、技术开发商、创新者和公共实体，将展示减少港口温室气体(GHG)排放的具体解决方案，同时维护其竞争力。

主要行动：

- 生产可再生能源
- 采用电动、氢和甲醇汽车
- 改造建筑和供热网络以提高能源效率
- 在基础设施建设中的应用循环经济
- 实现自动化
- 应用数字平台，以促进模式转变，确保车辆、船舶和集装箱的最佳流动

(11) 安特卫普港氢燃料电池驱动拖轮

欧洲最大能源港：未来能源

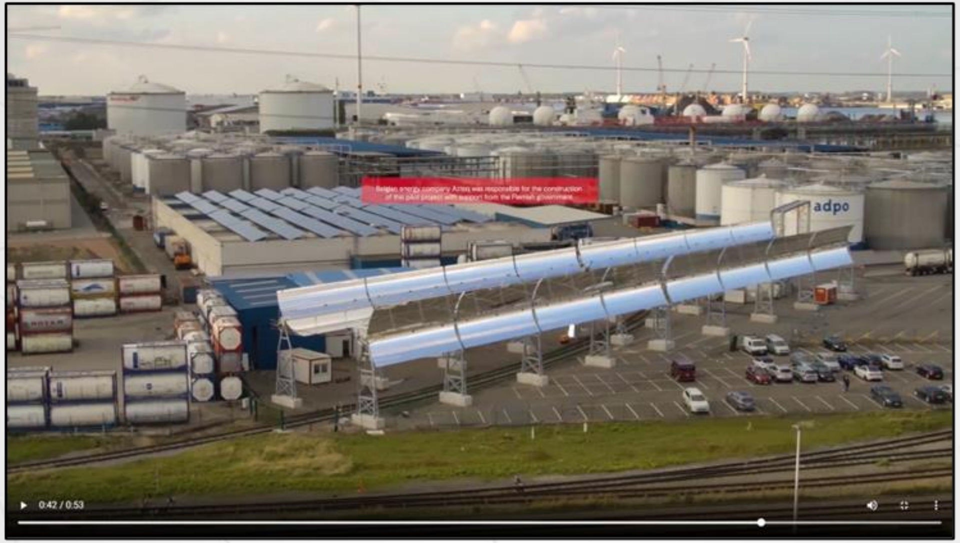
直接用电：本地风力光伏发电
氢能：自全球风力光伏发电制绿氢进口
甲醇：全球：绿氢+CO_2制

Port of Antwerp
H2
POWERED BY
CMB

(12) 安特卫普港风力发电

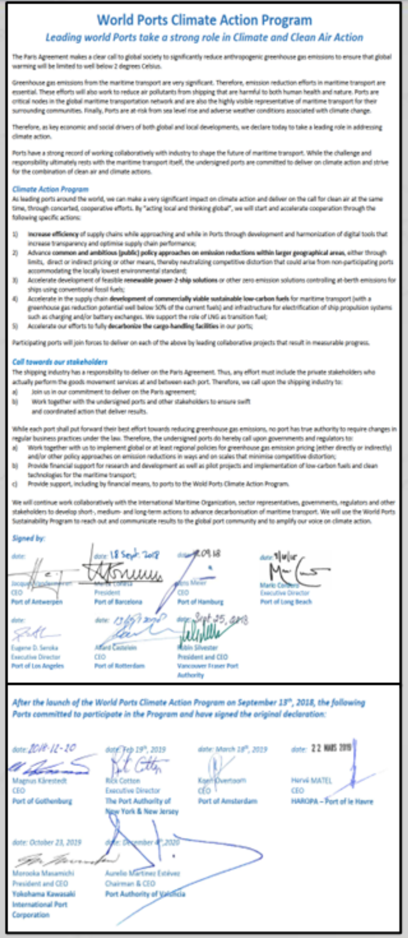
泽布吕赫港区：50台风机，130MW，满足90000家庭用电需求
安特卫普港区：80台风机，200MW，满足140000家庭用电需求

(13) 安特卫普港太阳能利用


Belgian energy company Azteq was responsible for the construction of this pilot project with support from the Flemish government.
adpo
0:42 / 0:53

(14) 鹿特丹港发起世界港口气候行动计划

2018



World Ports Climate Action Program

Leading world Ports take a strong role in Climate and Clean Air Action

The Paris Agreement makes a clear call to global society to significantly reduce anthropogenic greenhouse gas emissions to ensure that global warming will be limited to well below 2 degrees Celsius.

Greenhouse gas emissions from the maritime transport are very significant. Therefore, emission reduction efforts in maritime transport are essential. These efforts will also work to reduce air pollutants from shipping that are harmful to both human health and nature. Ports are critical nodes in the global maritime transportation network and are also the highly visible representative of maritime transport for their surrounding communities. Finally, Ports are at-risk from sea level rise and adverse weather conditions associated with climate change.

Therefore, as key economic and social drivers of both global and local developments, we declare today to take a leading role in addressing climate action.

Ports have a strong record of working collaboratively with industry to shape the future of maritime transport. While the challenge and responsibility ultimately rests with the maritime transport itself, the undersigned ports are committed to deliver on climate action and strive for the combination of clean air and climate actions.

Climate Action Program

As leading ports around the world, we can make a very significant impact on climate action and deliver on the call for clean air at the same time, through concerted, cooperative efforts. By "acting local and thinking global", we will start and accelerate cooperation through the following specific actions:

1) **Increase efficiency** of supply chains while approaching and while in Ports through development and harmonization of digital tools that increase transparency and optimise supply chain performance;
2) Advance **common and ambitious (public) policy approaches on emission reductions within larger geographical areas**, either through limits, direct or indirect pricing or other means, thereby neutralizing competitive distortion that could arise from non-participating ports accommodating the locally lowest environmental standard;
3) Accelerate development of feasible **renewable power-2-ship solutions** or other zero emission solutions controlling at-berth emissions for ships using conventional fossil fuels;
4) Accelerate in the supply chain **development of commercially viable sustainable low-carbon fuels** for maritime transport (with a greenhouse gas reduction potential well below 50% of the current fuels) and infrastructure for electrification of ship propulsion systems such as charging and/or battery exchanges. We support the role of LNG as transition fuel;
5) Accelerate our efforts to fully **decarbonize the cargo-handling facilities** in our ports;

Participating ports will join forces to deliver on each of the above by leading collaborative projects that result in measurable progress.

Call towards our stakeholders

The shipping industry has a responsibility to deliver on the Paris Agreement. Thus, any effort must include the private stakeholders who actually perform the goods movement services at and between each port. Therefore, we call upon the shipping industry to:

a) Join us in our commitment to deliver on the Paris agreement;
b) Work together with the undersigned ports and other stakeholders to ensure swift and coordinated action that deliver results.

While each port shall put forward their best effort towards reducing greenhouse gas emissions, no port has true authority to require changes in regular business practices under the law. Therefore, the undersigned ports do hereby call upon governments and regulators to:

a) Work together with us to implement global or at least regional policies for greenhouse gas emission pricing (either directly or indirectly) and/or other policy approaches on emission reductions in ways and on scales that minimise competitive distortion;
b) Provide financial support for research and development as well as pilot projects and implementation of low-carbon fuels and clean technologies for the maritime transport;
c) Provide support, including by financial means, to ports to the World Ports Climate Action Program.

We will continue work collaboratively with the International Maritime Organization, sector representatives, governments, regulators and other stakeholders to develop short-, medium- and long-term actions to advance decarbonisation of maritime transport. We will use the World Ports Sustainability Program to reach out and communicate results to the global port community and to amplify our voice on climate action.

Signed by:

date:
Jacques Vandermeiren
CEO
Port of Antwerpen

date: 18 Sept. 2018
Marta Conesa
President
Port of Barcelona

date: [illegible].09.18
Jens Meier
CEO
Port of Hamburg

date: 9/10/18
Mario Cordero
Executive Director
Port of Long Beach

date:
Eugene D. Seroka
Executive Director
Port of Los Angeles

date: 13/09 2018
Allard Castelein
CEO
Port of Rotterdam

date: Sept 25, 2018
Robin Silvester
President and CEO
Vancouver Fraser Port Authority

After the launch of the World Ports Climate Action Program on September 13th, 2018, the following Ports committed to participate in the Program and have signed the original declaration:

date: 2018-12-20
Magnus Kårestedt
CEO
Port of Gothenburg

date: Feb 19th, 2019
Rick Cotton
Executive Director
The Port Authority of New York & New Jersey

date: March 18th, 2019
Koen Overtoom
CEO
Port of Amsterdam

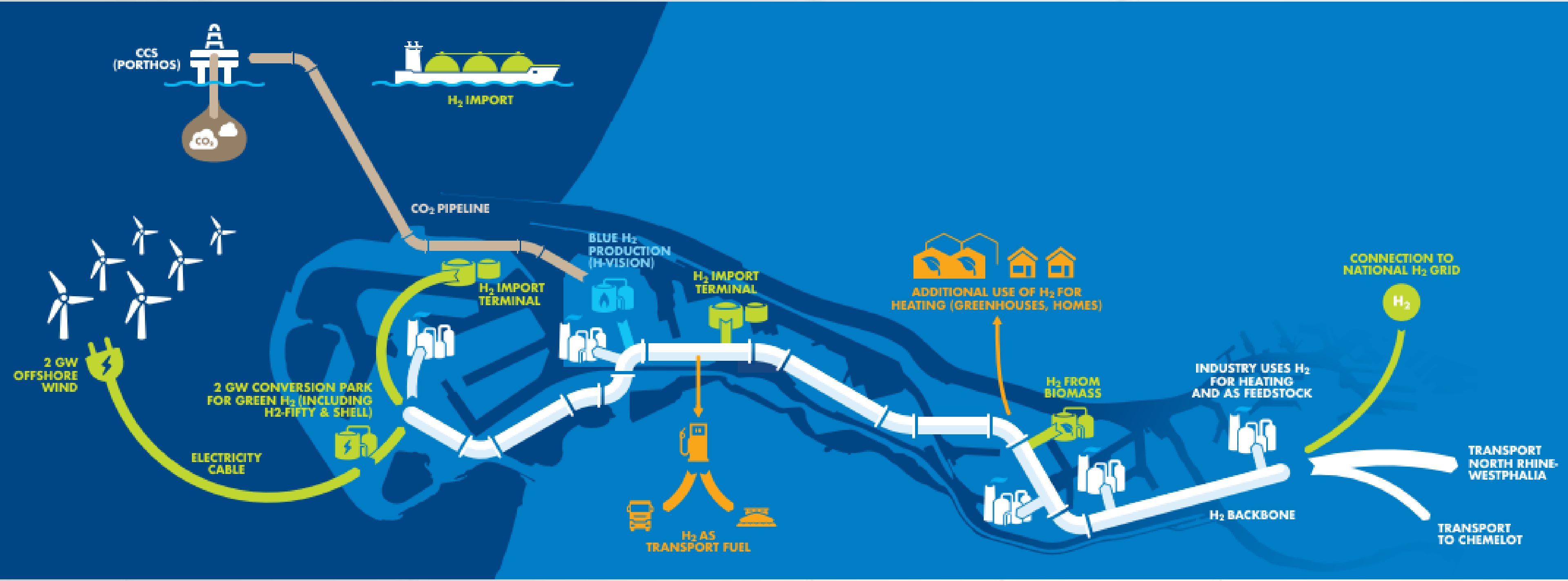
date: 22 MARS 2019
Hervé MATEL
CEO
HAROPA – Port of le Havre

date: October 23, 2019
Morooka Masamichi
President and CEO
Yokohama Kawasaki International Port Corporation

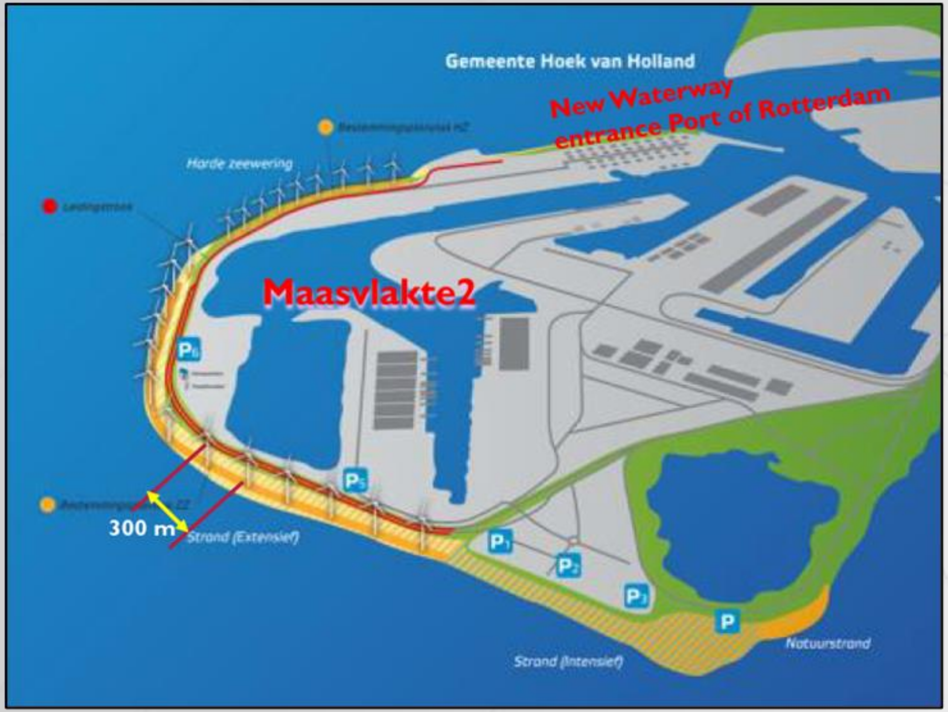
date: December 4th, 2020
Aurelio Martínez Estévez
Chairman & CEO
Port Authority of Valencia

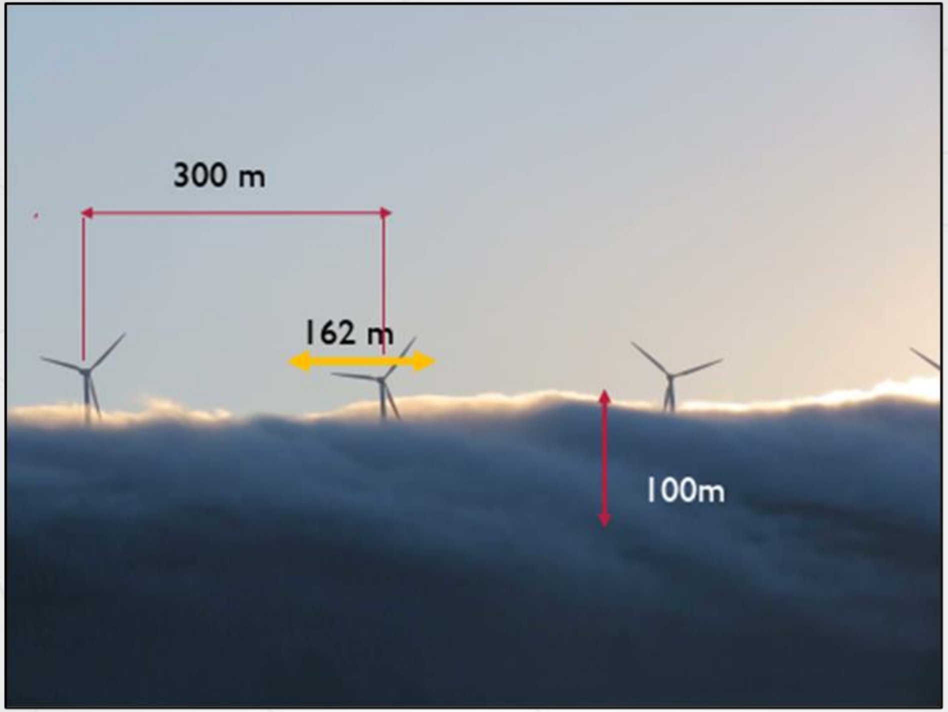
- 通过开发和协调提高透明度和优化供应链绩效的数字工具，提高临近和在港口的供应链效率;
- 通过限制、直接或间接定价或其他手段，在更大的地理区域内推进共同和有雄心的(公共)减排政策，从而消除因不参与而满足当地最低环境标准的港口可能产生的竞争扭曲;
- 加快开发可行的可再生动力船解决方案或其他控制传统化石燃料船舶泊位排放的零排放解决方案;
- 加快商业上可行的可持续低碳海运燃料的供应链开发以及船舶推进系统电气化的基础设施，如充电和/或电池交换，支持LNG作为过渡燃料的作用;
- 加快港口货物处理设施全面脱碳。

(15) 鹿特丹港风力发电与氢能运输和利用计划


CCS
(PORTHOS)
CO_2
H_2 IMPORT
CO_2 PIPELINE
BLUE H_2
PRODUCTION
(H-VISION)
H_2 IMPORT
TERMINAL
H_2 IMPORT
TERMINAL
ADDITIONAL USE OF H_2 FOR
HEATING (GREENHOUSES, HOMES)
CONNECTION TO
NATIONAL H_2 GRID
H_2
2 GW
OFFSHORE
WIND
2 GW CONVERSION PARK
FOR GREEN H_2 (INCLUDING
H2-FIFTY & SHELL)
ELECTRICITY
CABLE
H_2 FROM
BIOMASS
INDUSTRY USES H_2
FOR HEATING
AND AS FEEDSTOCK
TRANSPORT
NORTH RHINE-
WESTPHALIA
H_2 BACKBONE
TRANSPORT
TO CHEMELOT
H_2 AS
TRANSPORT FUEL

鹿特丹港风力发电与氢能运输和利用计划


Gemeente Hoek van Holland
New Waterway
entrance Port of Rotterdam
Harde zeewering
Maasvlakte2
P6
P5
P1
P2
P3
P
300 m
Strand (Extensief)
Strand (Intensief)
Natuurstrand

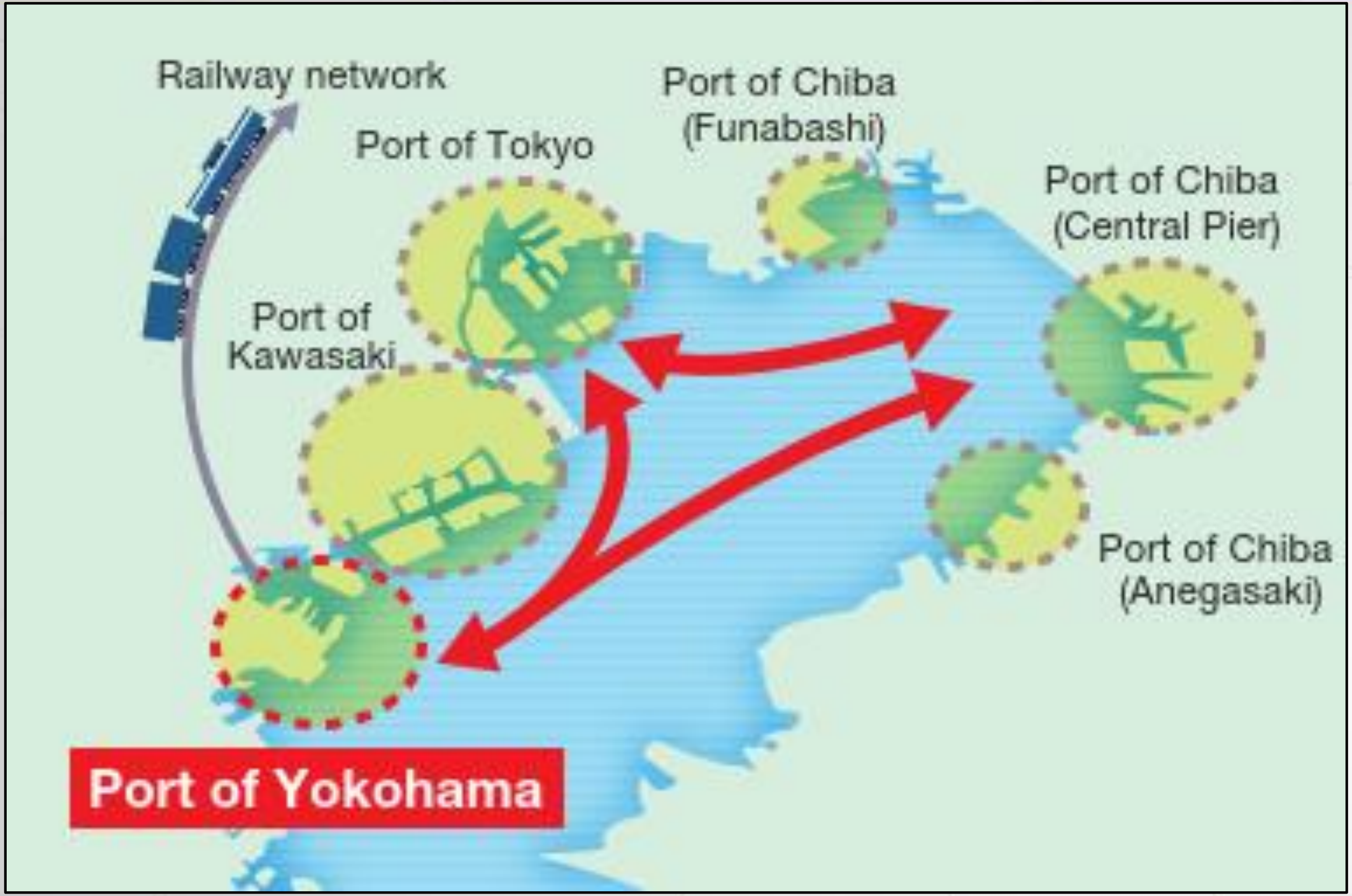

300 m
162 m
100m

(16)汉堡港CTA：全球第1个经认证的零碳集装箱码头

2019年

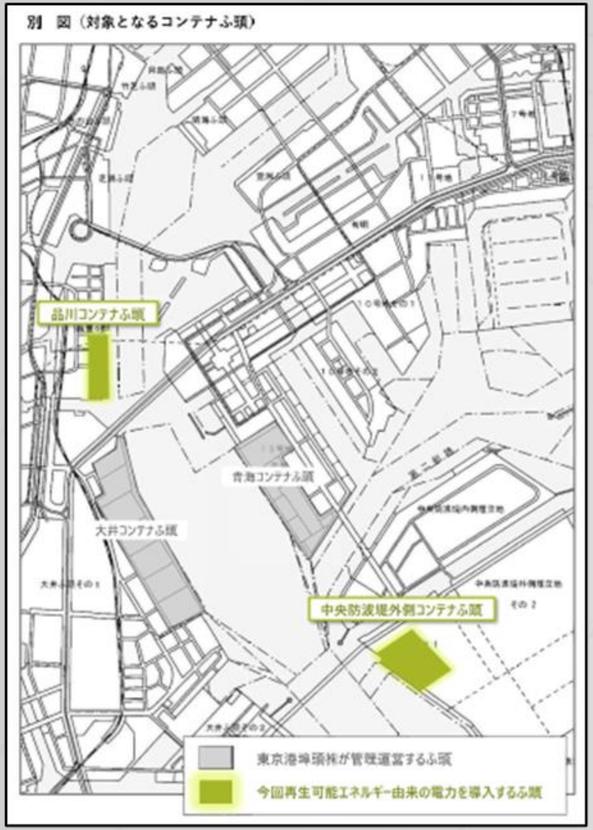
日本东京湾港口

千叶港、东京港、川崎港、横滨港

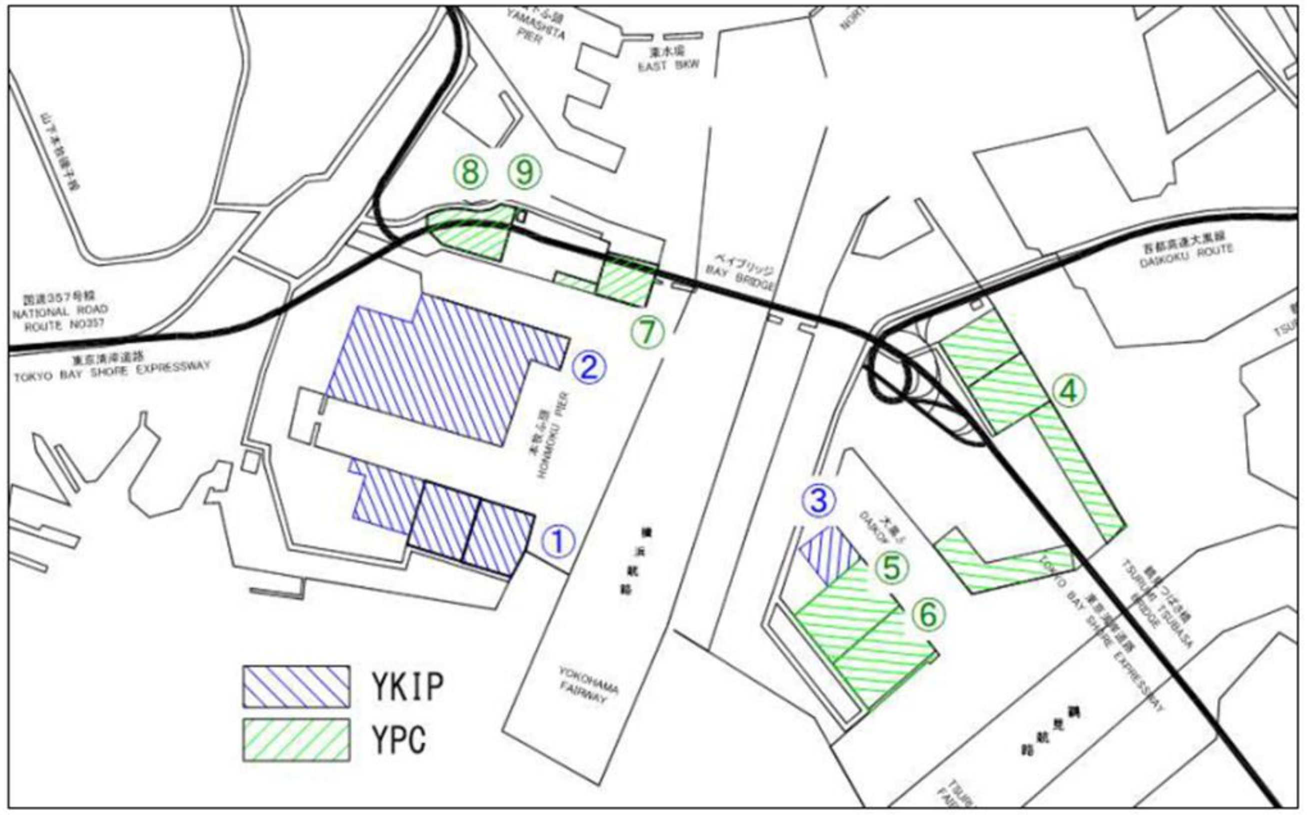

Railway network
Port of Tokyo
Port of Chiba (Funabashi)
Port of Chiba (Central Pier)
Port of Kawasaki
Port of Chiba (Anegasaki)
Port of Yokohama

(17)港口绿电使用

东京港、横滨港


別　図（対象となるコンテナふ頭）

品川コンテナふ頭
青海コンテナふ頭
大井コンテナふ頭
中央防波堤外側コンテナふ頭
10号地その1
10号地その2
その2
東京港埠頭株が管理運営するふ頭
今回再生可能エネルギー由来の電力を導入するふ頭


YKIP
YPC
①
②
③
④
⑤
⑥
⑦
⑧
⑨
YAMASHITA PIER
東水堤
EAST BKW
国道357号線
NATIONAL ROAD ROUTE NO357
東京湾岸道路
TOKYO BAY SHORE EXPRESSWAY
本牧ふ頭
HONMOKU PIER
ベイブリッジ
BAY BRIDGE
首都高速大黒線
DAIKOKU ROUTE
大黒ふ頭
DAIKOKU
横浜航路
YOKOHAMA FAIRWAY
鶴見つばさ橋
TSURUMI TSUBASA BRIDGE
TOKYO BAY SHORE EXPRESSWAY
鶴見航路

(18)横滨港日本第1艘LNG双动力拖轮

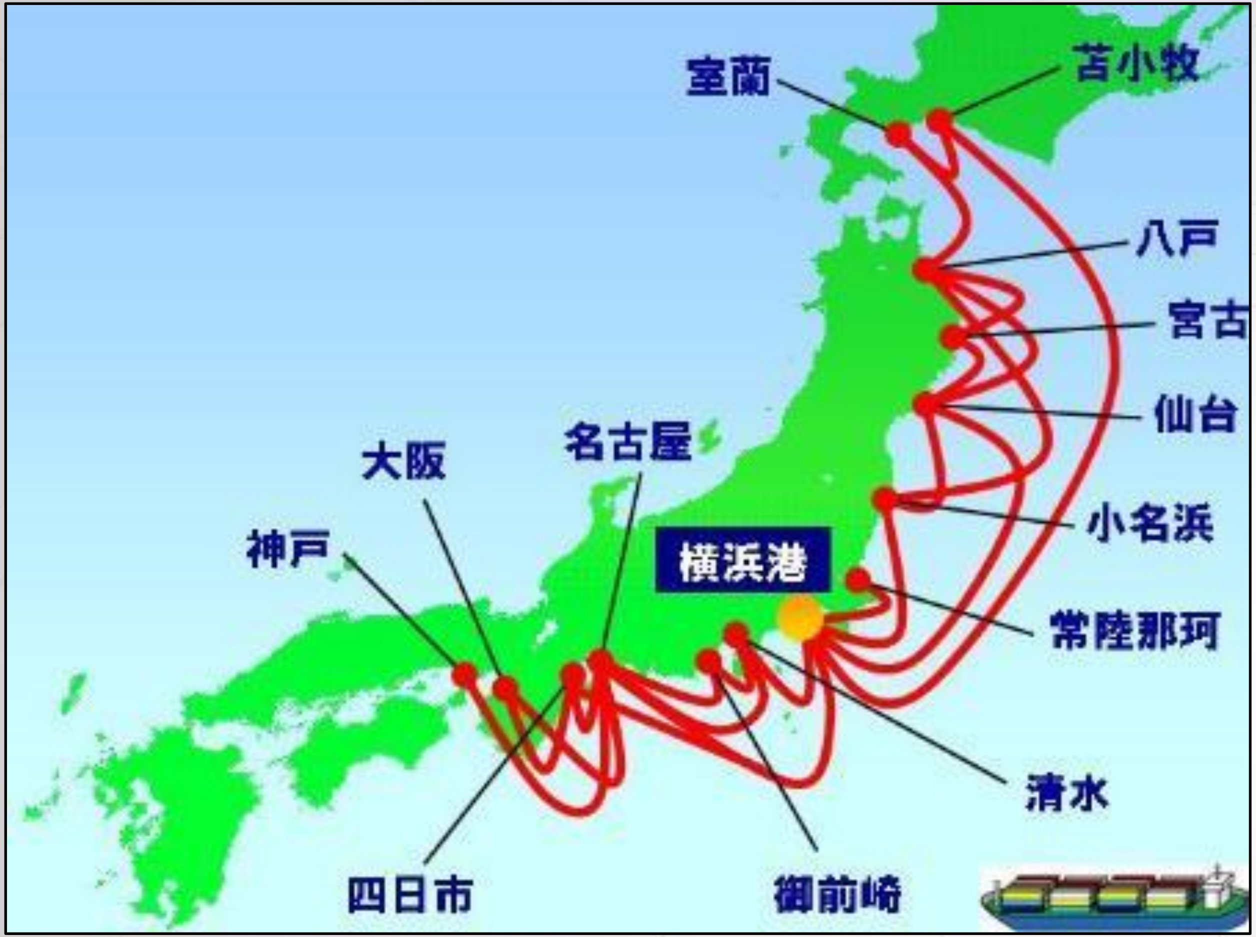
2015：“魁-Sakigake”；2020：东京湾LNG加注船

(19)横滨港氢燃料电池应急发电系统

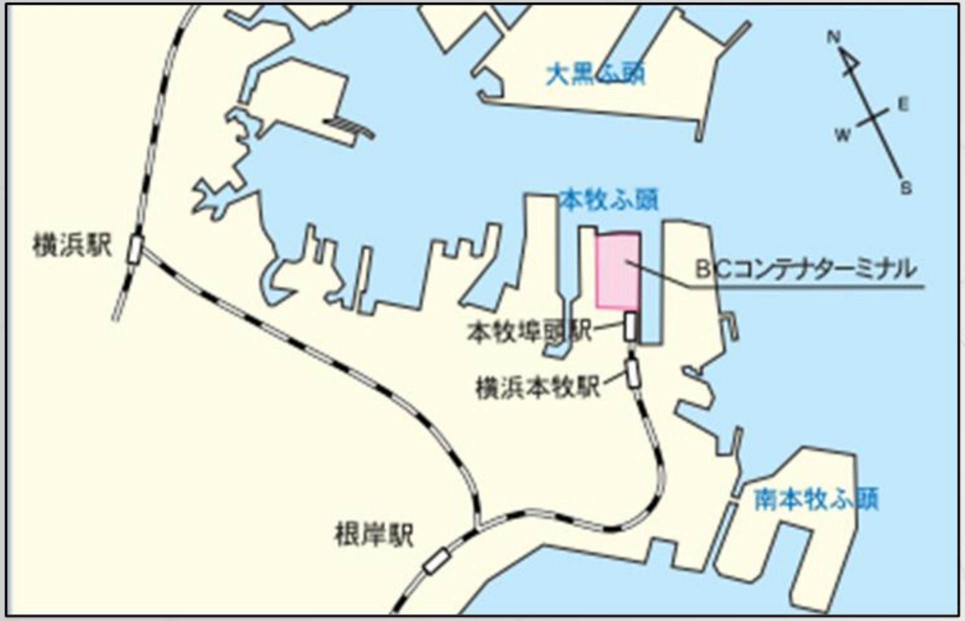
2014

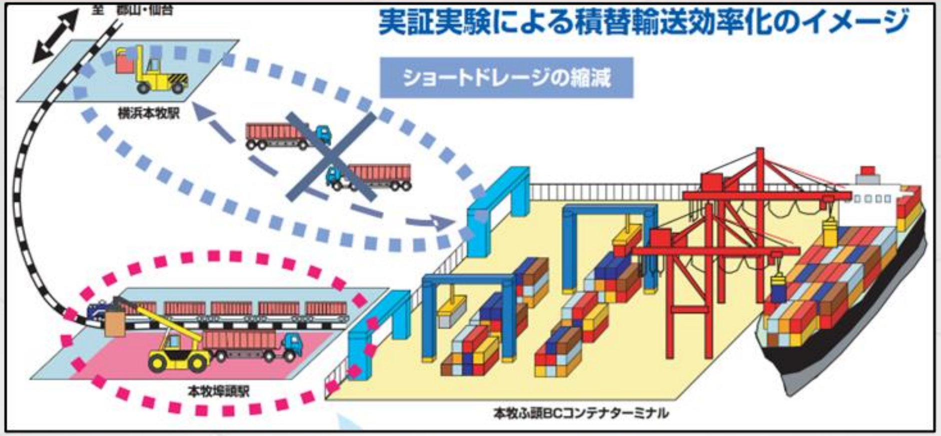
TOSHIBA
H2One

(20)横滨港出发的沿海运输


室蘭
苫小牧
八戸
宮古
仙台
名古屋
大阪
小名浜
神戸
横浜港
常陸那珂
清水
四日市
御前崎

(21)改卡车为火车集疏运


大黒ふ頭
N
E
W
S
本牧ふ頭
横浜駅
BCコンテナターミナル
本牧埠頭駅
横浜本牧駅
南本牧ふ頭
根岸駅


至 郡山・仙台
実証実験による積替輸送効率化のイメージ
ショートドレージの縮減
横浜本牧駅
本牧埠頭駅
本牧ふ頭BCコンテナターミナル

内容

1 路径措施

2 典型实践

3 经验借鉴

(1)认识理性

EPA2016年9月发布

EPA
United States
Environmental Protection
Agency

NATIONAL PORT STRATEGY ASSESSMENT: Reducing Air Pollution and Greenhouse Gases at U.S. Ports

Office of Transportation Air Quality
EPA-420-R-16-011
September 2016

港口是美国经济的重要组成部分，海港、五大湖港口和内河港口是全国和世界各地运送货物和旅客的门户。仅海港就提供了2300多万个工作岗位，海港货物活动占美国经济的26%。

Figure 4-1. Total NOx Emissions Aggregated by Sector, Tons/Year

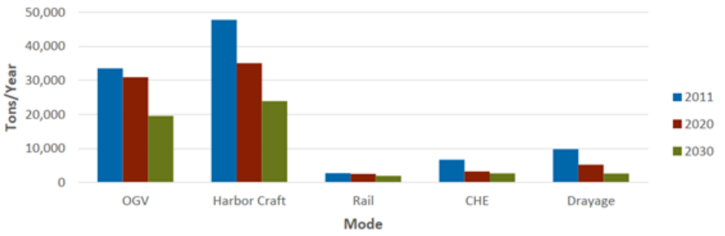


Figure 4-2. Total $PM_{2.5}$ Emissions Aggregated by Sector, Tons/Year

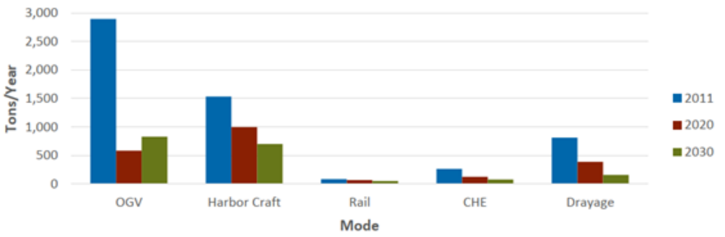
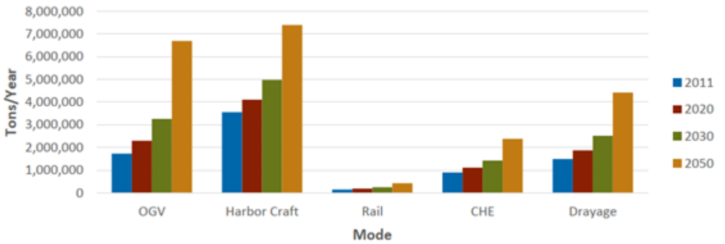


Figure 4-3. Total CO_2 Emissions Aggregated by Sector, Tons/Year



低排放标准港口机械逐渐淘汰

洛杉矶港：2007年开始测试电动集卡；2020年港口机械构成

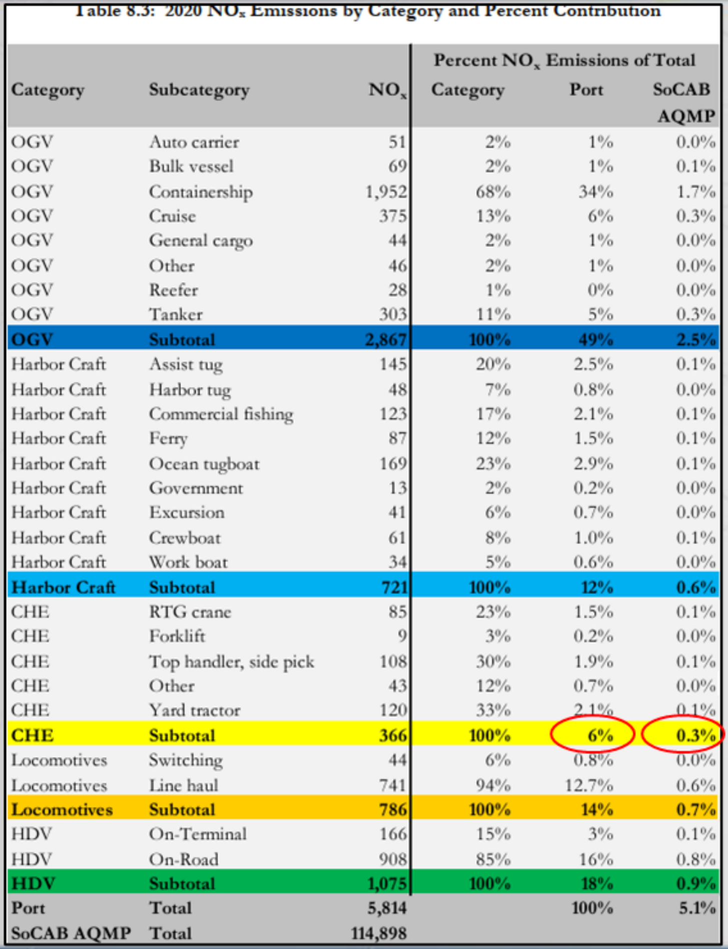


Table 8.3: 2020 NO_x Emissions by Category and Percent Contribution

Category	Subcategory	NO_x	Percent NO_x Emissions of Total Category	Port	SoCAB AQMP
OGV	Auto carrier	51	2%	1%	0.0%
OGV	Bulk vessel	69	2%	1%	0.1%
OGV	Containership	1,952	68%	34%	1.7%
OGV	Cruise	375	13%	6%	0.3%
OGV	General cargo	44	2%	1%	0.0%
OGV	Other	46	2%	1%	0.0%
OGV	Reefer	28	1%	0%	0.0%
OGV	Tanker	303	11%	5%	0.3%
OGV	**Subtotal**	**2,867**	**100%**	**49%**	**2.5%**
Harbor Craft	Assist tug	145	20%	2.5%	0.1%
Harbor Craft	Harbor tug	48	7%	0.8%	0.0%
Harbor Craft	Commercial fishing	123	17%	2.1%	0.1%
Harbor Craft	Ferry	87	12%	1.5%	0.1%
Harbor Craft	Ocean tugboat	169	23%	2.9%	0.1%
Harbor Craft	Government	13	2%	0.2%	0.0%
Harbor Craft	Excursion	41	6%	0.7%	0.0%
Harbor Craft	Crewboat	61	8%	1.0%	0.1%
Harbor Craft	Work boat	34	5%	0.6%	0.0%
Harbor Craft	**Subtotal**	**721**	**100%**	**12%**	**0.6%**
CHE	RTG crane	85	23%	1.5%	0.1%
CHE	Forklift	9	3%	0.2%	0.0%
CHE	Top handler, side pick	108	30%	1.9%	0.1%
CHE	Other	43	12%	0.7%	0.0%
CHE	Yard tractor	120	33%	2.1%	0.1%
CHE	**Subtotal**	**366**	**100%**	**6%**	**0.3%**
Locomotives	Switching	44	6%	0.8%	0.0%
Locomotives	Line haul	741	94%	12.7%	0.6%
Locomotives	**Subtotal**	**786**	**100%**	**14%**	**0.7%**
HDV	On-Terminal	166	15%	3%	0.1%
HDV	On-Road	908	85%	16%	0.8%
HDV	**Subtotal**	**1,075**	**100%**	**18%**	**0.9%**
Port	**Total**	**5,814**		**100%**	**5.1%**
SoCAB AQMP	**Total**	**114,898**			

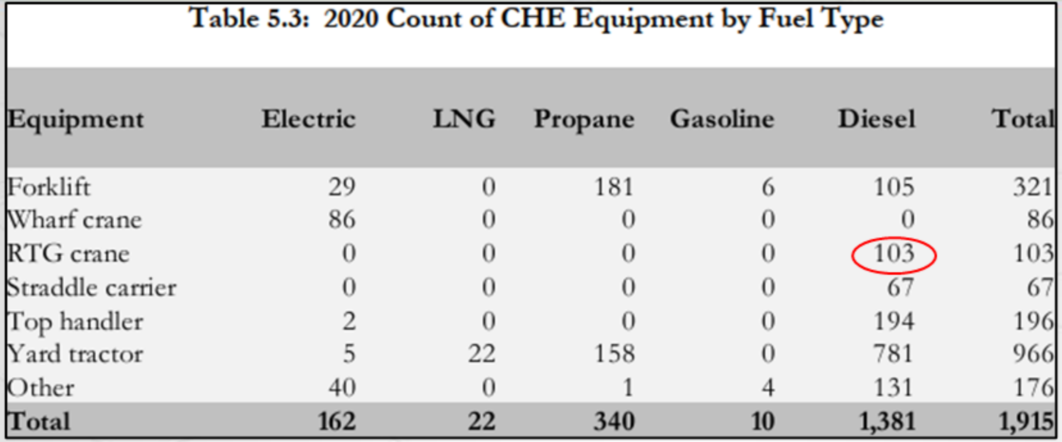


Table 5.3: 2020 Count of CHE Equipment by Fuel Type

Equipment	Electric	LNG	Propane	Gasoline	Diesel	Total
Forklift	29	0	181	6	105	321
Wharf crane	86	0	0	0	0	86
RTG crane	0	0	0	0	103	103
Straddle carrier	0	0	0	0	67	67
Top handler	2	0	0	0	194	196
Yard tractor	5	22	158	0	781	966
Other	40	0	1	4	131	176
Total	**162**	**22**	**340**	**10**	**1,381**	**1,915**

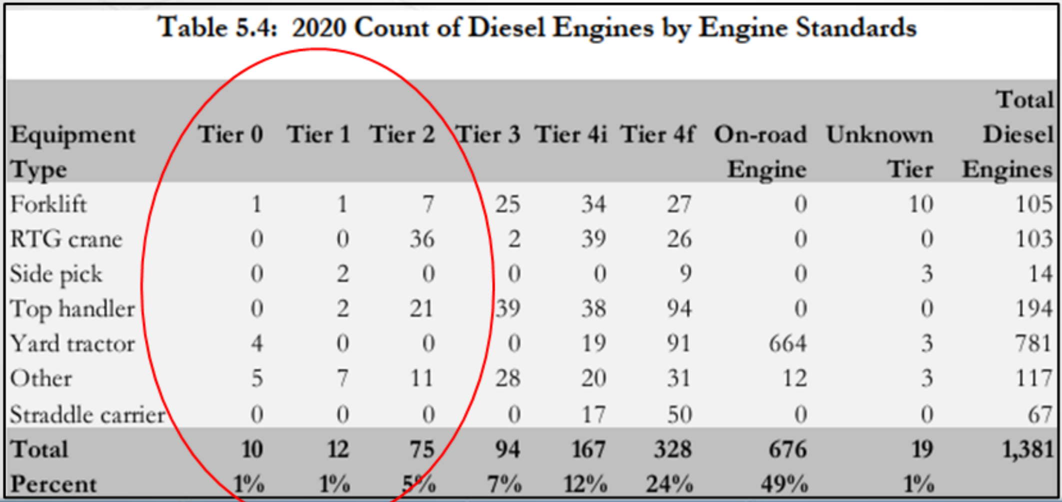
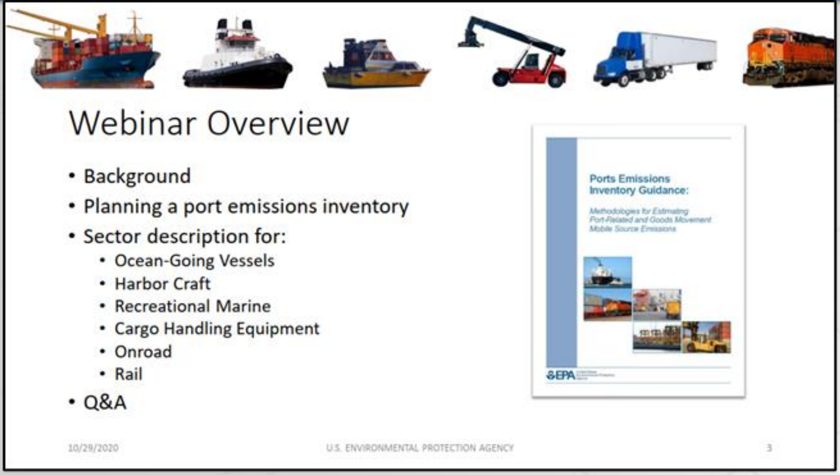


Table 5.4: 2020 Count of Diesel Engines by Engine Standards

Equipment Type	Tier 0	Tier 1	Tier 2	Tier 3	Tier 4i	Tier 4f	On-road Engine	Unknown Tier	Total Diesel Engines
Forklift	1	1	7	25	34	27	0	10	105
RTG crane	0	0	36	2	39	26	0	0	103
Side pick	0	2	0	0	0	9	0	3	14
Top handler	0	2	21	39	38	94	0	0	194
Yard tractor	4	0	0	0	19	91	664	3	781
Other	5	7	11	28	20	31	12	3	117
Straddle carrier	0	0	0	0	17	50	0	0	67
Total	**10**	**12**	**75**	**94**	**167**	**328**	**676**	**19**	**1,381**
Percent	**1%**	**1%**	**5%**	**7%**	**12%**	**24%**	**49%**	**1%**	

(2)措施系统

EPA2022年4月发布



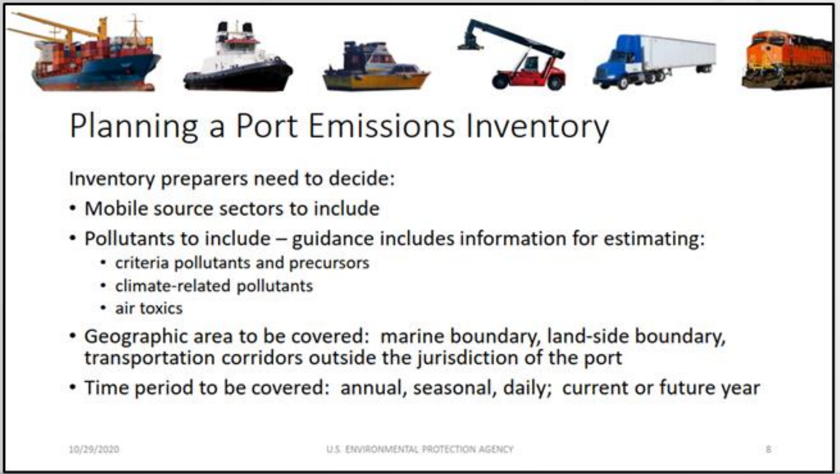
Webinar Overview

- Background
- Planning a port emissions inventory
- Sector description for:
  - Ocean-Going Vessels
  - Harbor Craft
  - Recreational Marine
  - Cargo Handling Equipment
  - Onroad
  - Rail
- Q&A

Ports Emissions Inventory Guidance:

Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions

10/29/2020 U.S. ENVIRONMENTAL PROTECTION AGENCY 3

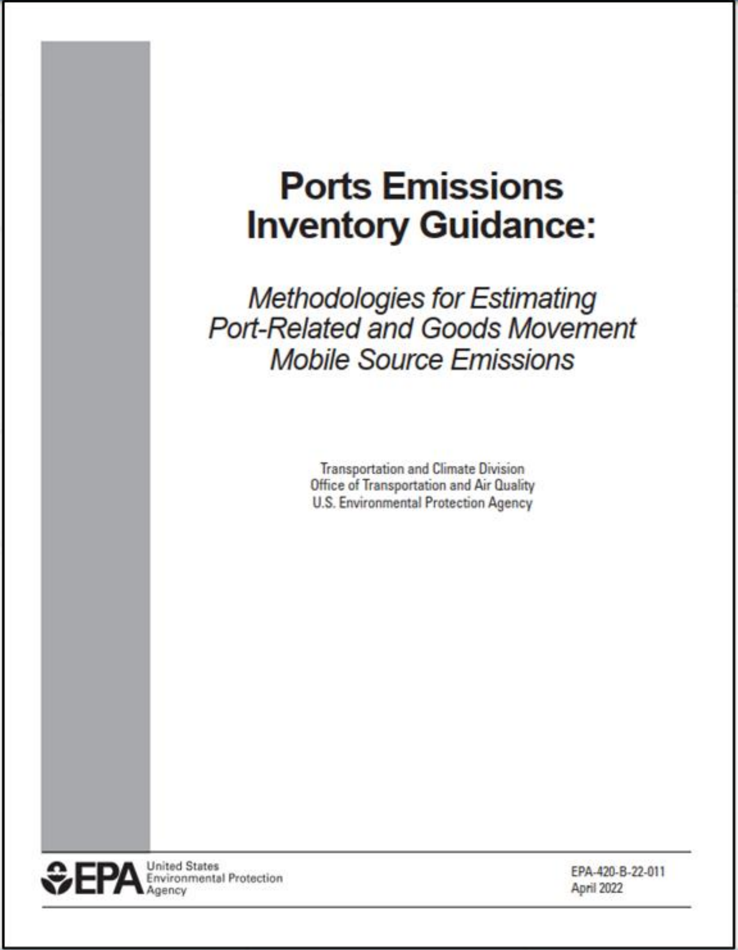


Planning a Port Emissions Inventory

Inventory preparers need to decide:

- Mobile source sectors to include
- Pollutants to include – guidance includes information for estimating:
  - criteria pollutants and precursors
  - climate-related pollutants
  - air toxics
- Geographic area to be covered: marine boundary, land-side boundary, transportation corridors outside the jurisdiction of the port
- Time period to be covered: annual, seasonal, daily; current or future year

10/29/2020 U.S. ENVIRONMENTAL PROTECTION AGENCY 8



Ports Emissions Inventory Guidance:

Methodologies for Estimating
Port-Related and Goods Movement
Mobile Source Emissions

Transportation and Climate Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

EPA United States Environmental Protection Agency

EPA-420-B-22-011
April 2022

港口排放清单→系统解决问题

视港口为物流链上的节点，强调整个运输系统的减污降碳
减污末端措施应用普遍，鹿特丹港和安特卫普港未来计划CCSU

治理路径		实践
优化结构	运输结构	推动海铁联运
		开展水水中转
	设备结构	提升集疏运车辆排放控制要求
		升级港口设备排放控制标准
		吸引环保型船舶挂靠
	能源结构	应用新能源或清洁能源（电动化）
		发展风力光伏发电
		要求靠港船舶使用岸电
节约能源、减少排放		实施港区船舶减速航行
		建立船舶排放控制区
管理完善		编制港口排放清单
		进行港口空气质量监测
		参加港口、区域、国家、国际相关协作组织

(3)目标适当

与国家或所在地方政府目标一致，不拔高

2017年版本湾区清洁空气行动计划设定与加州32号议会法案设定州减排目标一致

2020年港口相关温室气体排放在1990年的基础上减少40%；

2050年港口相关温室气体排放在1990年的基础上减少80%。

SAN PEDRO BAY PORTS

1990 GREENHOUSE GAS EMISSIONS BASELINE REPORT

The Port of LONG BEACH

LA THE PORT OF LOS ANGELES

MARCH 2019

Prepared by: STARCREST CONSULTING GROUP, LLC

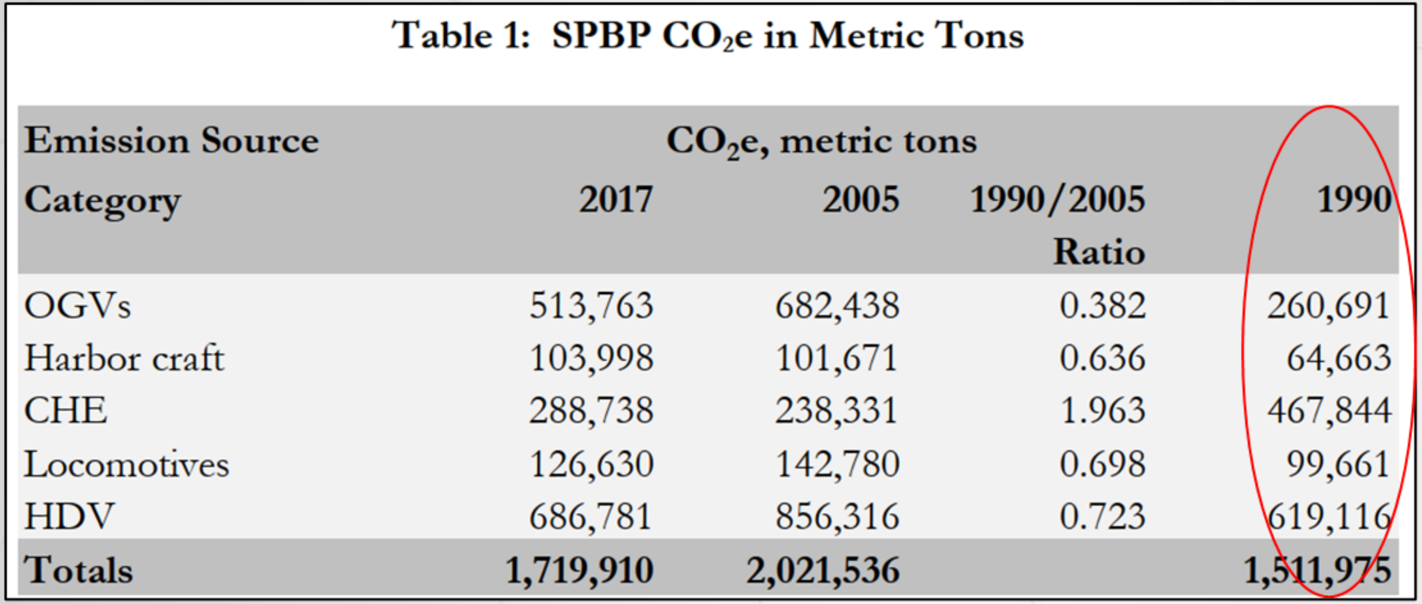
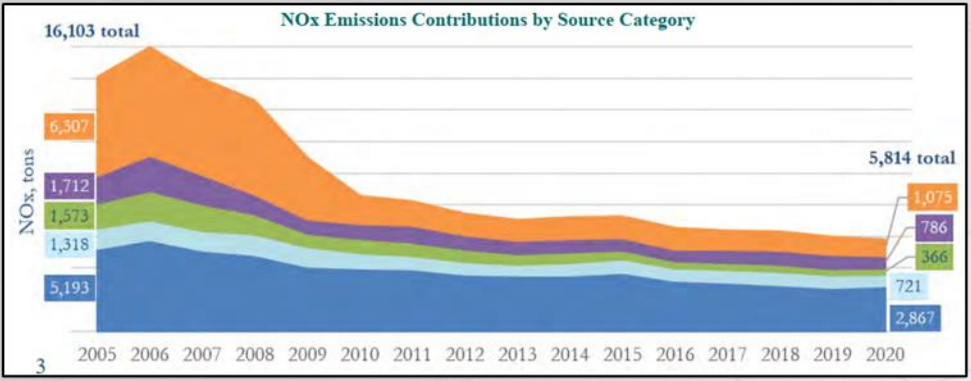


Table 1: SPBP CO_2e in Metric Tons

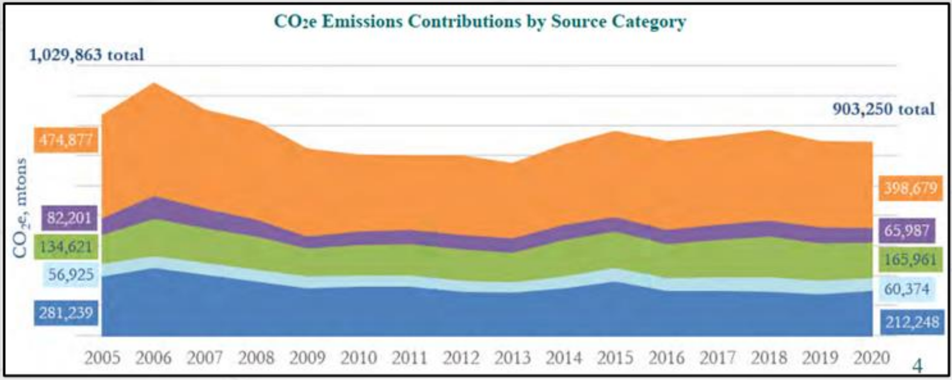
Emission Source Category	CO_2e, metric tons 2017	2005	1990/2005 Ratio	1990
OGVs	513,763	682,438	0.382	260,691
Harbor craft	103,998	101,671	0.636	64,663
CHE	288,738	238,331	1.963	467,844
Locomotives	126,630	142,780	0.698	99,661
HDV	686,781	856,316	0.723	619,116
Totals	**1,719,910**	**2,021,536**		**1,511,975**

目标适当

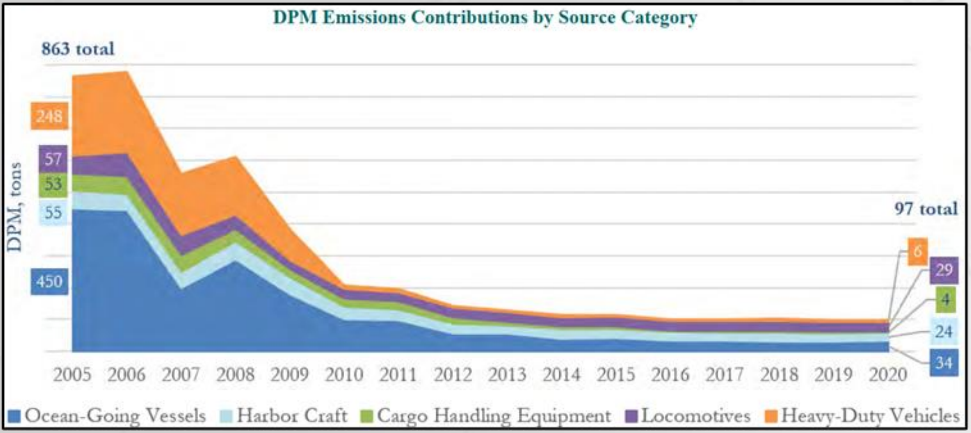
清洁空气行动计划：2020年洛杉机港效果



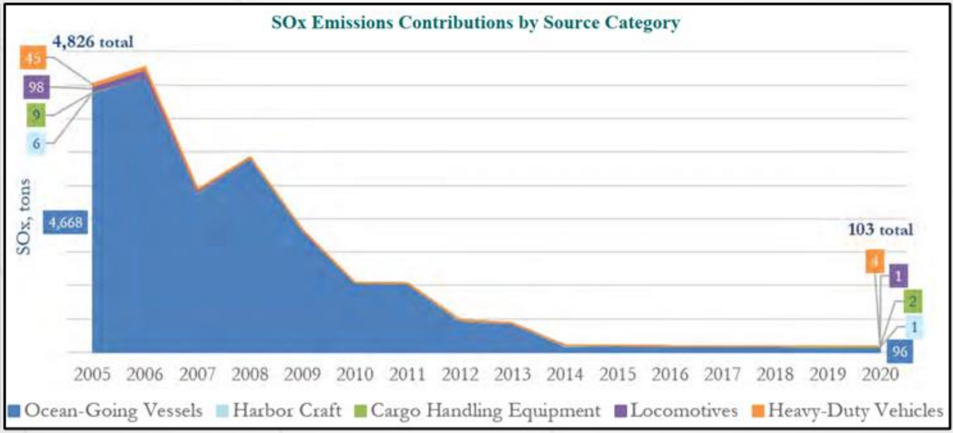
NOx Emissions Contributions by Source Category



CO_2e Emissions Contributions by Source Category

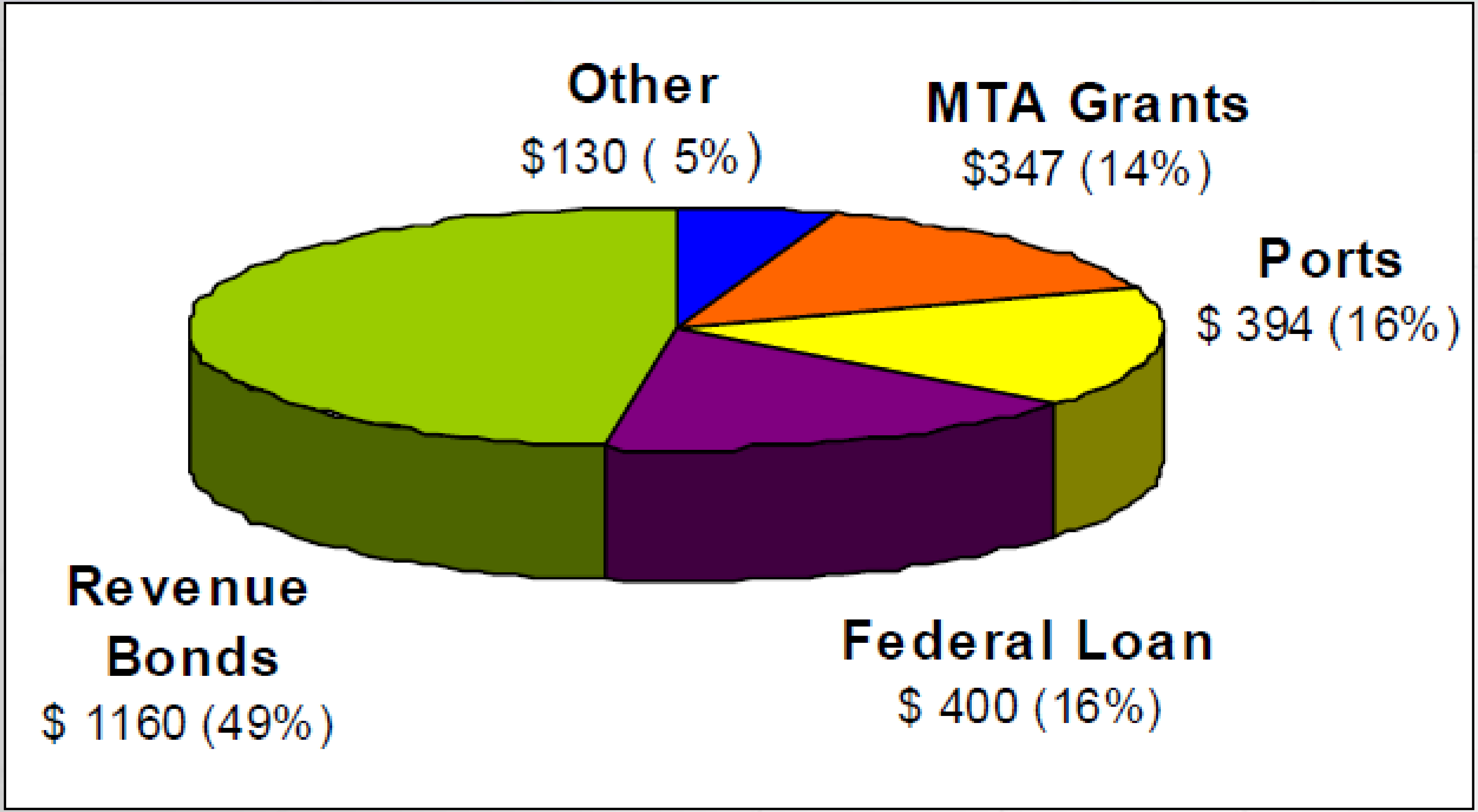


DPM Emissions Contributions by Source Category



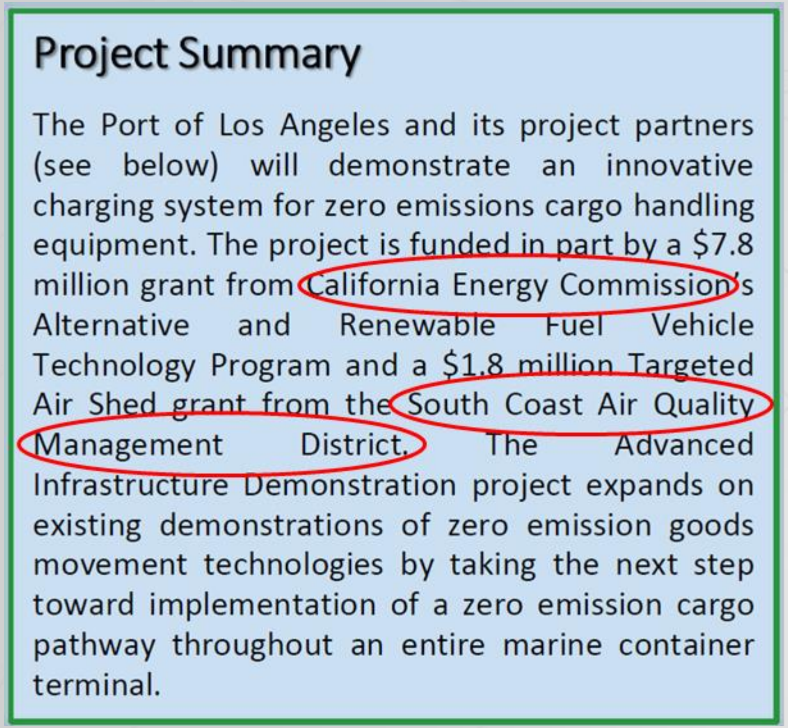
SOx Emissions Contributions by Source Category

(4)协同到位


Other
$130 (5%)
MTA Grants
$347 (14%)
Ports
$ 394 (16%)
Revenue Bonds
$ 1160 (49%)
Federal Loan
$ 400 (16%)

协同到位

洛杉矶港零排放港口机械示范项目资金来源



Project Summary

The Port of Los Angeles and its project partners (see below) will demonstrate an innovative charging system for zero emissions cargo handling equipment. The project is funded in part by a $7.8 million grant from California Energy Commission's Alternative and Renewable Fuel Vehicle Technology Program and a $1.8 million Targeted Air Shed grant from the South Coast Air Quality Management District. The Advanced Infrastructure Demonstration project expands on existing demonstrations of zero emission goods movement technologies by taking the next step toward implementation of a zero emission cargo pathway throughout an entire marine container terminal.

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