



# Session 1: Mobile Source



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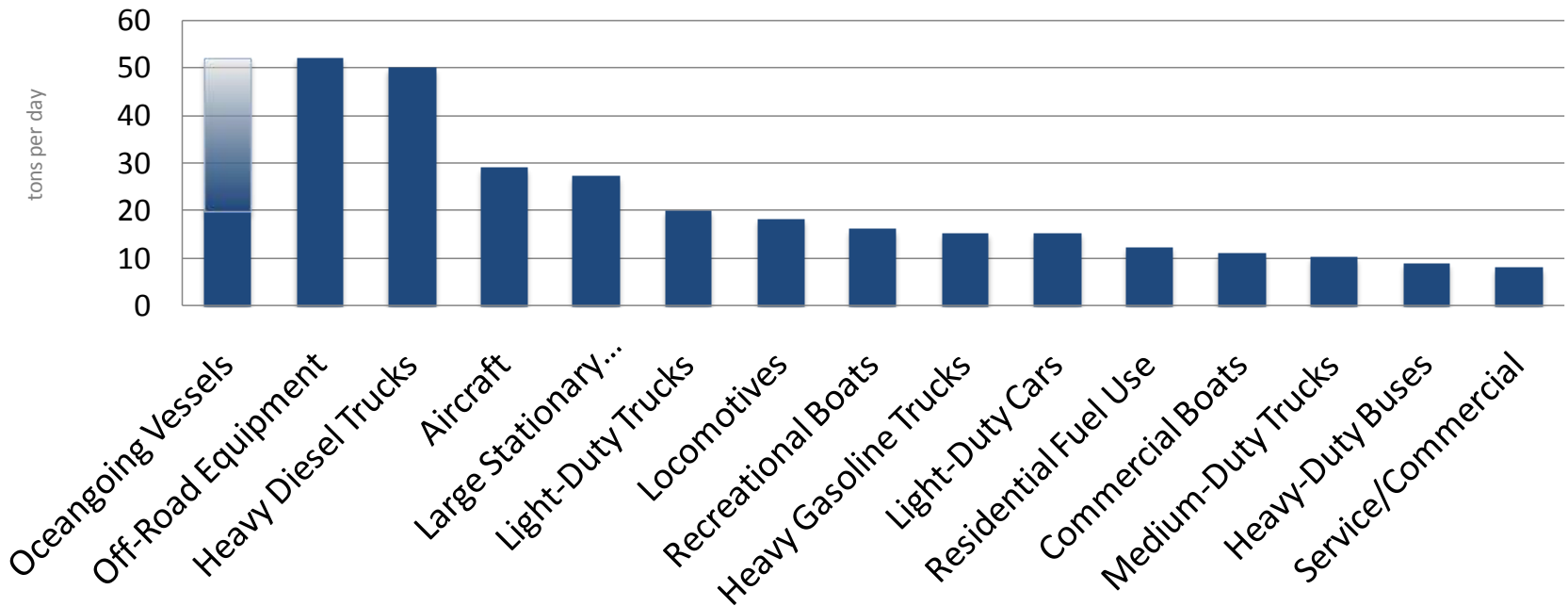
# Key Regional Air Quality Challenge: Reducing Nitrogen Oxides from Mobile Sources

- Attaining federal ozone and PM<sub>2.5</sub> standards will require substantial NO<sub>x</sub> reductions *beyond adopted rules*
- Ozone standard will likely require the greatest reductions
  - Attainment Deadlines:
    - **2023** (80 ppb standard)
    - **2032 timeframe** (75 ppb standard)



## South Coast Air Basin

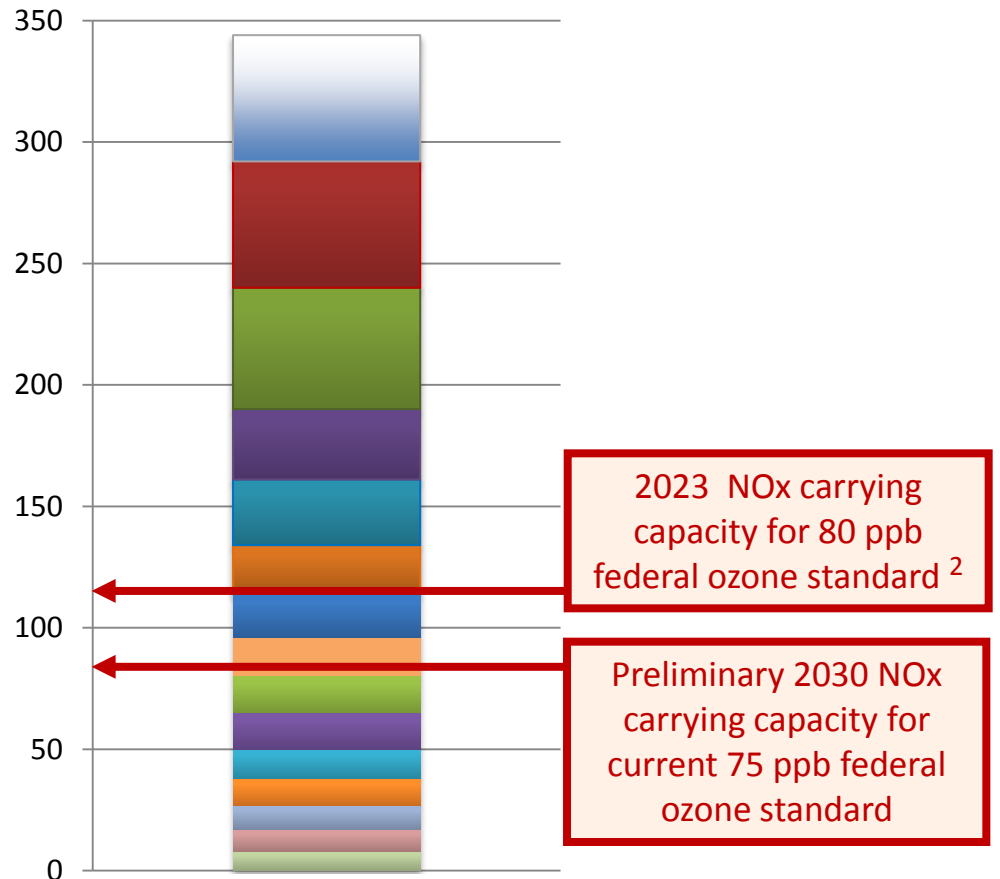
# Top 15 NO<sub>x</sub> Categories: 2023 NO<sub>x</sub> Emissions With Adopted Rules Preliminary SCAQMD Estimates\*



\* Preliminary emissions estimates based on data updated from 2007 AQMP where available: CARB 2010 emissions projections for trucks and off-road equipment; IMO Tier 1 – 3 for ocean vessels; EPA 2008 rule for locomotives; 2007 AQMP short-term measures for other categories. Range for oceangoing vessels based on varying deployment assumptions for IMO Tier 2 and 3 vessels and range of ports' cargo forecasts.

# Top 15 NOx Categories: 2023 NOx Emissions With Adopted Rules Preliminary SCAQMD Estimates<sup>1</sup>

- Oceangoing Vessels
- Off-Road Eq
- Heavy Duty Diesel Trucks
- Aircraft
- Large Stationary
- Light Duty Trucks
- Locomotives
- Recreational Boats
- Heavy Duty Gasoline Trucks
- Light Duty Cars
- Residential Fuel Combustion
- Commercial Boats
- Medium Duty Trucks
- Heavy Duty Buses
- Service/Commercial



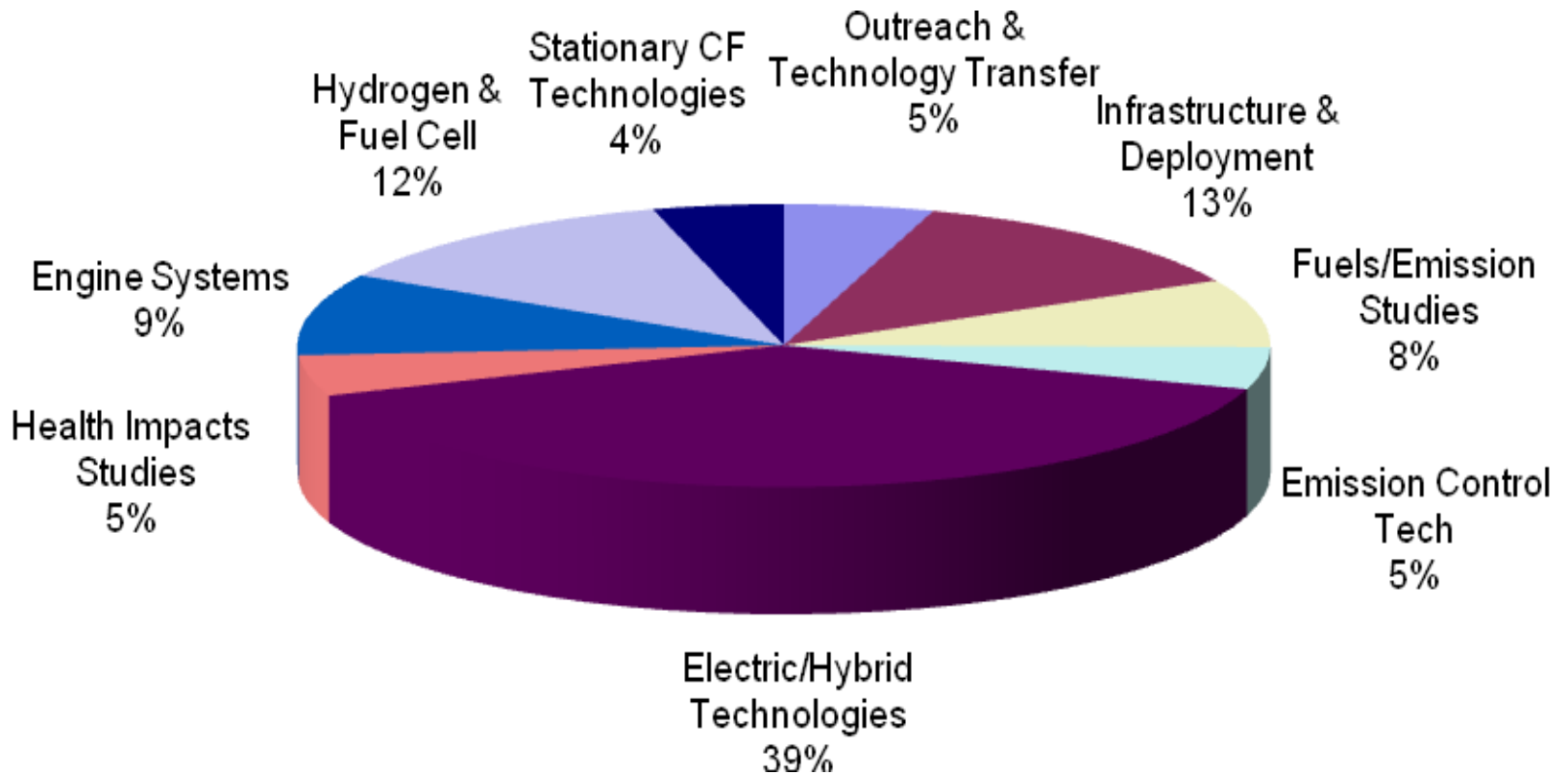
2023 NOx carrying capacity for 80 ppb federal ozone standard<sup>2</sup>

Preliminary 2030 NOx carrying capacity for current 75 ppb federal ozone standard

1. Preliminary emissions estimates based on data updated from 2007 AQMP where available: CARB 2010 emissions projections for trucks and off-road equipment; IMO Tier 1 – 3 for ocean vessels; EPA 2008 rule for locomotives; 2007 AQMP short-term measures for other categories. Range for oceangoing vessels (20 -52) based on varying deployment assumptions for IMO Tier 2 and 3 vessels and range of ports' cargo forecasts.

2. 1997 80 ppb federal ambient ozone standard. Source: 2007 AQMP.

# Plan Update



**\$16.1M Total**

# DOE Zero Emission Container Transport Program

- March 20, 2012: DOE Released Solicitation for Zero Emission Cargo Transport Demonstration Projects
- May 15, 2012: AQMD on behalf of Southern California Zero Emission Freight Movement Regional Collaborative submitted a proposal
  - CNG Hybrid Catenary Truck Project; \$7.8 million
  - 3 battery electric truck and 1 fuel cell truck projects; \$4.2 million
- August 8, 2012: DOE awarded truck projects for \$4.2 million  
Total project cost: \$8.8 million  
1-year development phase; 2-year demonstration phase
- August 17, 2012: AQMD submitted revised proposal



# DOE Funded Projects

## Balqon

- Battery Electric Truck
- Total Project Cost: \$1,950,000  
DOE Award: \$975,000
- No-of trucks: 3
- Load hauling capacity: 50,000 lbs
- Range: 150 miles/charge
- Battery: 380 kWh Lithium Iron Phosphate  
Charging Load: 40 kW; 100 kW  
Charging Time: 8-10 hrs.; 3-4 hrs



# DOE Funded Projects

## Balqon

- Development Status
  - Prototype developed
  - Initial chassis dynamometer tests conducted



# DOE Funded Projects

## TransPower

- Battery Electric Truck
- Total Project Cost: \$2,853,169  
DOE Award: \$1,192,185
- No-of trucks: 4
- Load hauling capacity: 50,000 lbs
- Range: 100-150 miles/charge
- Battery: 214/321 kWh Lithium Ion  
Charging Load: 140kW  
Charging Time: 2-3 hours  
2 On-board Inverter Charger Units, 70kW each



# DOE Funded Projects

## TransPower

- Development Status
  - Prototype developed
  - Initial drivability tests being conducted

# DOE Funded Projects

## US Hybrid

- Battery Electric Truck
  - Total Project Cost: \$1,987,621
  - DOE Award: \$993,811
  - No-of trucks: 2
  - Load hauling capacity: 40,000 lbs
  - Range: Approximately 100 miles/charge
  - Battery: 300 kWh Lithium Ion
- Charging Load: Up to 240 kW (DC Level 3)
- Charging Time: 1.5 hours
- Capable of charging with integrated on-board charger (125A, 3phase, 460V) or SAE Level II or III



# DOE Funded Projects US Hybrid

- Development Status  
Initial development stage

# DOE Funded Projects Vision

- Hydrogen Fuel Cell Truck
- Total Project Cost: \$2,016,240  
DOE Award: \$1,008,120
- No-of trucks: 4
- Load hauling capacity: 50,000 lbs
- Range: Approximately 200 miles/fill
- Hydrogen Capacity: 20kg  
Pressure: 6250 psi  
PEM Fuel Cell
- Battery: 135 kWh Lithium Ion



# DOE Funded Projects Vision

- Development Status  
Prototype developed  
Initial drivability tests being conducted in drayage applications

# Current Project Status

- NREL and DOE Data Collection and Analysis
  - vehicle efficiency
  - cargo ton-miles per vehicle and fleet
  - hydrogen consumption (if any)
  - charging profiles: times, duration, and electricity used
  - operational profiles: times of operation, type of operation, loading (payload), and accessory loading
  - time stamps
  - capital costs and operating costs
  - maintenance logs and maintenance costs
  - fuel cell specific information (if applicable)
  - battery specific data including state of charge, voltage, current, and temperature

# Project Applicability

- Zero Emission Cargo Transportation
- Vehicles configured for wayside power operation
  - Catenary power
  - Ground slot/third-rail power
- Other Applications/Technology Transfer
  - Airport ground support equipment
  - Port cargo handling equipment