



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



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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



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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



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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



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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



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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

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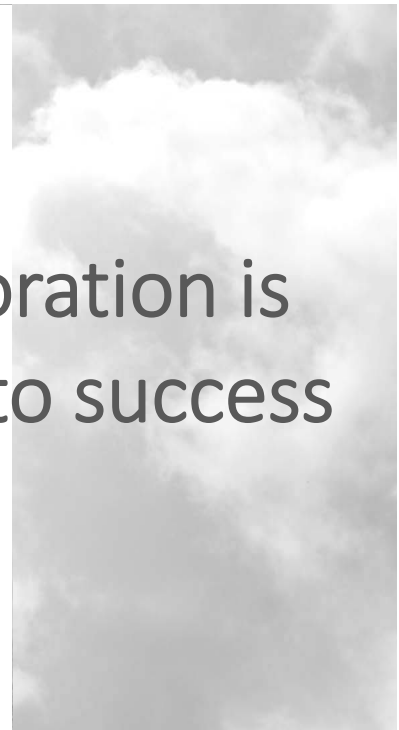
South COAST AQMD Survey of Shipping Lines (cont'd)

- 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

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Collaboration is
the key to success





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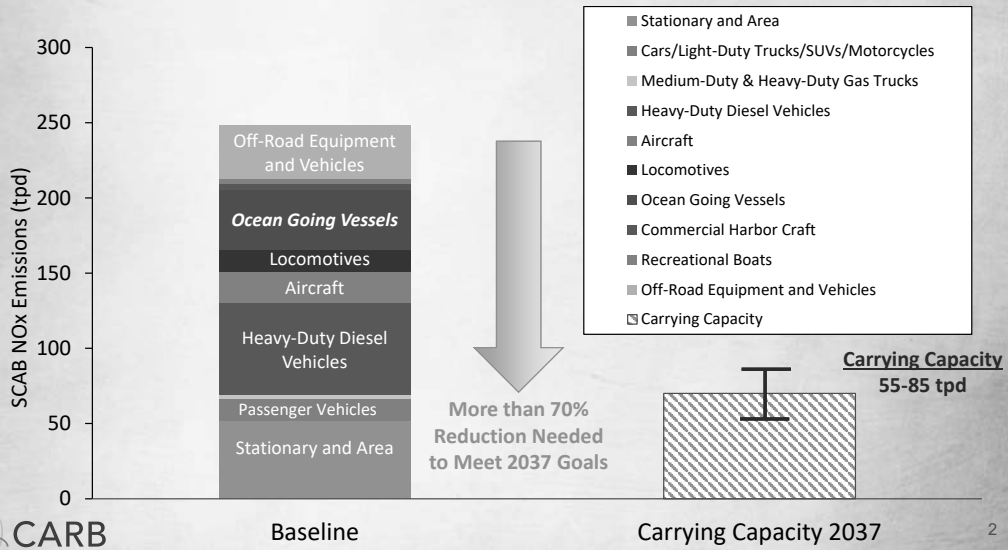
CARB's Potential Future Measures for Reducing Emissions from OGVs

2022 AQMP Mobile Source Working Group

April 1, 2021

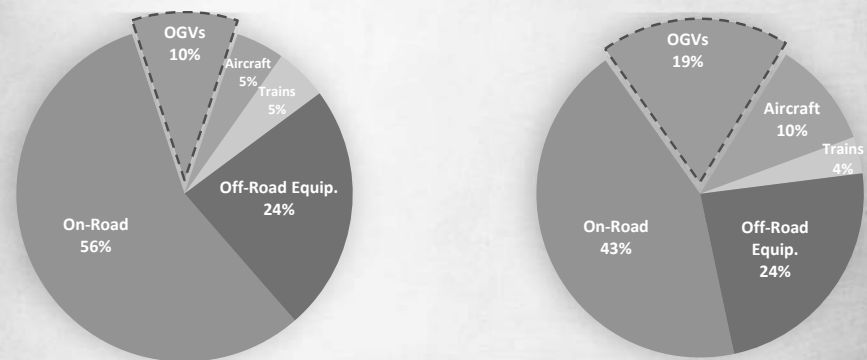
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South Coast 2037 Draft Attainment Goal



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



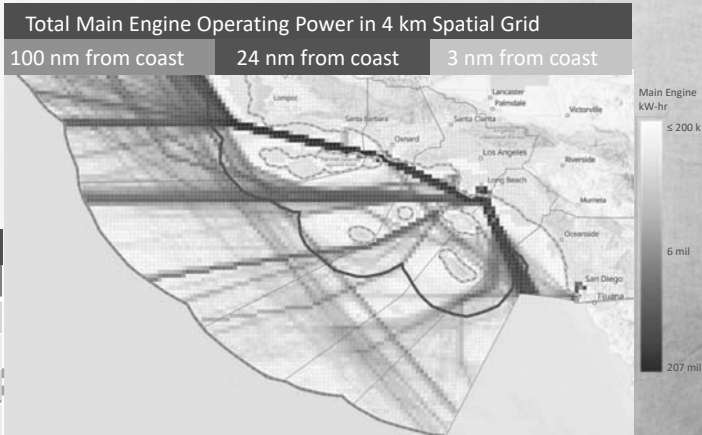
OGV Inventory Status

- 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.

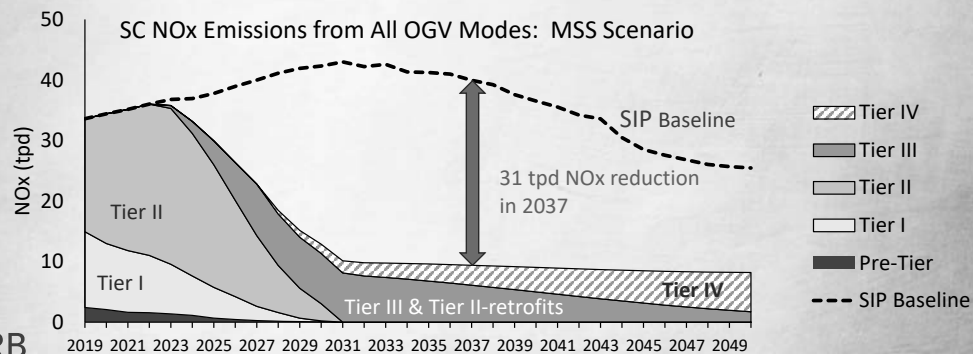


Existing Regulatory & Incentive Measures

- CARB has two existing regulations designed to reduce NOx, PM, and SOx 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



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
- ≥ 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

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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



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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

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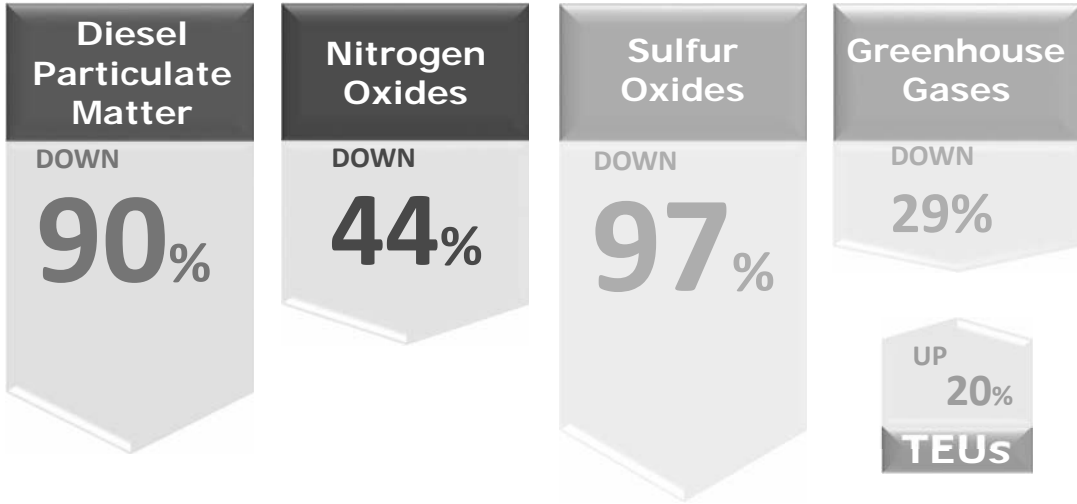
Container Throughput & Vessel Call Comparison

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

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2019 OGV Emissions Reductions



*Compared to 2005 Levels

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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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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



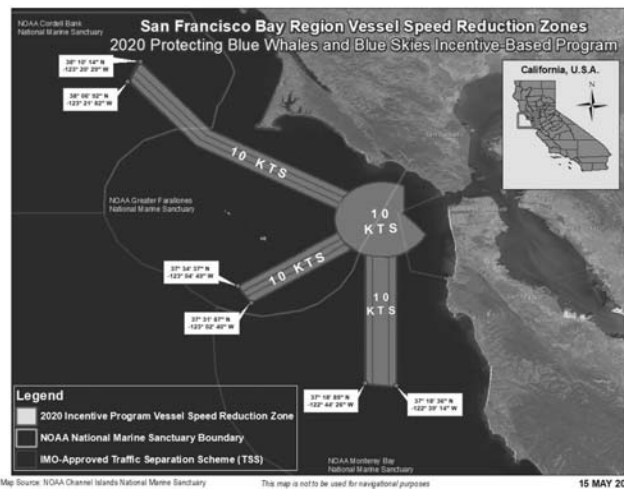
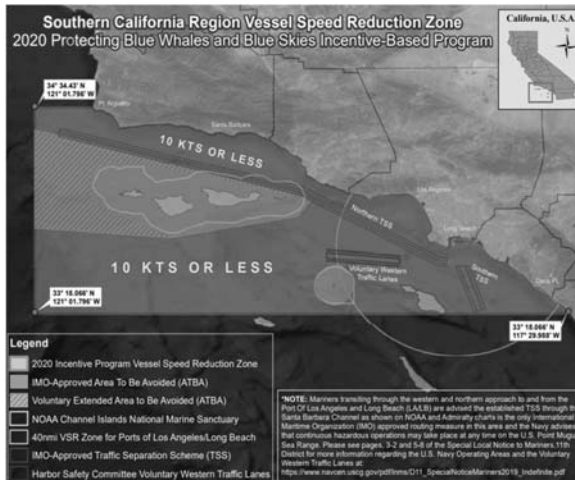
A PARTNERSHIP FOR CLEANER AIR, SAFER WHALES, AND QUIETER OCEANS

- 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





VSR ZONES



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

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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 Celambokidis
Cascadia Research

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2020 VSR INCENTIVE PROGRAM PARTICIPANTS



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VSR INCENTIVE PROGRAM ACCOMPLISHMENTS

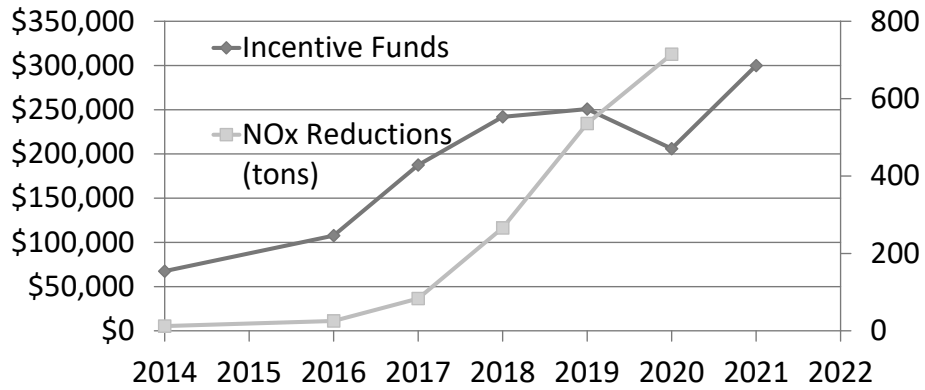
Year	2014	2016	2017	2018	2019	2020
Area	Santa Barbara Channel	Santa Barbara Channel Region	Santa Barbara Channel Region & San Francisco Bay Area			SoCal Region & SF Bay Area
# Companies	7	10	11	12	15	16
# Vessels	14	25	44	280	349	495
Slow-speed Distance (nautical miles)	2,700	5,000	12,630	46,026	99,019	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

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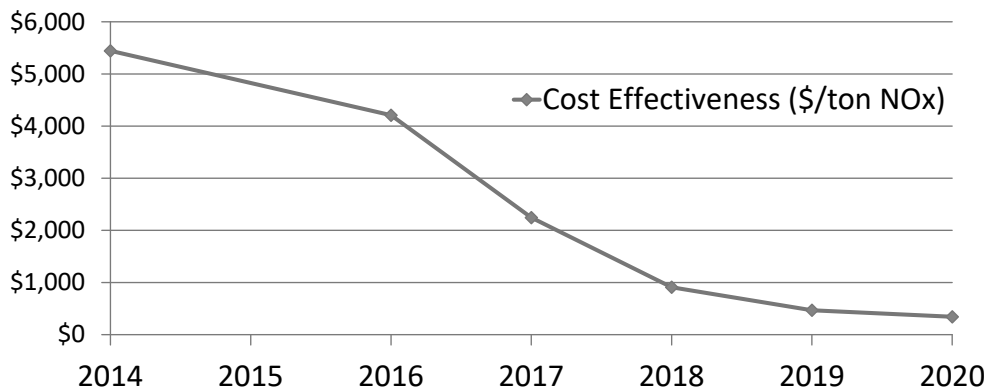
NOx REDUCTIONS

INCENTIVE FUNDS and NOx REDUCTIONS



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COST EFFECTIVENESS



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