
# Pacific Rim Initiative for Maritime Emission Reductions (PRIMER)

Governing Board Retreat

May 2019

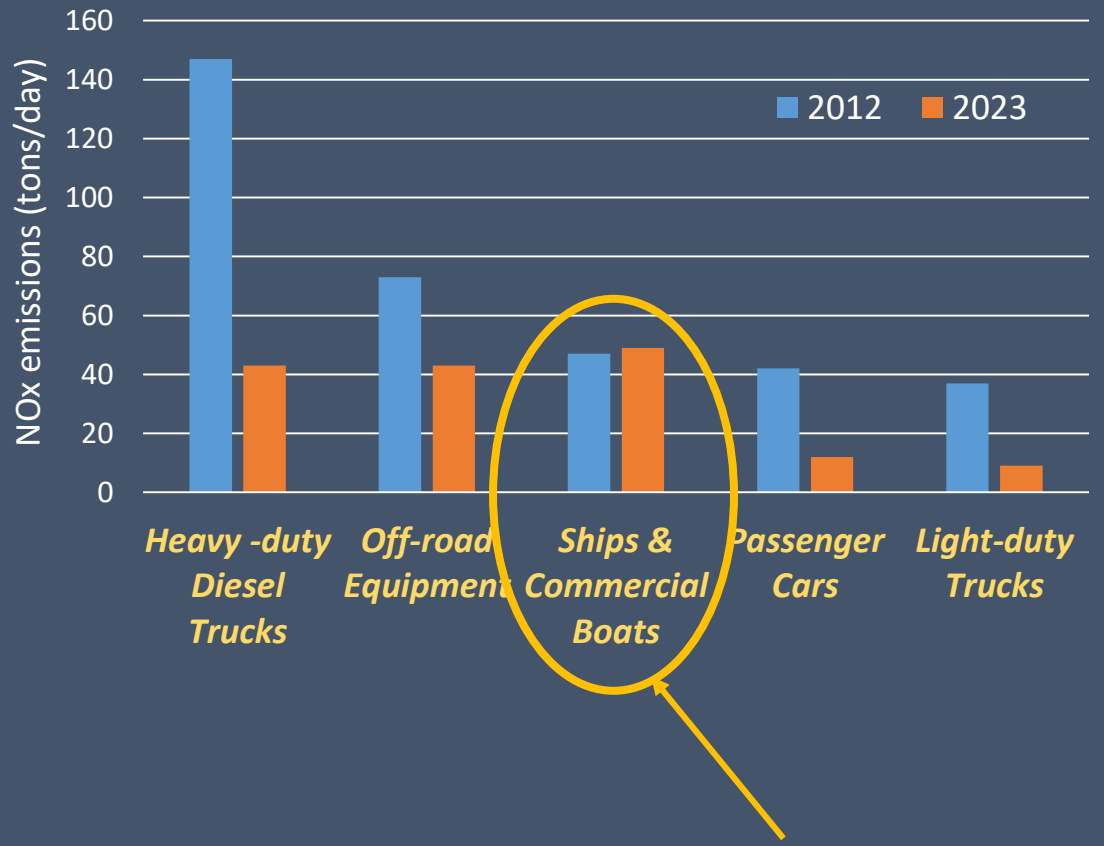
# Overview

- The importance of ship emissions and regulatory context
- Discussion of PRIMER concept and current status
- Opportunities for vessel engine retrofits & technology demonstration projects
- Next steps

# Importance of Ship Emissions

## Top 5 NOx Categories in Ports of LA/LB 2015


## Top 5 NOx Categories in South Coast 2012 and 2023




Shipping is the only category with a projected increase in NOx emissions

# Challenges in Addressing Ship Emissions

## Limited Regulatory Authority

- Mobile sources are subject to CARB and EPA regulatory authority
- Emissions from shipping are subject to international authority (IMO)

## Current International Regulations are Insufficient

- Require cleaner vessels (Tier 3 engines) in Emission Control Areas (ECAs) for vessels built after 2016
- Very few Tier 3 vessels being produced due to slow fleet turnover and glut in pre-2016 keels

# Current IMO Regulations for NOx

- Established classification of engines required for vessels based on year built

| Year Built | Engine Tier | NOx Emissions |
|---|---|---|
| Pre-2000 | Tier 0 | uncontrolled |
| 2000 | Tier 1 | 9.8-17 g/Kwh |
| 2011 | Tier 2 | 15% cleaner than Tier 1 |
| 2016 | Tier 3 | 75% cleaner than Tier 2 |

Emission Control Area (ECA) only

# Current Emission Control Areas


Chinese emission control zones for SOx; recently added NOx

- Imposes requirements within 200 nautical miles of an ECA
  - SOx: requires low sulfur fuel
  - NOx: requires vessels built after 2016 to meet Tier 3 engine standards
- North Sea and Baltic ECA will add NOx requirements in 2021

# Issue: Few Tier 3 Vessels are Being Built

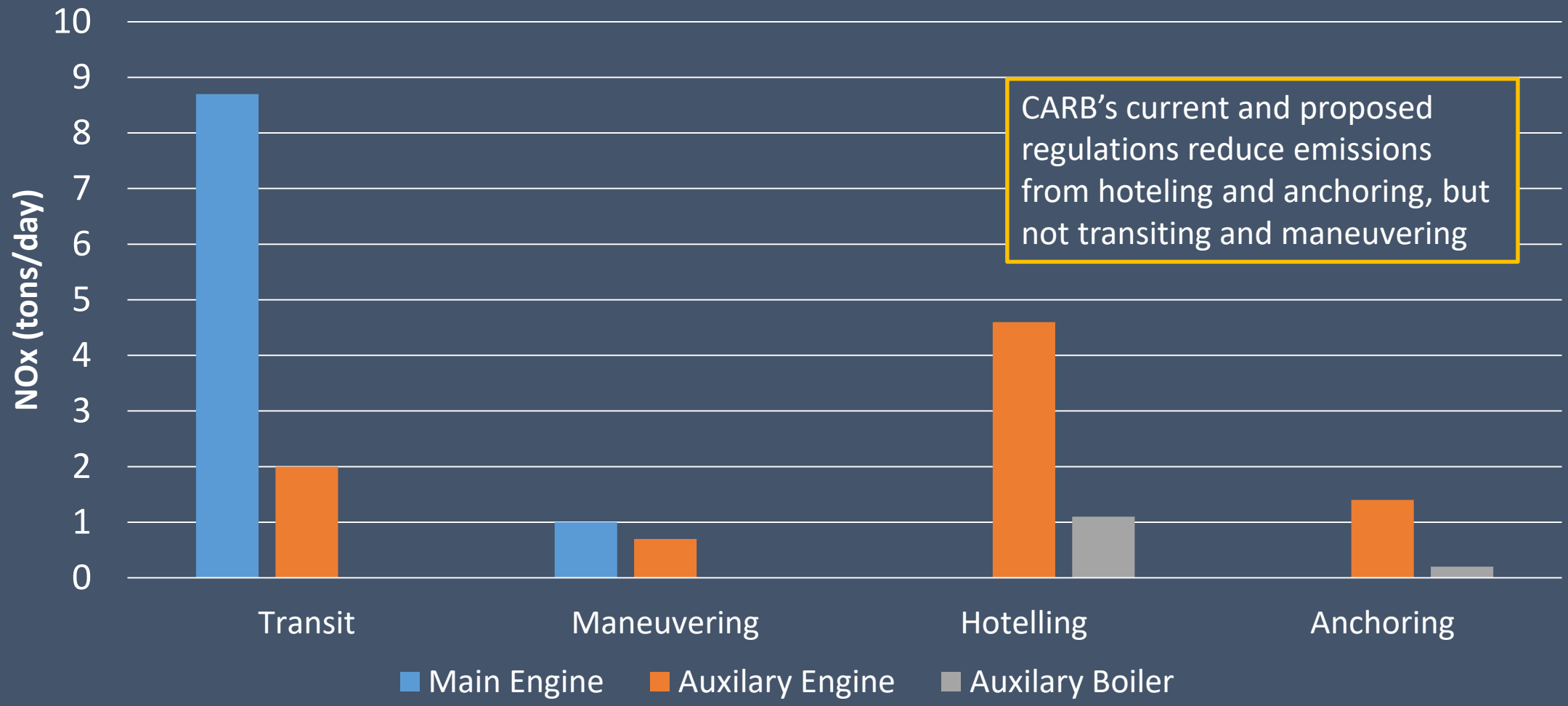
- Tier 0-2 vessels are not restricted from entering ECAs
- Limited number of Tier 3 vessels built thus far and on order
- There is a surplus of pre-2016 keels; new vessels are being constructed on these keels
- Both San Pedro ports have incentive programs in place to attract Tier 3 vessels
  - Has not resulted in calls by Tier 3 vessels
  - In 2016, 79% of vessel calls were Tier 0 or Tier 1
  - Tier 3 vessels not projected until 2030s and 2040s

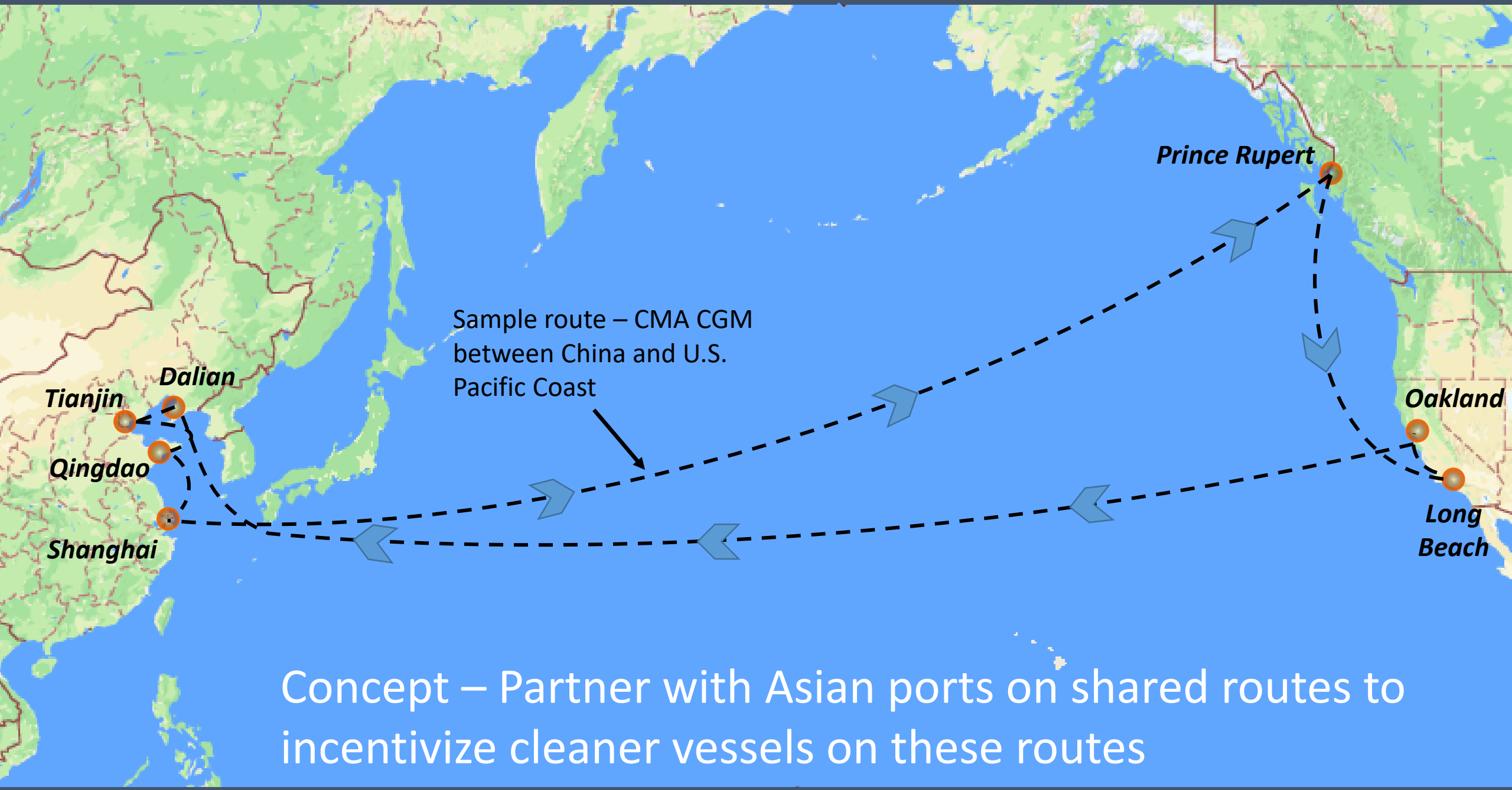
# Regulations – Existing and Proposed Statewide Requirements for At-Berth Emissions

- CARB's Existing Regulation
  - Applies to fleets of container, reefer, and cruise ships
  - Requirements for ships to use shore power or approved alternative technologies
    - 50% by 2015, 70% by 2017, 80% by 2020

- CARB's Proposed Regulation (latest proposal)
  - 100% of visits in 2021 for regulated vessel types (80% control)
  - New requirements for other vessel types
    - Auto Carrier and Ro-Ro – 100% in 2025 (80% control)
    - Tankers – 100% in 2025 (50% control); 100% in 2031 (80% control)
  - New infrastructure requirements for terminal operators and ports

# OGV Emissions by Operational Mode at Ports of LA/LB (2016)






Concept – Partner with Asian ports on shared routes to incentivize cleaner vessels on these routes

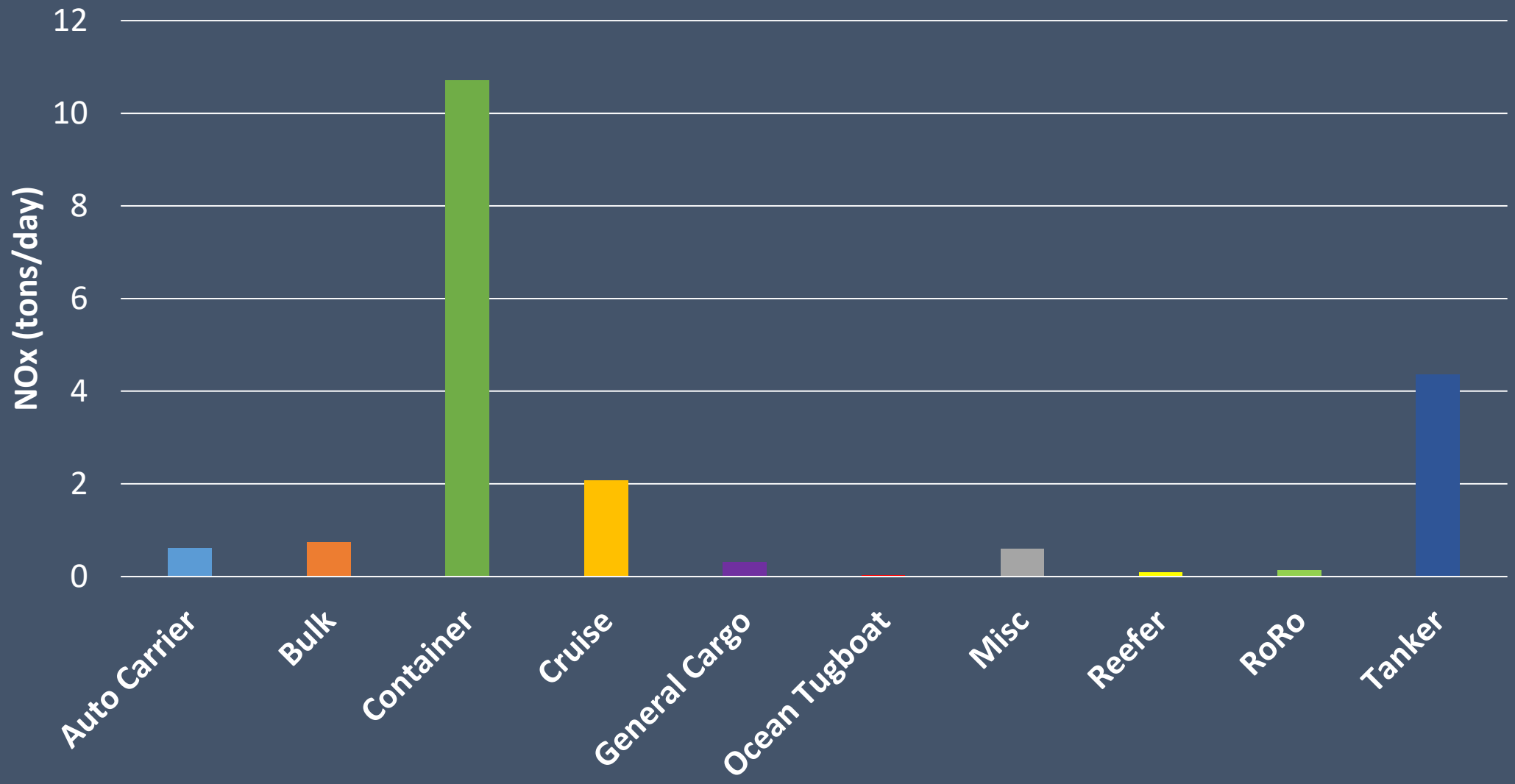
# Pacific Rim Initiative for Maritime Emission Reduction (PRIMER)

- Identify top ports in China that are on the same routes as Ports of LA/LB
- Collaborate with regional authorities/ports/shipping lines to develop a joint program where each participating port provides an incentive for a call by a cleaner vessel
- Each port's individual incentive is then leveraged to encourage changes in shipping behavior
  - Re-routing of existing Tier 3 vessels
  - Encourage construction of Tier 3 vessels on pre-2016 keels
  - Encourage retrofits of existing vessels cleaner than Tier 2

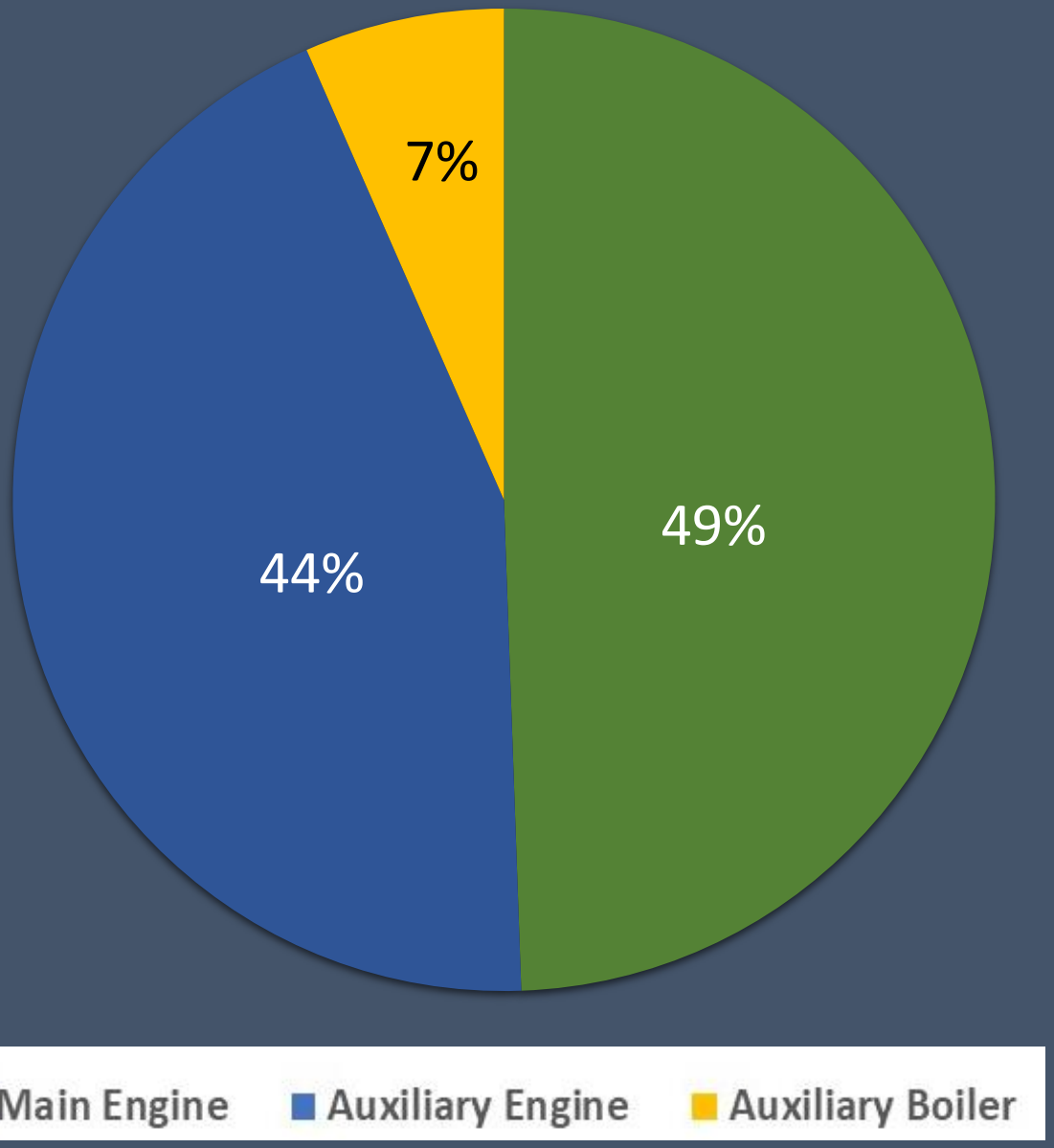
Preliminary estimates are very cost-effective for NOx emission reductions

# Frequent Caller (≥5) Container Vessels at Ports of LA/LB and Key Asian Ports in 2016

# OGV Emissions by Vessel Type at Ports of LA/LB (2016)



# OGV Emissions by Engine Type at Ports of LA/LB (2016)



# Challenges

- Behavioral
  - Need to better understand current shipping behavior and business models
  - Tailor incentives so that they are sufficient to change behavior
- Technology
  - Identify feasible retrofit technologies and costs
  - Technology demonstration projects
- Emission trade-offs
  - Avoid GHG disbenefit associated with some retrofit technologies

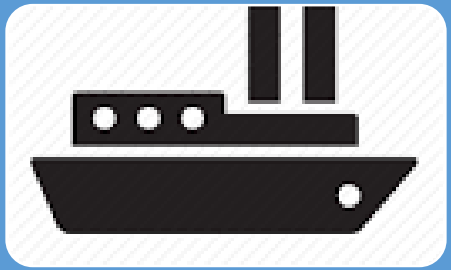
# PRIMER Current Status

## Engagement with China

- August 2018: met with officials from the central government in Beijing and local officials in Hong Kong and Shanghai
- January 2019: met with officials in Shenzhen and presented at International MoVE 2019 Workshop in Chengdu, China

## Technical analysis to support the concept

- Data analysis to understand shipping patterns
- Hired consultant for cost-optimization work

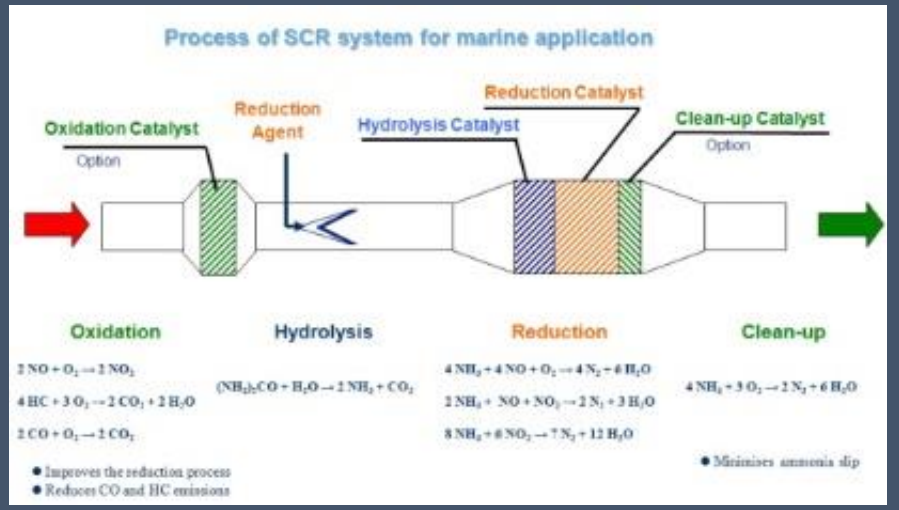


## Held Technology Forum for OGV retrofits

- Convened engine manufacturers, shipping lines, ports and other stakeholders to discuss retrofit technology
- Secured commitment for a technology demonstration project

# Potential OGV Retrofit Technologies

- Selective Catalytic Reduction
  - Urea solution used as reducing agent
- Exhaust Gas Recirculation
  - Recirculated exhaust air lowering peak combustion temperature
- Fuel/Water Emulsification
  - Water mixed into the fuel
- Humid Air Motor
  - Heated intake air saturated with water vapor
- Direct Water Injection
  - Water directly injected into the combustion cylinder
- Battery/Hybrid



# Technology Demonstration Projects

- South Coast AQMD in discussions with MAN Energy Solutions and Wartsila on potential demo projects
- Draft proposal received from MAN Energy Solution for first retrofit technology demonstration project
  - Water/Fuel Injection technology for both main and auxiliary engines with 40% NOx reduction target
  - Shipping line confirmed participation (CMA CGM)
  - Details are being finalized (vessel identification, funding)
  - Schedule: 2019-2021
- Additional proposals for other technologies expected soon

# Next Steps

- Research & information gathering
  - Better understand how shipping lines route vessels and factors that influence their decisions
  - Collect information on feasible technologies & costs
  - Identify and work with key industry partners

- Continue building relationships with key Asian partners
  - Meeting/information exchange
    - Initial emphasis on Shenzhen, Hong Kong, and Shanghai
    - Official communication platforms to be established
  - Collaboration with other US agencies
    - US EPA: US-China Green Ports and Vessels Initiative
    - POLA/POLB: US-China sister ports

# Questions?