Regulation to Reduce Hotelling Emissions from Ships in California Ports (Adopted 12/6/07)

AAPA Cruise Seminar

February 6, 2008

California Environmental Protection Agency

Air Resources Board

BACKGROUND

Emissions from At-Berth Ships

- Auxiliary engines provide power for ship’s electrical power needs
- Power requirements are specific to ship type and cargo

Health Impacts Due to Hotelling Emissions

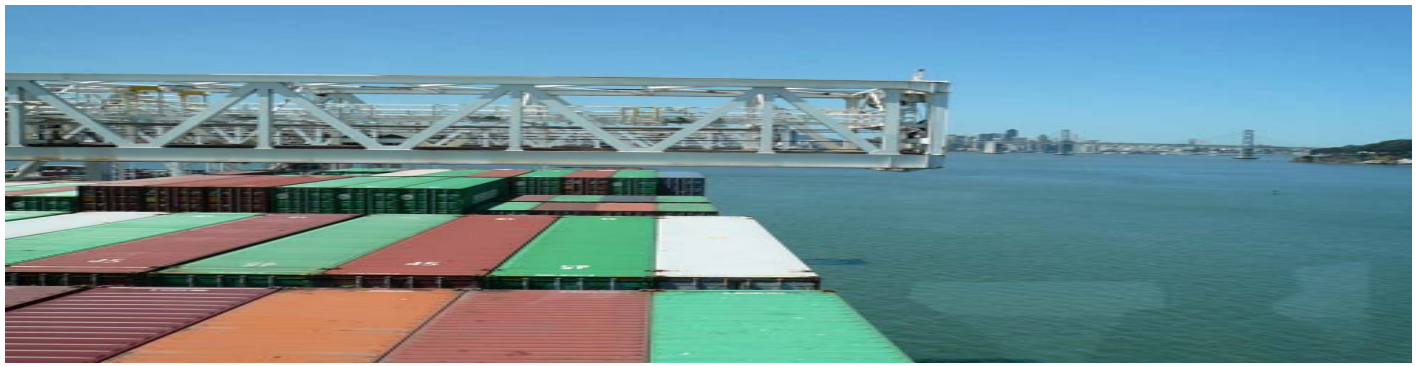
- Diesel particulate matter (PM)
  - 70 percent of inhalable cancer risk in CA
- Elevated cancer risk near ports
  - POLA/POLB health risk assessment indicates potential cancer risk from hotelling emissions (2006) affects:
    - **2,000,000 with risk greater than 10 in a million**
    - **340,000 with risk greater than 100 in a million**
    - **87,500 with risk greater than 200 in a million**

Health Impacts Due to Hotelling Emissions
(Continued)

- Non-cancer annual impacts (2006)
  - 60 premature deaths
  - 1,800 respiratory impacts
  - 11,000 work loss days
  - 61,000 minor restricted activity days

Ship Activity to California Ports (2006)

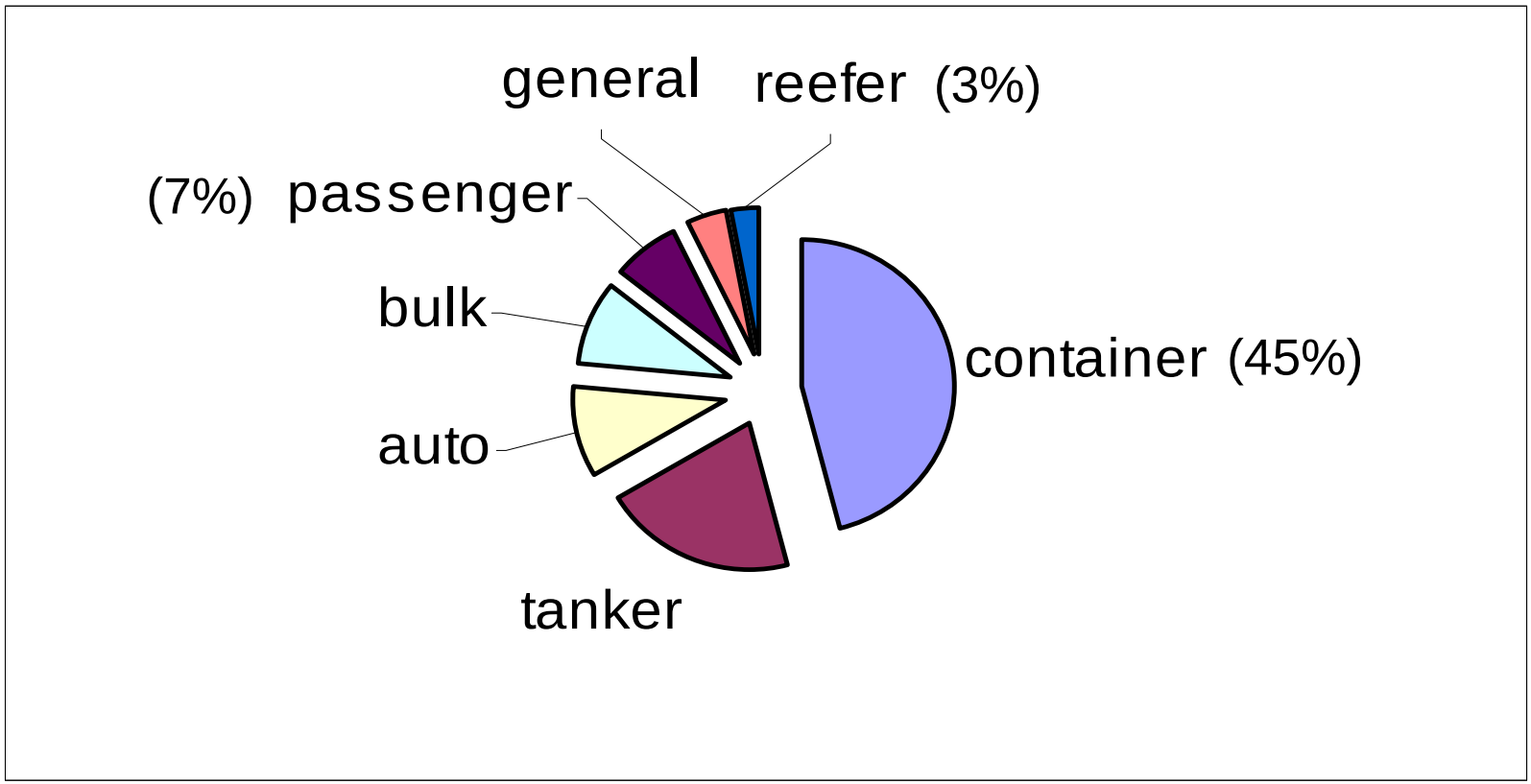
- 2,000 ships
- 10,500 visits
- Majority visiting ports of Long Beach, Los Angeles, and Oakland



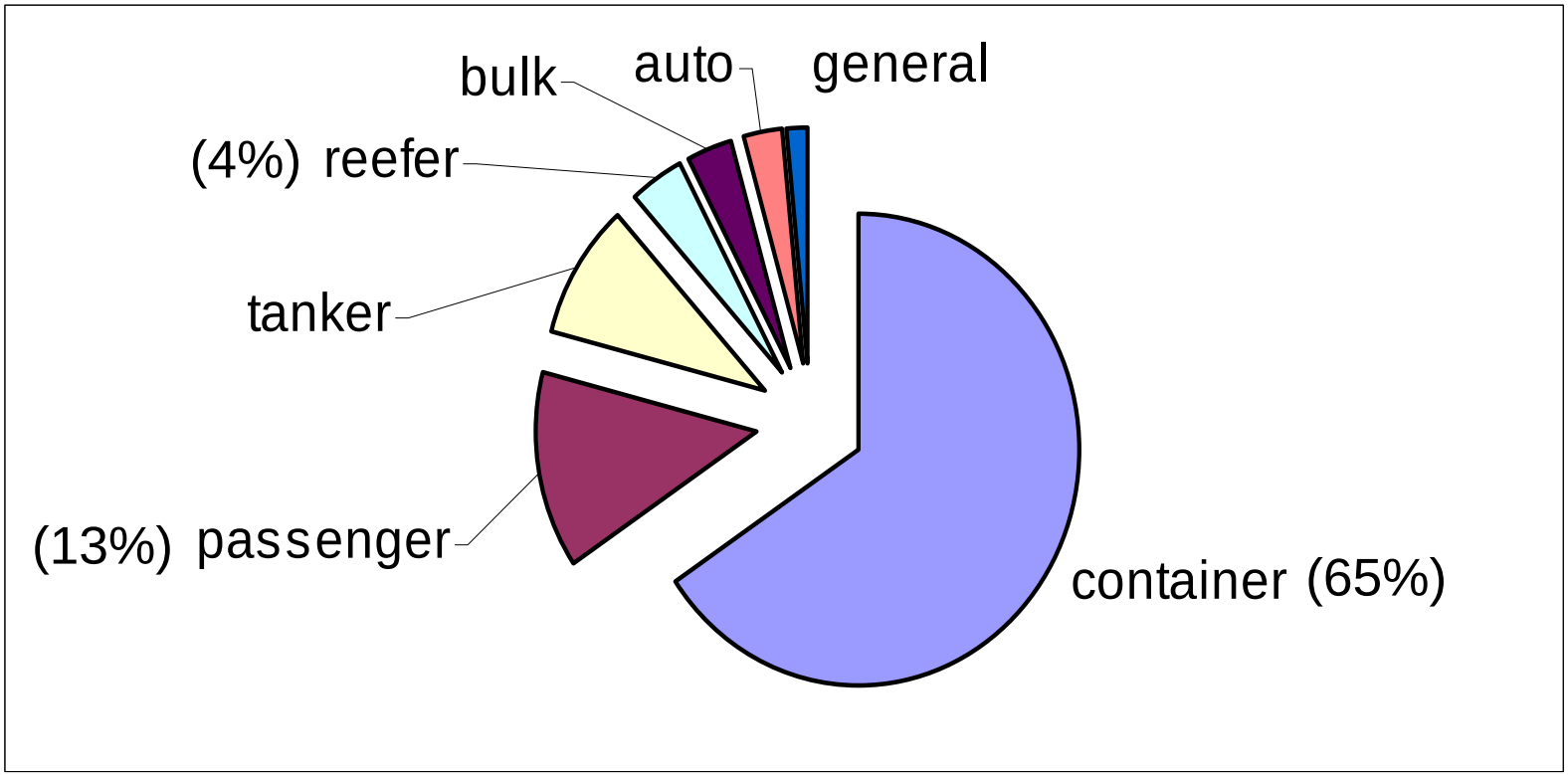
Ship Types

- Container ships
- Passenger ships
- Refrigerated cargo ships
- Tankers
- General cargo ships
- Bulk ships
- Vehicle carriers

Visits by Ship Category (2006)



Hotelling NOx Emissions by Ship Category (2006)



Shore Power Candidates

- Frequent Visitors
- Long Hotelling Times
- Significant Power Needs

Shore Power Candidates (Cont.)

- Most Cost-Effective for Container Ships, Passenger Ships, and Refrigerated Cargo Ships
- Prime Candidate Ports: Los Angeles, Long Beach, Oakland, San Diego, San Francisco, and Hueneme
- Two-Thirds Of Capital Costs & Benefits at Los Angeles/Long Beach

Container Ships

- 45 percent of total ship visits (2006)
- 65 percent of emissions
- Frequent visitors: 60% of ships make 80% of visits
- Power needs: 1 to 7 MW
- Average berthing times:
  - 50 hrs/visit (POLA/POLB)
  - 21 hrs/visit (Oakland)

Passenger Ships

- 7 percent of total ship visits (2006)
- 13 percent of emissions
- Frequent visitors: 40% of ships make 85% of visits
- Power needs: 5 to 15 MW
- Average berthing times: 10 hours/visit

Reefer Ships

- 3 percent of total ship visits (2006)
- 4 percent of emissions
- Frequent visitors: 30% of ships make 75% of visits
- Power needs: 2 to 5 MW
- Berthing times: 20-60 hours/visit

Other Vessel Categories

- Continue to evaluate other ship categories
- Proposed requirements for Board consideration within a year

REGULATION

Key Elements

- Targeted ship categories most suitable for shore power
- Provided flexibility by allowing alternative technologies that achieve emission reductions
  - Can be implemented expeditiously
  - Achieves equally effective reductions
- Design schedule to obtain reductions as soon as practicable

Grid-Based Shore Power

- Requires capital-intensive improvements to terminals and ships
- Proven technology
  - U.S. Navy
  - Passenger ships on West Coast
  - Container ships in California

Other Potentially Viable Emission Control Techniques

- Proposal allows other control technologies to achieve required emission reductions

Implementation Schedule

Date	Reduced Onboard Power Option (Grid)	Emission Reduction Option
January 1, 2010	Ships must use shore power if available	10% reduction
January 1, 2012	Ships must use shore power if available	25% reduction
January 1, 2014	**50% visits and power demand**	50% reduction
January 1, 2017	**70% visits and power demand**	70% reduction
January 1, 2020	**80% visits and power demand**	80% reduction

Who Does What

- Vessel fleets are subject to emission reduction requirements
- Terminals must accommodate the vessel fleets
  - Plan document due in 2009 indicating how requirement is satisfied
  - Follow-up reports

Regulatory Impact

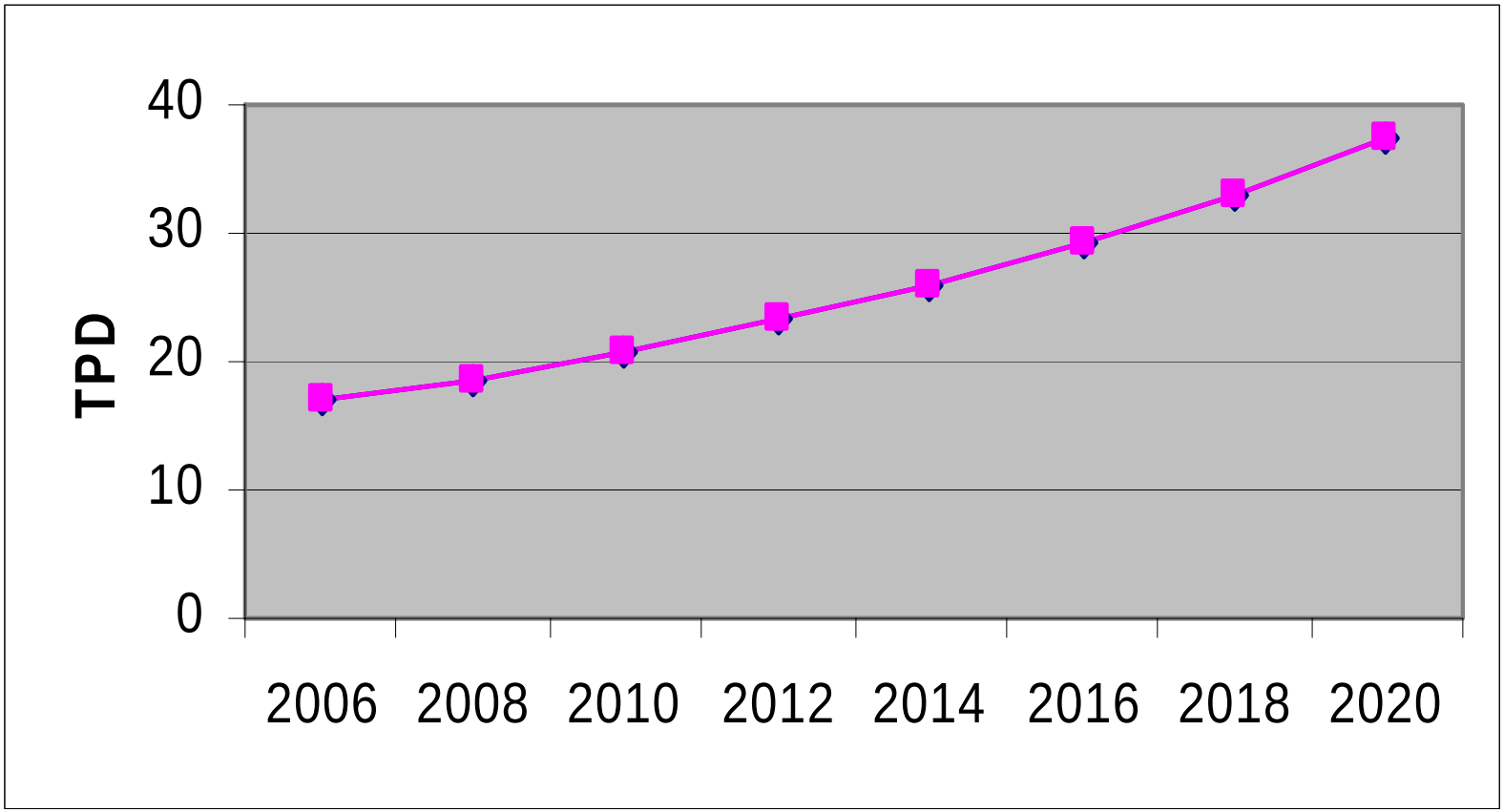
- Shoreside
  - six ports
  - 31 terminals
  - 76 berths
- Ships
  - 1450 ships

Affected Terminals

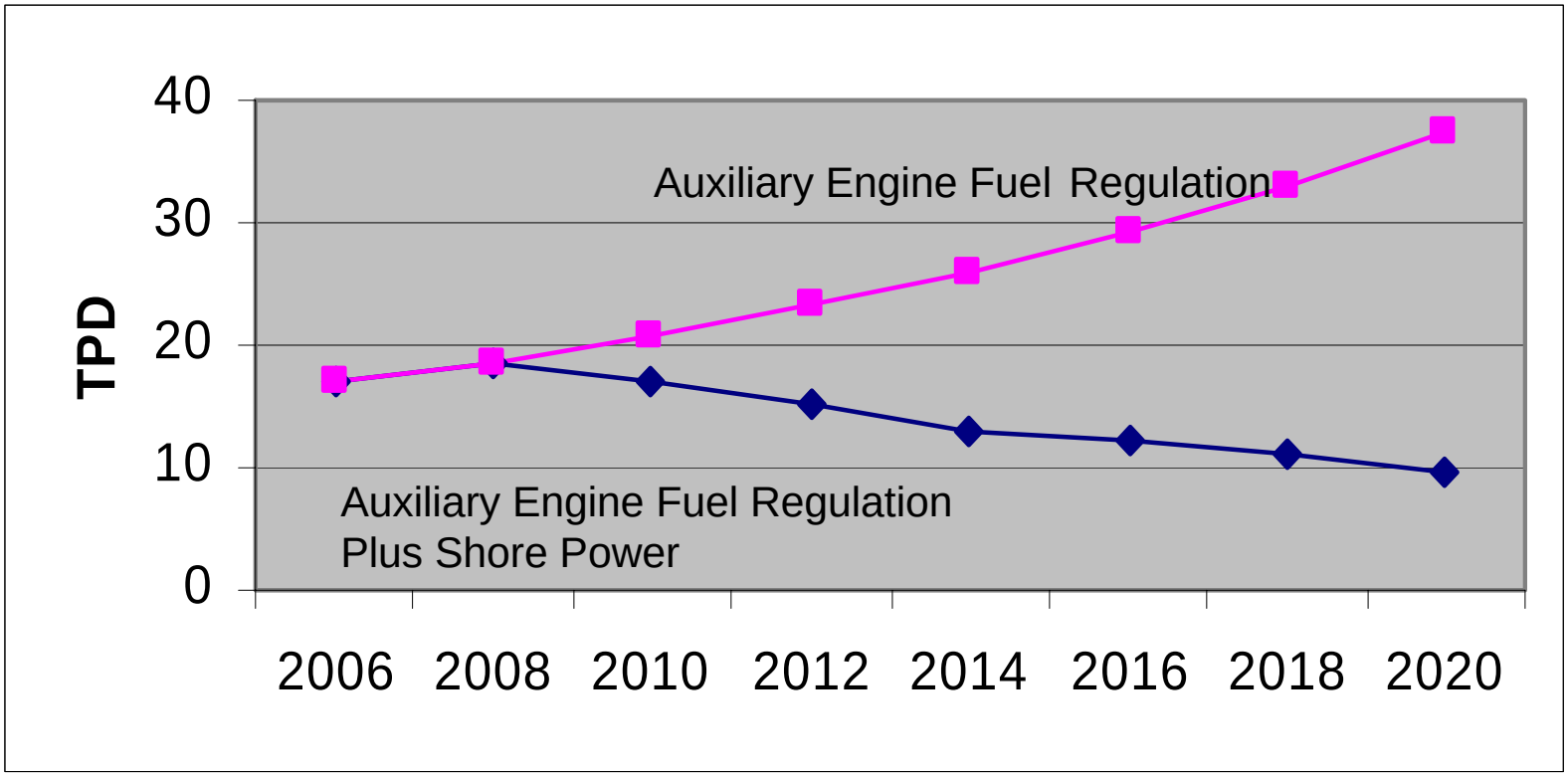
- 31 Terminals at Six Ports
  - Hueneme: 1 reefer terminal
  - Long Beach: 8 container and 1 passenger terminal
  - Los Angeles: 7 container and 1 passenger terminal
  - Oakland: 10 container terminals
  - San Diego: 1 reefer and 1 passenger terminal
  - San Francisco: 1 passenger terminal

AIR QUALITY BENEFITS

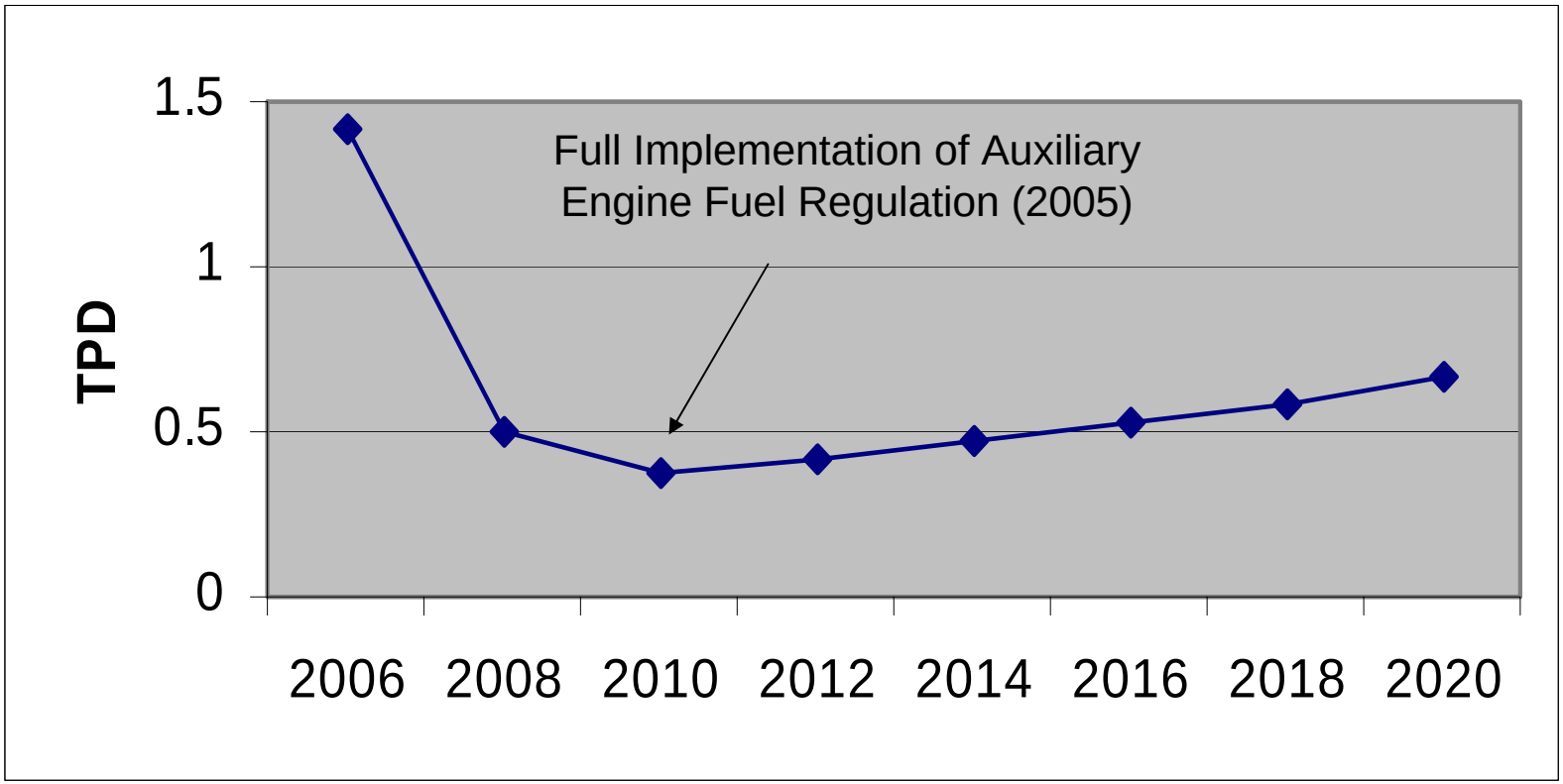
NOx Emissions



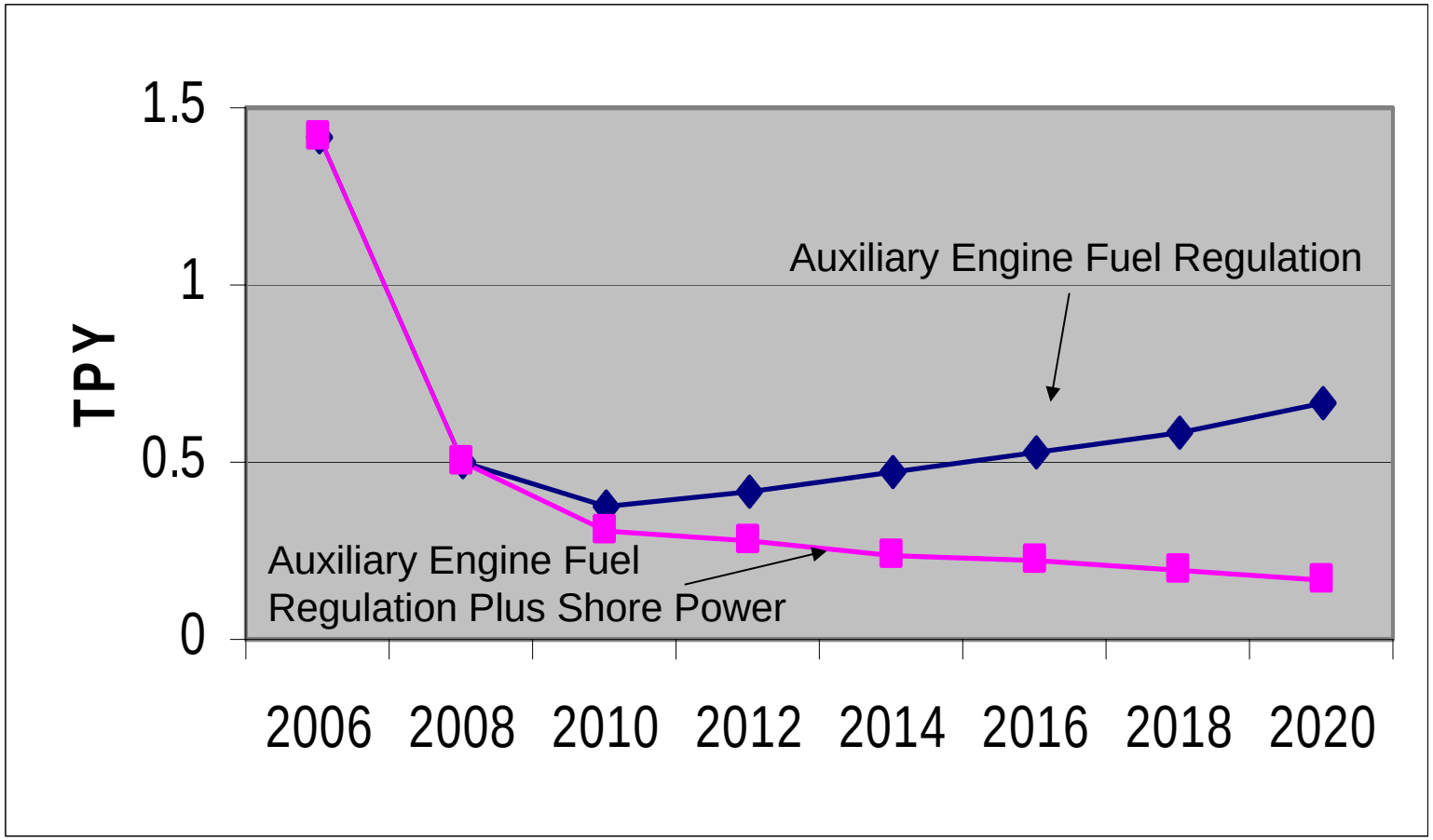
NOx Reductions



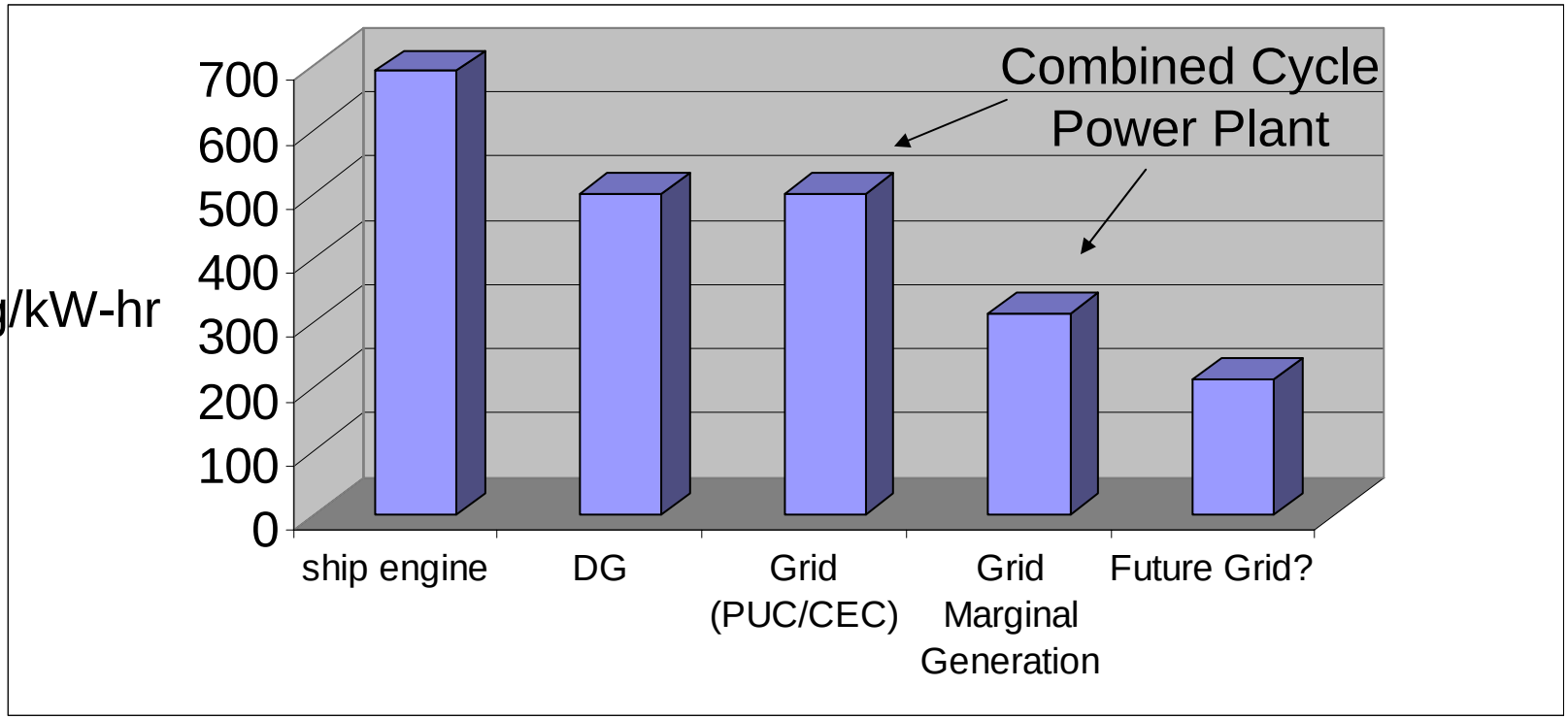
PM Emissions



PM Reductions



CO_2 Emissions for Ship Power Sources



Cumulative Health Benefits

- Health benefits (2009-2020)
  - Significant reduction in near-source cancer risk: > 25-in-a-million risk eliminated
  - Premature deaths avoided: 280
  - Respiratory impacts avoided: 8,200
  - Work loss days avoided: 49,000
  - Minor restricted activity days avoided: 280,000

ESTIMATED COSTS

Estimated Costs

- Overall costs of $1.8 billion dollars (2006 dollars)—assuming grid power is used
  - 65 percent for ship modifications
  - 20 percent for shore modifications
  - 15 percent operating costs

Potential State Funding to Incent Early Reductions

- Proposition 1B Bond Funding (Goods Movement)
  - **Staff bringing recommended guidelines to the Board this month**
  - **Funding potentially available for early grid-based shore power and clean DG**
- Carl Moyer Funding (Ships)
  - **Staff bringing proposed revisions to the Board this year**
  - **Revisions will explicitly address shore power**

Summary

- Hotelling emissions affect public health
  - cancer risks
  - noncancer risks
  - climate change
- Container ships, passenger ships, and refrigerated cargo ships are attractive candidates for shore power
- CARB regulation allows alternative technologies
- CARB requirements are cost-effective

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