



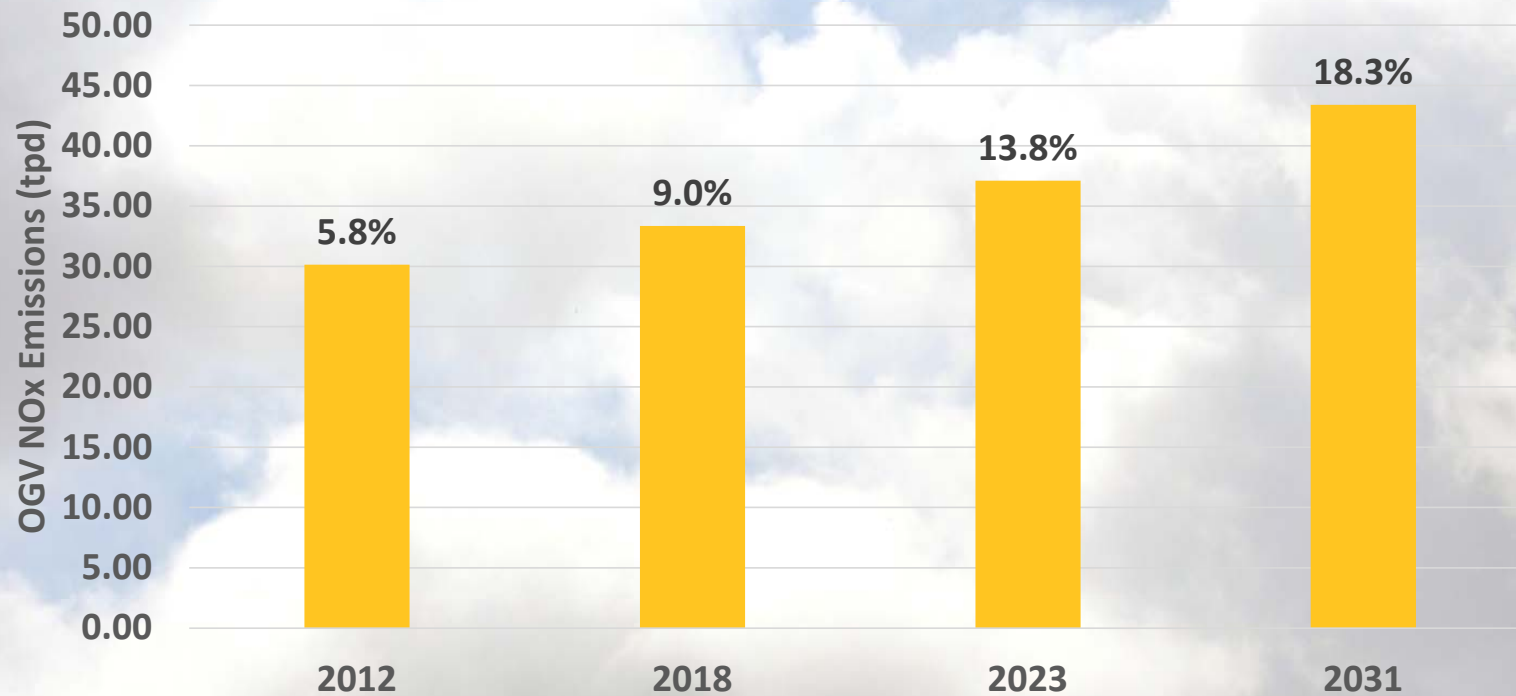
Potential OGV Emissions Reduction Strategies

2022 AQMP OGV Working Group Meeting #2
April 1, 2021

Cleaning The Air That We Breathe...



OGV NOx Emissions Contribution



Significant OGV NOx emission reductions are needed for attainment of ozone standards.



Possible Initiatives/Programs for EPA's Consideration

- IMO's current focus on GHG programs
- Possible actions that EPA/federal government may consider (in conjunction with IMO)
 - New engine standards
 - Optional engine standards based on verified retrofit control technologies
 - Potential requirements for existing vessels in ECAs given existing fleet composition and few Tier III vessels
 - Limits on older vessels (e.g., Tier 0 & Tier I)
 - Tier II+ requirements pending availability of retrofit or remanufacturing kits
 - Support development and demonstration of retrofit control technologies





CARB's Potential Regulatory Programs

- At-Berth Regulation
 - Covers container, reefer, cruise, tanker and auto carrier vessels
 - Interim evaluation in 2022 to assess possible:
 - Inclusion of bulk and general cargo vessels
 - Requirements for anchorage emissions
- Explore regulatory concepts for transit and maneuvering operations





San Pedro Bay Ports Clean Air Action Plan (CAAP) Measures

- Ports existing incentive programs
 - Vessel speed reduction, Environmental Shipping Index (ESI), Green Ship Incentive
- 2017 CAAP Measures
 - Improve existing VSR Program
 - Modify existing incentive programs
 - Variable rates on ships; higher fees for Tier 0 and I ships starting in 2025 or later
 - Support demonstration of emission reduction technologies and operational efficiency improvements





Possible South Coast AQMD Programs and Actions

- Pacific Rim Initiative for Maritime Emission Reductions (PRIMER) in collaboration with agencies, ports and shipping lines
 - Phase 1 (near-term) – For shipping lines with existing qualified Tier III vessels
 - Phase 2 (near/mid-term) – Based on future Tier III and Tier II+ vessels (new vessels and retrofits)
- Develop and demonstrate retrofit technologies
- Improve OGV emissions inventory
 - Evaluate Tier III NOx reduction benefit at low loads
 - Tanker vessels fugitive emissions
- Other possible actions
 - Petition to EPA for additional requirements
 - Legislative efforts





Shipping Lines On-Going and Future Efforts

- Compliance with existing regulations
 - CARB's At-berth
 - IMO/EPA requirements
 - Tier III standard, 0.1% sulfur in ECAs
 - Energy efficiency improvements
 - GHG reduction target (50% in 2050)
- Operational efficiency improvements
- Exploring different fuels and technologies





South COAST AQMD Survey of Shipping Lines

- Expected changes to current fleet composition by 2023, 2030, and 2040 (e.g., Tier level, technology, fuel, vessel size) and drivers for these changes
- Planned vessel deployments to the Ports of Los Angeles and Long Beach and current or foreseeable barriers for deployment of cleaner vessels to these shipping routes
- Specific clean technologies, alternative fuels, or operational improvements being used, tested, or explored for new builds or in-service vessels



South COAST AQMD Survey of Shipping Lines (cont'd)

- Recommendations for retrofit technologies and participation in demonstration projects in partnership with AQMD and CARB, and ports
- Suggestions for design, development and implementation of new incentive programs for cleaner vessels and participation in these programs
- Suggestions for increasing cleaner vessel visits to address transit, maneuvering and anchorage emissions



Collaboration is
the key to success





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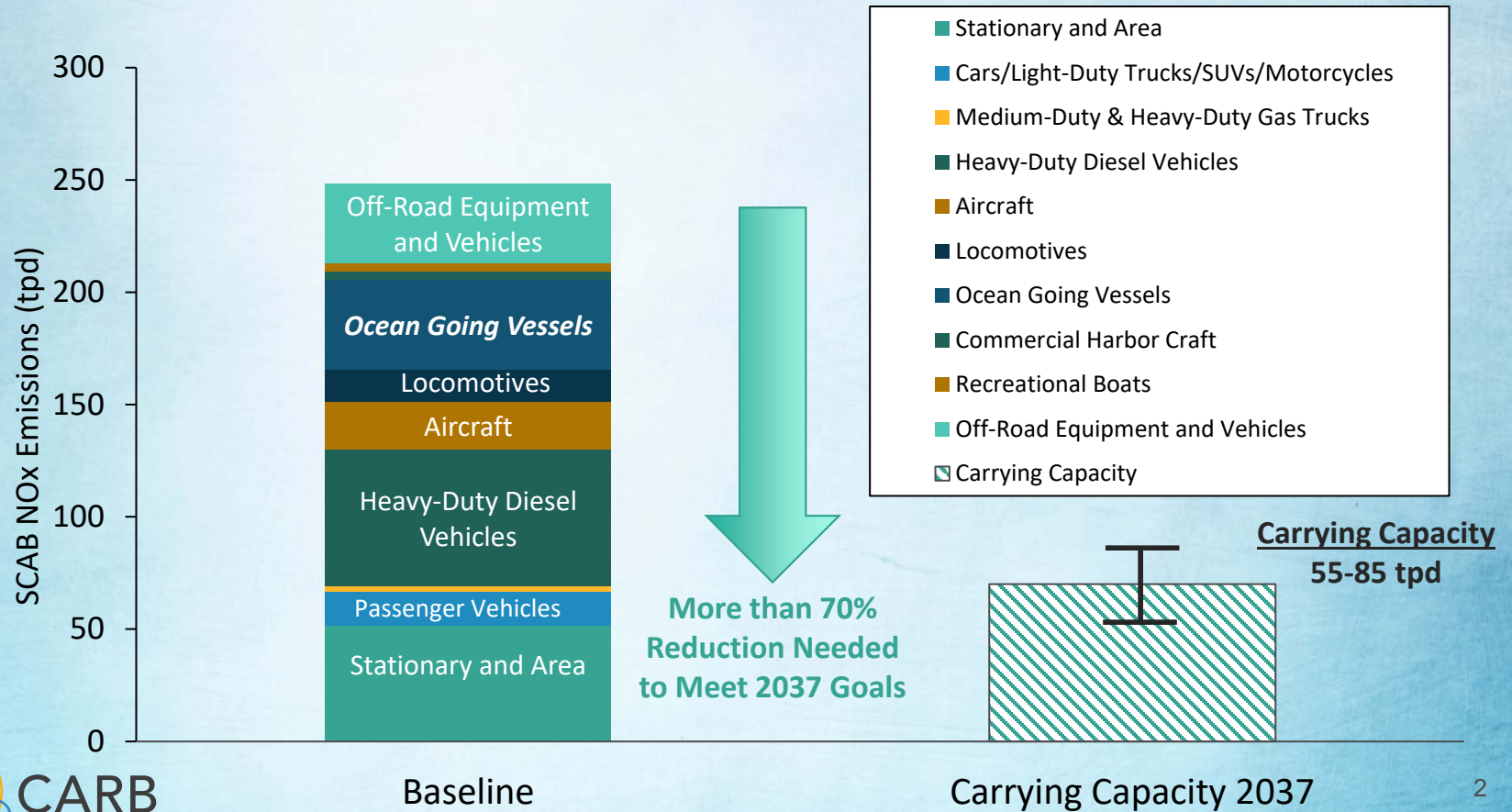


CARB's Potential Future Measures for Reducing Emissions from OGVs

2022 AQMP Mobile Source Working Group

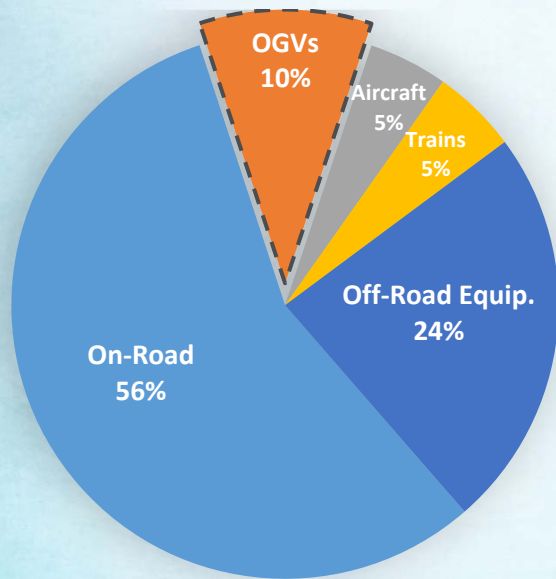
April 1, 2021

South Coast 2037 Draft Attainment Goal

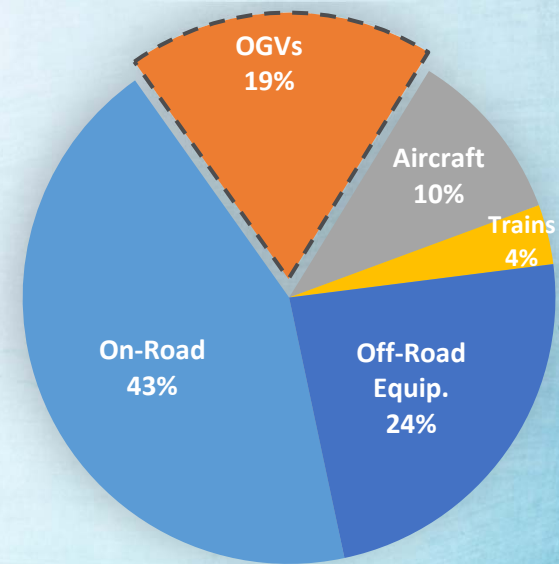


OGV NOx Emission Contribution in South Coast

- OGV emissions (up to 100 nautical miles) make up 20% of mobile source NOx emission in 2037, up from 10% in 2017



2017



2037

OGV Inventory Status

- At-Berth inventory updated in 2020
- Inventory updates for transit, maneuvering, anchorage in progress, based on Automatic Identification System (AIS) data
 - Improve base year accuracy and location specificity
 - Review growth forecast and future engine Tiers for visiting vessels
 - Review literature on emission factors for main/auxiliary engines and boilers
 - Draft Release: Summer 2021

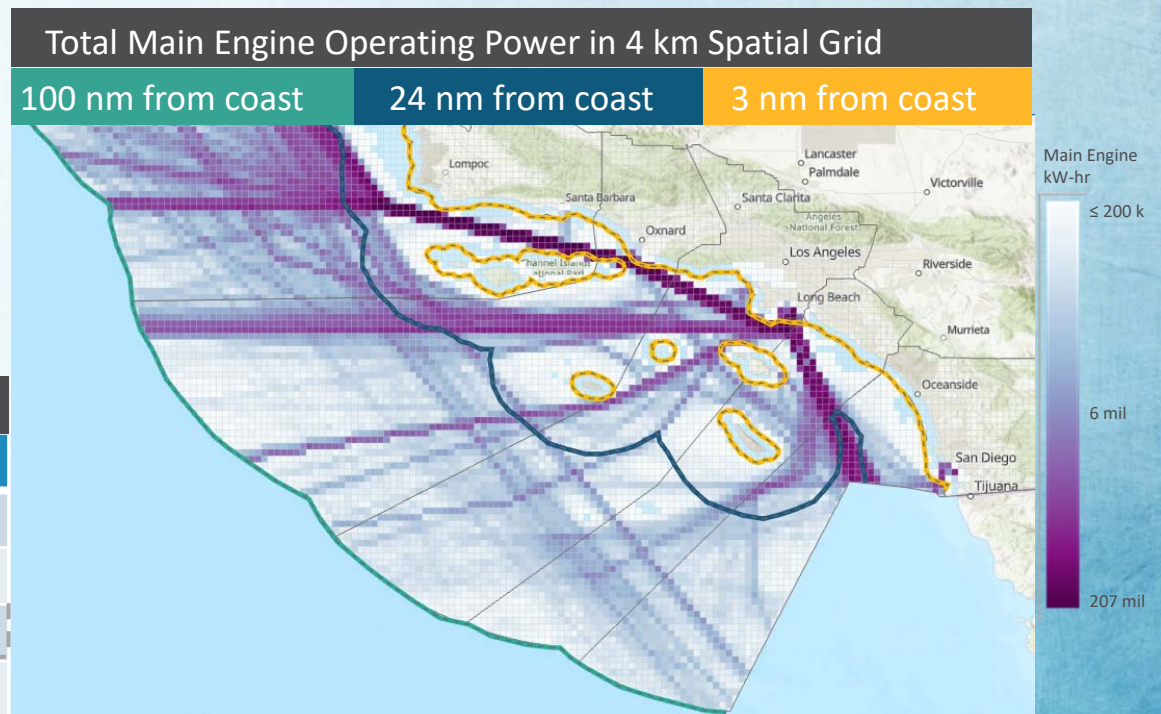


2016 AIS Data Trends: OGV Main Engines

- Main engine operating power (kW-hr) represents the installed propulsive power, engine load, and duration.

Percent of Main Engine Operating Power by Distance

District	100 nm	24 nm	3 nm
Santa Barbara	45.10 %	51.29 %	3.60 %
San Diego	66.02 %	30.03 %	3.95 %
South Coast	22.54 %	68.57 %	8.89 %
Ventura	42.23 %	47.97 %	9.80 %

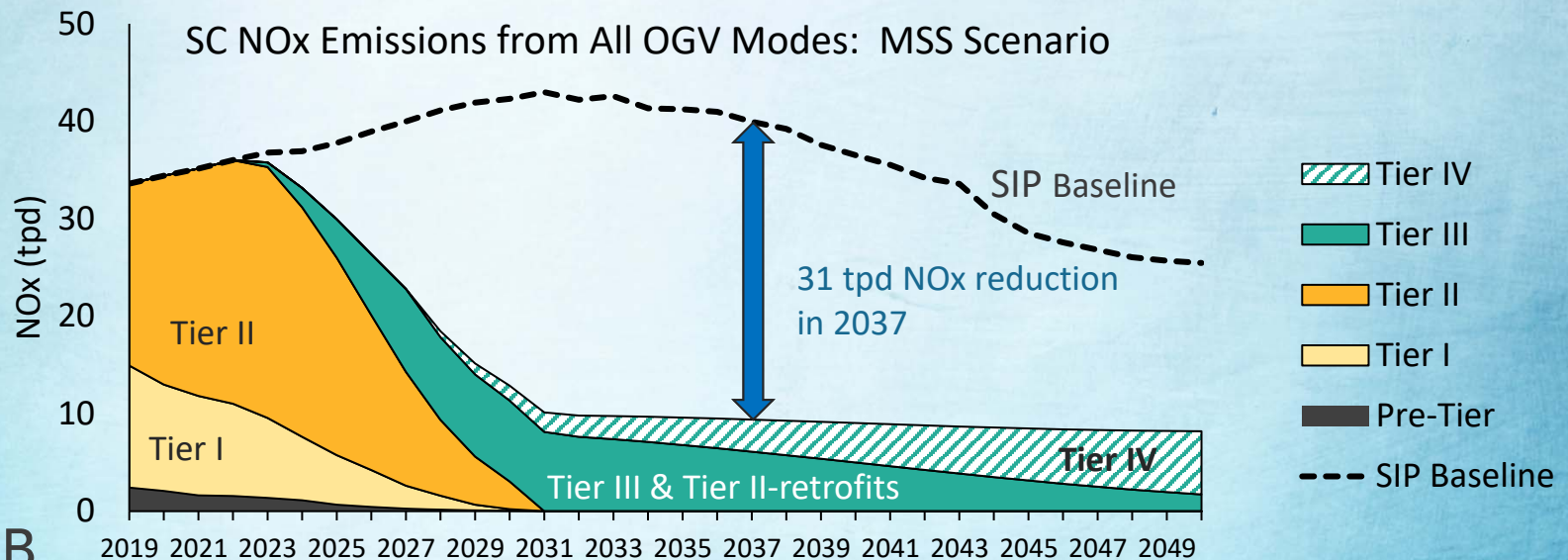


Existing Regulatory & Incentive Measures

- CARB has two existing regulations designed to reduce NO_x, PM, and SO_x emissions from OGVs
 - At Berth Regulation
 - Reduces emissions from auxiliary engines from vessels at berth
 - Expanded regulation adopted in 2020 to increase emissions reductions
 - OGV Clean Fuel Regulation
 - Requires vessels to use cleaner fuels (distillate 0.1% sulfur)
 - Applies to OGVs within 24 nm
- Voluntary vessel speed reduction (VSR) zones in Santa Barbara Channel, San Pedro Bay, San Francisco Bay, and San Diego

2020 Mobile Source Strategy (MSS)

- Address transit, anchorage, and maneuvering emissions
 - Replace Pre-Tier III visits with Tier III (or retrofitted Tier II visits that achieve similar reductions) by 2031
 - Advocacy for stricter IMO Tier standards and cleaner vessels



Potential Future Measures for Reducing Emissions from OGVs

- CARB is exploring potential future measures to reduce NO_x, PM, and GHG emissions from OGVs
 - In-transit
 - At anchor
- Further efforts needed to explore feasibility



Potential Regulatory Measures

- CARB staff is exploring several potential future measures, including requirements for:
 - Cleaner engines for all OGVs visiting California
 - Carbon fuel intensity
 - VSR
 - At anchor emissions reductions
 - Bulk and general cargo vessels
- Potential emissions reduction benefits must be further explored

Incentive & Advocacy-Based Measures

- Potential voluntary incentive measures are being explored:
 - Alternative fuels
 - Cleaner engines
 - Expanding voluntary VSR zone
- Advocacy for stricter IMO Tier standards and cleaner vessels



Alternative Fuels: LNG

- Draft LNG factors compared to Tier III emissions factors:
 - 35 – 50% less NOx
 - 70 – 80% less PM
 - 30 – 35% less CO2
- Emission Factors Source:
 - Port Emissions Inventory Guidance, U.S. EPA 2020
- Infrastructure constraints should be considered



Engine Group	Engine Type	Fuel Type	NOx Emission Factor (g/kWh)
Propulsion	MSD, Tier II	Distillate	10.5
	MSD, Tier III	Distillate	2.6
	LNG	LNG	1.3
Auxiliary	MSD, Tier II	Distillate	7.7
	MSD, Tier III	Distillate	2.0
	LNG	LNG	1.3

* Based on limited LNG and Tier III engine data

Potential Partnerships

- Several partnerships can be explored to consider how to achieve additional reductions from OGVs, including:
 - Working with U.S. EPA for cleaner engine requirements for vessels visiting California/U.S. ports
 - Development of incentive programs with South Coast AQMD and possible partnerships with Pacific ports
 - Coordinating with Ports and Air Districts to expand current VSR programs
 - Working with U.S. EPA and IMO to develop stricter marine engine standards

Next Steps

- An updated emissions Inventory development is underway
- Further assessment required, including:
 - Magnitude of emissions reductions from each potential measure
 - Assess when benefits could be achieved
 - Whether an incentive-based or regulatory approach is best
 - How to best advocate for IMO and federal support
- Continue to workshop for potential future ideas

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- Useful Links:
 - At Berth Regulation: <https://www.arb.ca.gov/ports/shorepower/shorepower.htm>
 - Clean Fuel Regulation: <https://ww2.arb.ca.gov/our-work/programs/ocean-going-vessel-fuel-regulation>
 - 2020 Mobile Source Strategy: <https://ww2.arb.ca.gov/resources/documents/2020-mobile-source-strategy>





SAN PEDRO BAY PORTS CLEAN AIR ACTION PLAN

Status Update on CAAP
Ocean-Going Vessel Measures & Efforts
April 1, 2021

Morgan Caswell, Port of Long Beach
Teresa Pisano, Port of Los Angeles



Overview of CAAP OGV Measures

- Vessel Speed Reduction (VSR) Programs
- Ship Incentive Programs
- Technology Advancement Program (TAP) Demonstrations
- Vessels At Berth



For more details: <https://cleanairactionplan.org/>



Vessel Speed Reduction Programs

- ❖ **Objective:** reduce emissions from OGVs by lowering speeds as vessels approach or depart the Ports.
 - ≤ 12 knots at 20nm or 40 nm from Point Fermin
 - $\geq 90\%$ fleet compliance earns rebate on dockage fees
 - 40nm
 - 20nm
 - 96% participation within 20nm and 92% participation within 40nm in 2020





Ship Incentive Programs

- ❖ **Objective:** reduce emissions from OGVs through per-call incentives to attract cleaner ships.



Environmental Ship Index

- Participation in IAPH ESI
 - Score 40-49: \$750/call
 - Score ≥ 50 : \$2500/call
- IMO Tier III: \$5000/call



Green Ship Incentive Program

- IMO Tier II: \$2500/call
- IMO Tier III: \$6000/call
- Program modifications underway to promote Tier II+ and Tier III ships



Ocean-Going Vessel Demonstrations

- **Technology Advancement Program**

- SCAQMD Water-in-Fuel Demonstration
- Pasha LNG/Diesel Dual-Fuel Demonstration



- **Grant-funded**

- Port of Long Beach START project
- Support CARB-funded project for tankers at-berth





Vessels at Berth

- CARB Ocean-Going Vessels At Berth Regulation
 - Board approved in August 2020
 - Expands requirements for regulated fleets and includes new vessel categories, including RoRo and tanker vessels
 - Requires submission of Terminal and Port Plans by December 1, 2021
- Efforts Underway
 - Ongoing engagement with terminal operators and other stakeholders regarding Terminal Plan/Port Plan development
 - Draft plans are underway

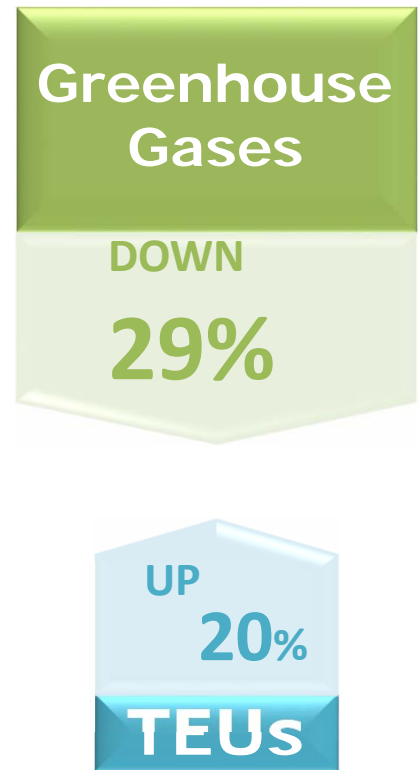
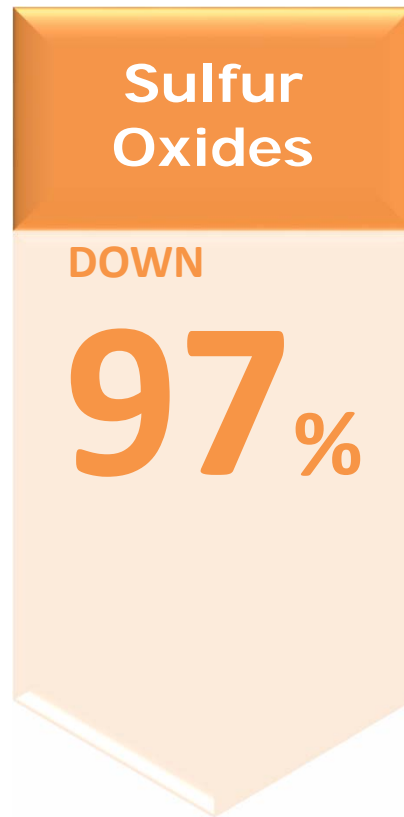
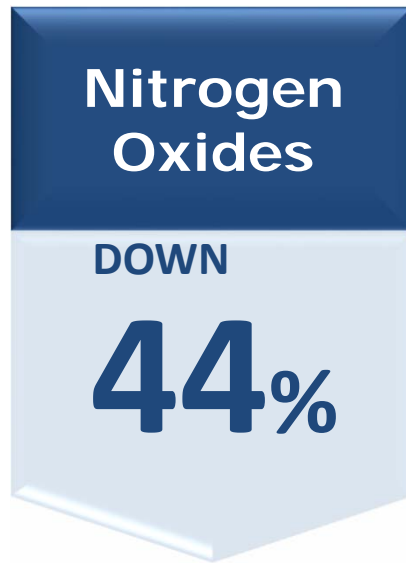
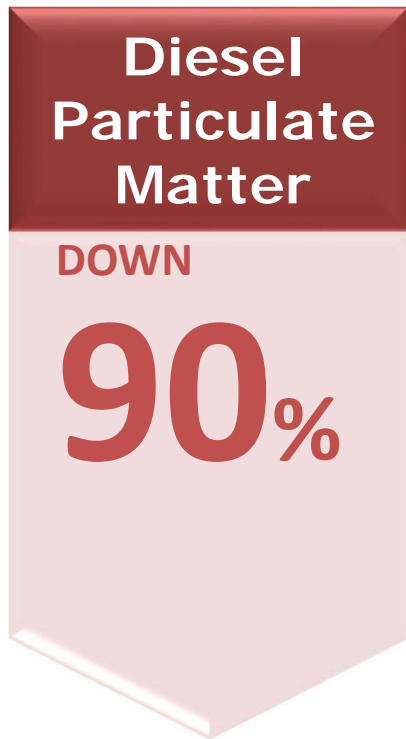


Container Throughput & Vessel Call Comparison

	2005 vs. 2019
Container Throughput (TEUs)	↑ 20%
Containers (TEUs) per call	↑ 72%
Containership Arrivals	↓ 30%



2019 OGV Emissions Reductions



*Compared to 2005 Levels

A photograph of a port scene. In the foreground, a red buoy floats in the dark blue water. In the middle ground, a white container ship is docked at a pier, with several colorful shipping containers (red, blue, and white) stacked on its deck. In the background, several large white gantry cranes are visible against a clear blue sky with some light clouds. The overall scene is bright and clear.

Next Steps

- Continue evaluation of vessel incentive programs
- Develop Port Plans to comply with the CARB At Berth Regulation
- OGV demonstration projects



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Teresa Pisano, Port of Los Angeles
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An aerial photograph of a large port and city area. The image shows a complex network of waterways, docks, and industrial facilities. In the foreground, there is a large marina filled with numerous boats. The city extends into the background, with a dense urban landscape. The sky is blue with some clouds. A semi-transparent teal banner is overlaid across the center of the image, containing the text "Thank you!".

Thank you!



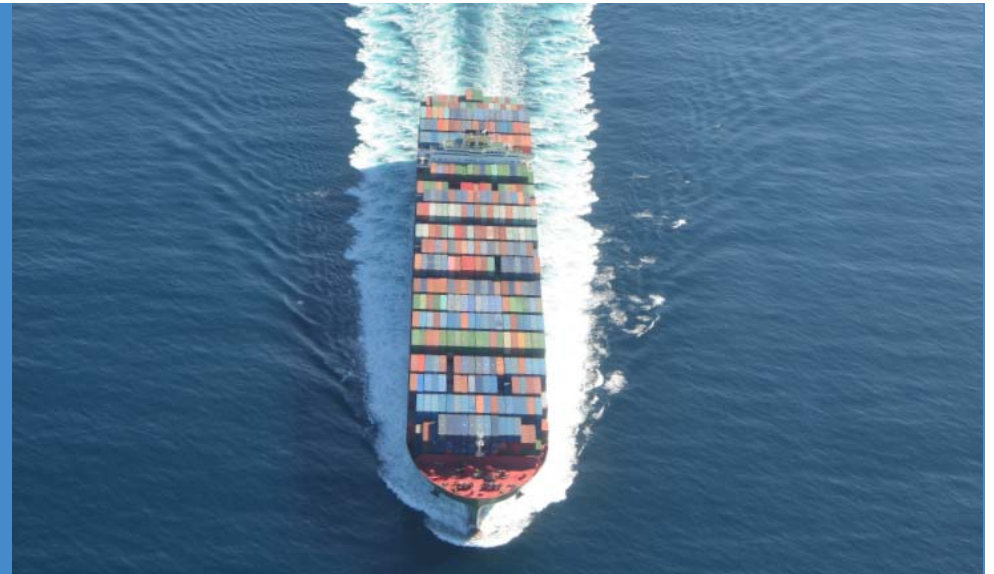
PROTECTING BLUE WHALES & BLUE SKIES INCENTIVE BASED VESSEL SPEED REDUCTION PROGRAM

South Coast AQMD 2022 AQMP Mobile Source
Working Group for Ocean-Going Vessels
April 1, 2021 Meeting

Santa Barbara County Air Pollution Control District

Ventura County Air Pollution Control District

NOAA Channel Islands National Marine Sanctuary



A PARTNERSHIP FOR CLEANER AIR, SAFER WHALES, AND QUIETER OCEANS

- Air Districts, National Marine Sanctuaries, Non-profits, Foundations
- 2014 pilot in Santa Barbara Channel, expanded each year 2016-2020
- Financial & recognition incentives to shipping companies to slow down in VSR zones
- Benefits:
 - Significant NOx emission reductions
 - Reduce fatal ship strikes on whales
 - Reduce ocean noise





**Ventura County
Air Pollution
Control District**



air pollution control district
SANTA BARBARA COUNTY



**BAY AREA
AIR QUALITY
MANAGEMENT
DISTRICT**



CALIFORNIA MARINE
SANCTUARY FOUNDATION



THE
Volgenau
FOUNDATION



**GREATER
FARALLONES
ASSOCIATION**



NATIONAL MARINE
SANCTUARIES

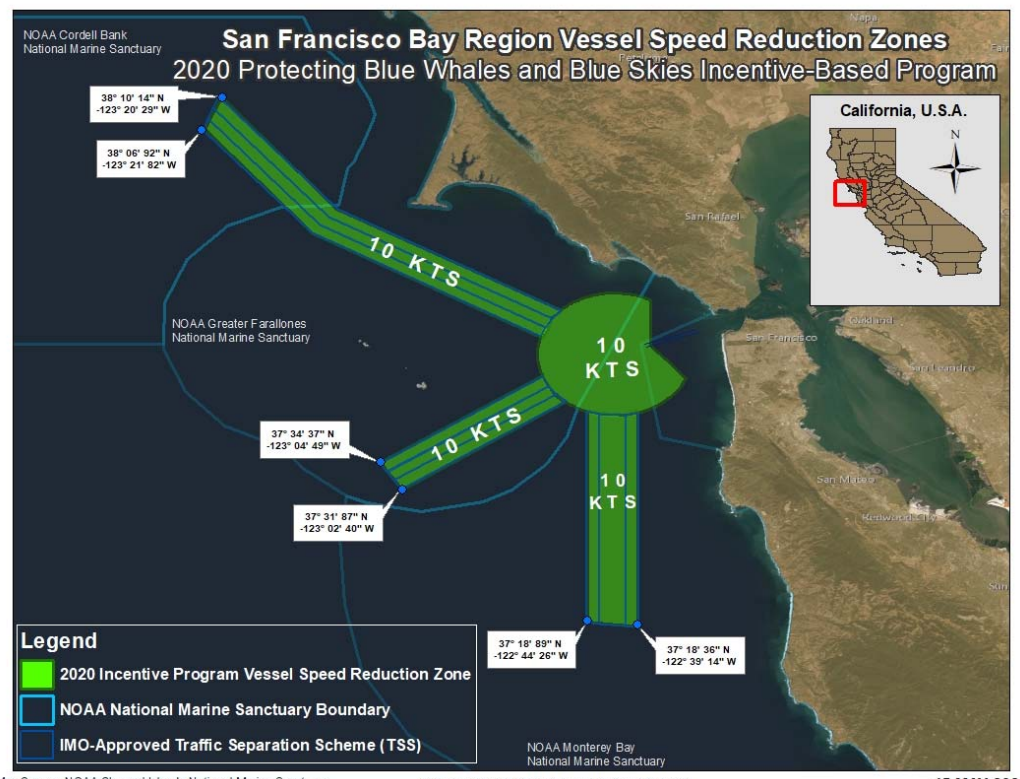
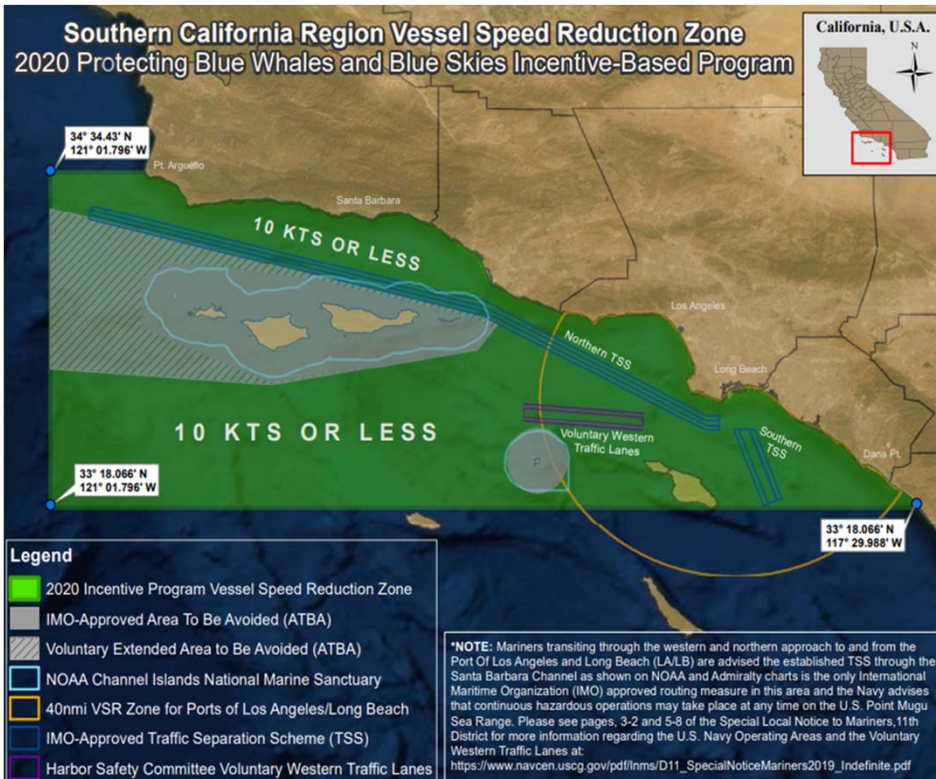


environmental
DEFENSE CENTER



**National
Marine Sanctuary
Foundation**

VSR ZONES



Map Source: NOAA Channel Islands National Marine Sanctuary

This map is not to be used for navigational purposes

OVERVIEW OF PROGRAM

- Seasonal program (May to November) to coincide with ozone season and presence of whales
- Open to container and car carrier shipping companies
- Air Districts seeking near-term NOx reductions
 - Federal and International Maritime Organization (IMO) actions on engine requirements will take a long time
 - Air districts are required to plan to meet federal and state ozone standards
- Analyze AIS data to determine performance and benefits; data and labor intensive effort
- Starcrest Consulting Group develops methodology and performs air emission calculations

OVERVIEW OF PROGRAM

Incentives are tiered based on % of distance traveled at 10 knots or less

Financial rewards range \$2,500 to \$30,000 in 2020 – many companies declining awards

Extensive positive public relations campaign – award ceremony, press coverage and advertising



John Calambokidis
Cascadia Research

2020 VSR INCENTIVE PROGRAM PARTICIPANTS

 POLYNESIA LINE



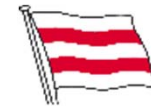
MEDITERRANEAN SHIPPING COMPANY



Hapag-Lloyd

 YANG MING


MOL
MOL ACE
Auto Carrier Express




NYK LINE
NIPPON YUSEN KAISHA



 "K" LINE
KAWASAKI KISEN KAISHA, LTD.



EVERGREEN


CMA CGM


COSCO
SHIPPING



MAERSK LINE

 Wallenius
Wilhelmsen


ONE
OCEAN NETWORK EXPRESS

HYUNDAI
GLOVIS

Matson

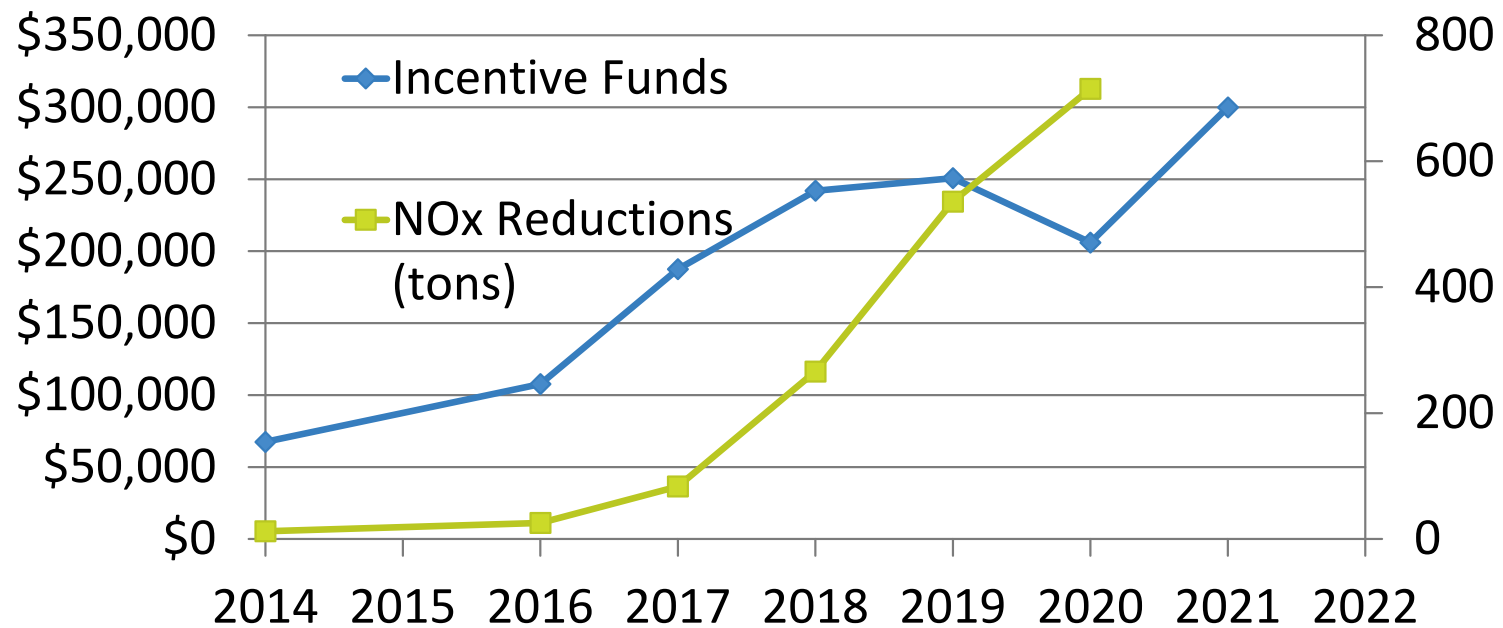
VSR INCENTIVE PROGRAM ACCOMPLISHMENTS

Year	2014	2016	2017	2018	2019	2020
Area	Santa Barbara Channel	Santa Barbara Channel Region	Santa Barbara Channel Region & San Francisco Bay Area			SoCal Region & SF Bay Area
# Companies	7	10	11	12	15	16
# Vessels	14	25	44	280	349	495
Slow-speed Distance (nautical miles)	2,700	5,000	12,630	46,026	99,019	181,306
NOx Reductions (tons)	12.4	25.6	SoCal: 74 tons SF Bay: 10 tons	SoCal: 208 tons SF Bay: 58 tons	SoCal: 430 tons SF Bay: 106 tons	SoCal: 593 tons SF Bay: 122 tons
GHG Reductions (metric tons)	535	1,005	2,630	8,668	17,026	TBD
Ocean Noise Reduction	*	*	*	*	*	*
Ship Strike Reduction	*	*	*	*	*	*

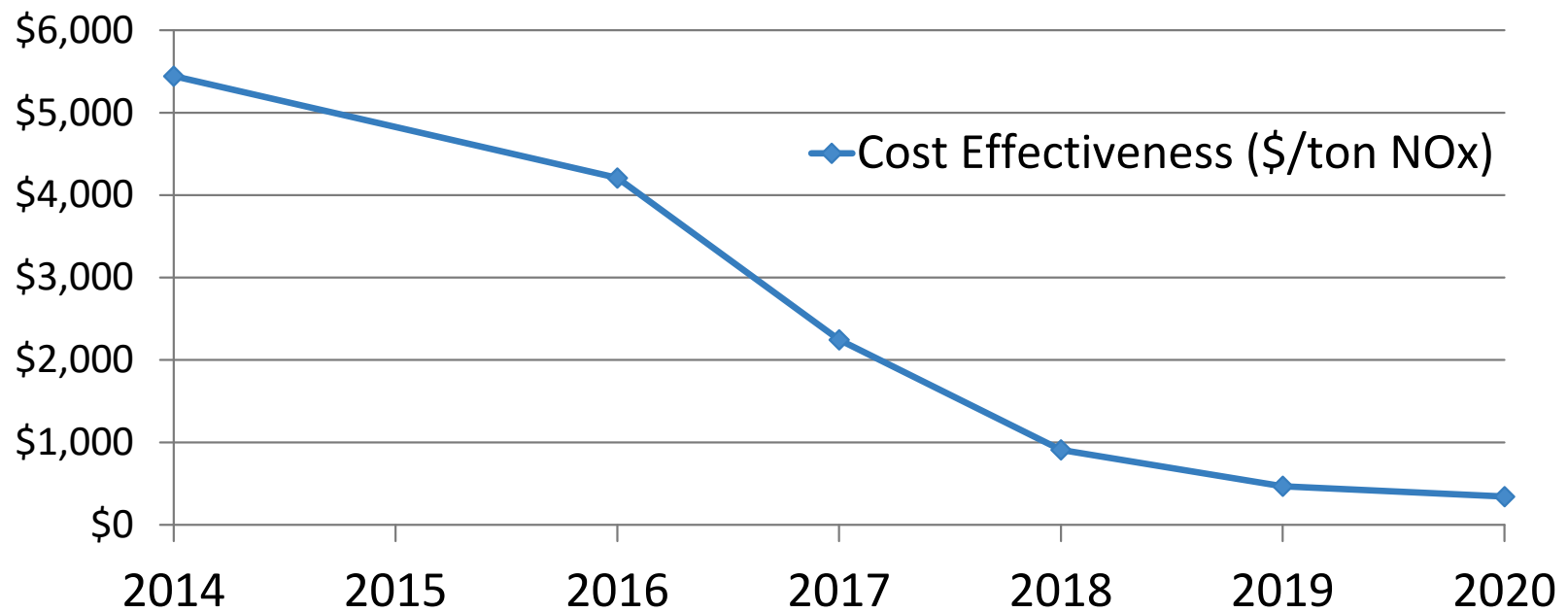
*Quantification methodology under development, but real qualitative benefits demonstrated in recent research

NOx REDUCTIONS

INCENTIVE FUNDS and NOx REDUCTIONS

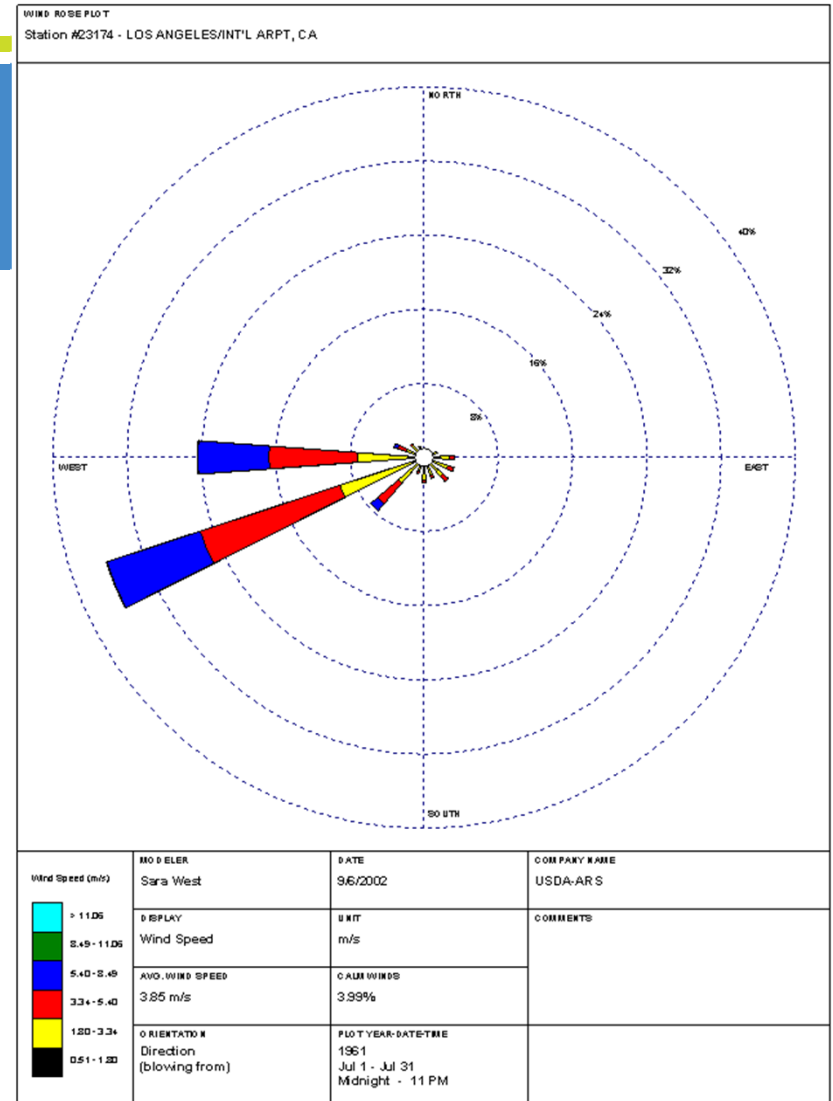


COST EFFECTIVENESS



FUTURE OF PROGRAM

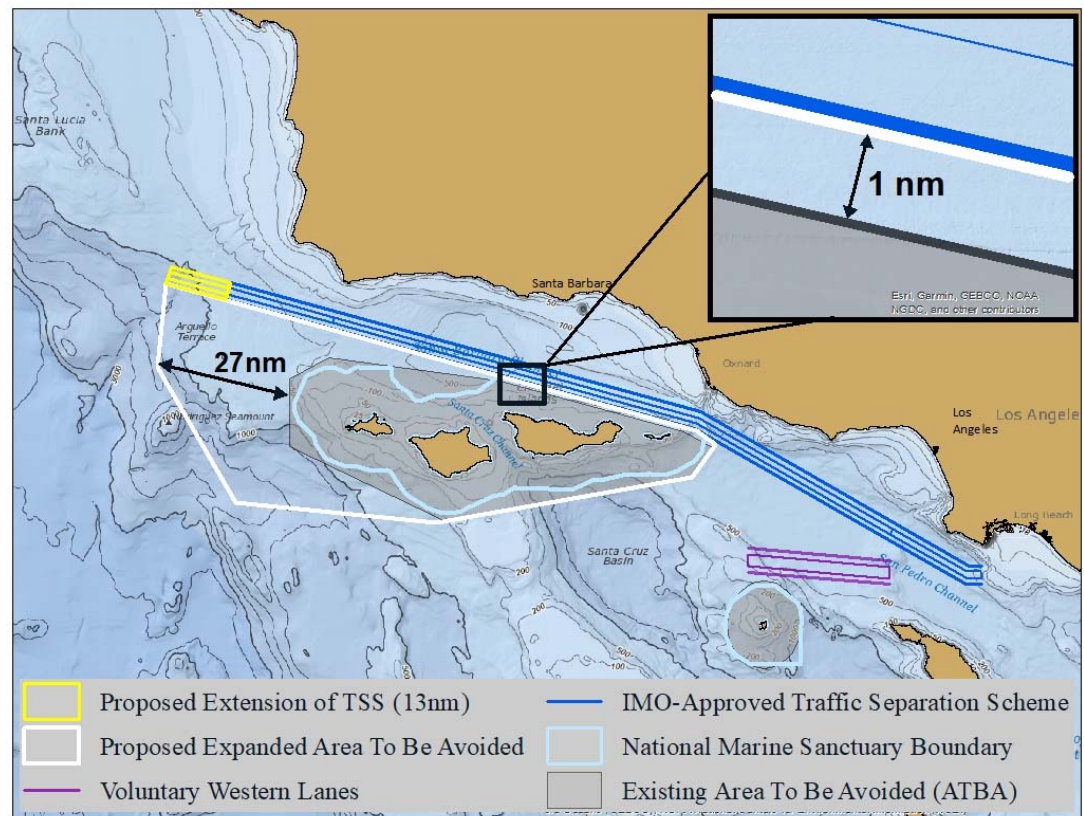
- SEP Funding in place for 2021 and 2022
- Additional incentive funds could drive further reductions of emissions, ship strikes and ocean noise
- Beyond 2022 funding is needed to continue program – participating air districts do not have revenue stream
- Emission reductions from program benefit SCAQMD attainment and emissions inventory at ports (Hueneme, Long Beach, Los Angeles)
- Statewide VSR would benefit all state coastal communities and environment



WSPR 01 Rev 2.3 by Coastal Environmental Services - www.ceslab.com/cees.html

FUTURE FEDERAL ACTIONS

- Separating ships and whales - International Maritime Organization 2022
- Ocean-Based Climate Solutions Act
- Lawsuit
- VSR Regulation?



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ourair.org/air-pollution-marine-shipping/

