Sector-Based Workshop

Transportation: Vehicles and Fuels

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Overview of Transportation Sector

- Transportation consists of:
  - Vehicles and Engines
  - Fuel
  - Usage (Vehicle Miles Traveled)

Overview: Vehicles/Engines, Fuel

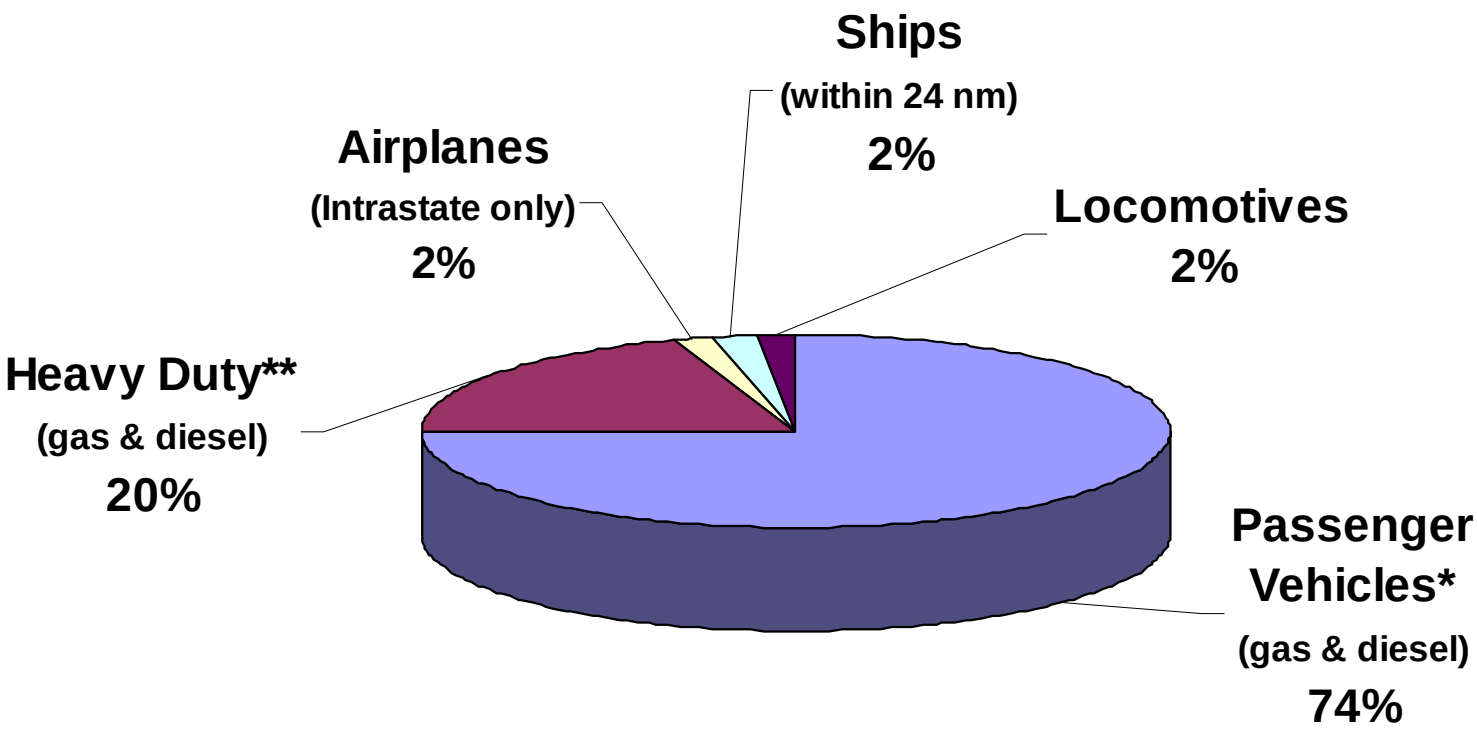
- On-Road and Off-Road Vehicles
- Ports and Intermodal Facilities
- Transportation Fuels

Overall Transportation Sector Emissions ($MMTCO_2E$)

Emissions include: Heavy-Duty Trucks, Passenger Vehicles, Locomotives, Ships, and Airplanes

1990 Baseline Emissions:	150
2004 Baseline Emissions:	182
2020 Preliminary Forecasted Emissions:	229

Transportation Emissions 2004 (182 MMTCO$_2$E)



*Passenger = light duty fleet (passenger cars, motorcycles, light duty trucks & medium duty vehicles with loaded weights of 8500 lbs or less)

**Heavy duty = heavy duty fleet (light-heavy through heavy-heavy duty trucks, as well as all buses and motorhomes)

Transportation Vehicle/Engines Profile

- Vehicles/Engines—subsector of Transportation Sector
- Role in California economy
  - Enabling people to get to jobs
  - Moving goods around California and country
  - Building houses and roads
  - Growing food
  - Key to quality of life for California
- Competitive Position/Costs
  - ARB has adopted cost effective vehicle/engine rules for criteria pollutants over decades
  - ARB the first to regulate GHG through AB 1493 resulting in cost effective control of GHG and criteria pollutants
- Leakage potential – very small
  - Vehicles/engines sold in the state have steadily increased

On-Road Vehicle/Engine Profile (2004)

- Light Duty Vehicles — 23.3 million
  - *VMT* — *279 billion miles*
  - *GHG emissions* — *135.8 $MMTCO_2E$*

**Light Duty = passenger cars, motorcycles, light duty trucks & medium duty vehicles with loaded weights of 8500 lbs or less*

- Heavy Duty Vehicles — 1.3 million
  - *VMT* — *26.4 billion miles*
  - *GHG emissions* — *35.7 $MMTCO_2E$*

**Heavy duty = light-heavy through heavy-heavy duty trucks, as well as, all buses and motorhomes*

Vehicle/Engines Profile (con't.)

- Vehicles densely located in key urban areas
  - 40% South Coast Air Quality Management District
  - 20% Bay Area Air Quality Management District
  - 10% San Joaquin Valley Air Pollution Control District

- Off-road engines/equipment
  - *17.7 million units*[1]
  - *GHG emissions*[2] *54,990 tons/day* CO_2

[1]Does not include gas cans, cargo handling equipment, commercial harbor craft, agricultural engines, ocean going vessels, locomotives, or aircraft

[2]CO_2 emissions only, total CO_2E GHG emissions from these category is undergoing development

Existing Controls with GHG Benefits

- AB 1493 (Adopted 2005)
  - Applicable to light duty vehicles beginning MY 2009 (2020: 32 $MMTCO_2E$)
- Heavy Duty Vehicles
  - Idling restrictions (2020: 1.2 $MMTCO_2E$)
    - No commercial truck idling (Implementation date 2005)
    - New engine shutdown requirements (2008)
    - In-use sleeper cab idling requirements (2008)
  - In-use fleet rules requiring early turnover of less efficient/higher polluting engines (varies)**

**GHG benefits from fleet rules are still undergoing evaluation

Discrete Early Actions

- SmartWay Truck Efficiency
  - Scheduled for adoption in Oct 2008
  - Estimated Reductions for All Trucks Nationwide
    - 2010: 6 $MMTCO_2E$
      - 7% of these emission reductions would occur in California
    - 2020: 20 $MMTCO_2E$
      - 11% of these emission reductions would occur in California
- Tire Inflation Program
  - Scheduled for adoption in first quarter 2009
  - Estimated Reductions
    - 2010: 0.54 $MMTCO_2E$
    - 2020: 0.20 $MMTCO_2E$

Potential Emission Reduction Measures

- Regulations
  - Light Duty Vehicles
    - Standards for Off-Cycle Driving (2008)
    - Cool Paints (2009)
    - Strengthen Light-Duty Vehicle Standards (2012)
      - Accelerate introduction of hybrids in the fleet
      - Update AB1493 to require advanced highly efficient hybrids
    - Low friction engine oil **
  - Heavy Duty Vehicles
    - Speed reduction requirement **
    - Enhanced idling requirements **

**Scoping Plan Public Solicitations or staff concepts still undergoing review

Potential Emission Reduction Measures (continued)

- Enforcement
  - Heavy Duty Vehicle Anti-Idling Enforcement (2008)
- Incentives – Emission Credits/Grant Funding
  - Private Fleet Rule: Hybrid Vehicle Early Adoption Incentives (2008)
  - Hybridization of Medium/Heavy Duty Vehicles (2011)
  - Truck Stop Electrification (TBD)

Other Potential Emission Reduction Measures Identified by CAT

- Energy Efficient Tires (AB844) - CEC/IWMB

State Fleet

- Climate Action Strategies for the State-owned fleet
  - Lowest life cycle costing procurement methodology
  - Ultra Low Emission Vehicle (ULEV) minimum engine standard
  - Alternative fuel and hybrid vehicles given highest priority
  - Commitment to purchasing at least 50 percent of the light-duty non-public safety vehicles as flex-fuel vehicles by 2010
  - Developing a centralized fleet asset management system to manage vehicles more effectively and reduce emissions

Future GHG Reduction Concepts

- Require even more stringent GHG fleet averages
  - Plug-in hybrids, fuel cell and battery electric vehicles are the majority of the fleet
  - Triple the efficiency of all on-road vehicles
    - Conventional gas, diesel and flex-fuel vehicles with at least double the mpg of new vehicles today
    - Hybrid gas, diesel and flex-fuel vehicles with at least 60 mpg
    - All electric and plug-in hybrids with over 100 mpg (gasoline equivalent)
    - Hydrogen Fuel Cell Vehicles with over 80 mpg (gasoline equivalent)
- Implement aggressive program to turnover vehicle/engine fleet
- Require a percentage of each vehicle to be made of recycleable materials and a program to recycle these parts
- Create necessary fuel production/infrastructure to produce low GHG lifecycle biofuels, electricity and hydrogen

Source: State's Alternative Fuels Plan, Oct. 2007, page 61-64

Future GHG Reduction Concepts for Off-Road

- Require more efficient engines for all classes engines/vehicles
  - Examples: use of electronic fuel injection on small off-road engines and fuel cells on locomotives
- Require more electrification for off-road equipment
- Require use of lower GHG alternative fuels (e.g. Natural gas, biofuels, etc.)

Potential Policy Tools

- VOLUNTARY MEASURES
  - Real-time vehicle information (i.e., average fuel economy) to encourage driver modification
  - Encourage use of mass transit
  - Educational programs targeting efficient driving
- FEES
  - Link license fees to vehicle/engine GHG emissions
- INCENTIVES
  - Provide incentives for purchasing a vehicle/engine with overall low GHG lifecycle emissions
- MARKETS
  - Direct inclusion of vehicles in carbon market infeasible, but addressing vehicle use by inclusion of transportation fuels in a larger carbon market will be evaluated

Ports and Intermodal Facilities

Overview

- Ports and Intermodal Facilities
  - Sub-sector of transportation
  - Ports and intermodal rail yards involved with goods movement
  - Equipment/vehicles: ocean-going vessels, locomotives, cargo handling equipment, drayage trucks, commercial harbor craft, truck refrigeration units
  - Potential measures include options similar to other transportation sources and approaches tailored to goods movement operations

Ports/Intermodal Facility Profile (con't)

- Ocean-going vessels
  - 10,000 ship visits/year to California
  - world-wide fleet @ 90,000 vessels
- Locomotives
  - 15,000 interstate
  - 800 intrastate
- 4,300 cargo handling equipment
- 4,000 commercial harbor craft
- 40,000 truck refrigeration units
- 100,000 drayage trucks statewide

Early Actions

- Discrete Early Action
  - ARB Shore Side Power ("Cold Ironing") Rule (adopted Dec 2007)
    - reductions in both criteria pollutants and GHG's
    - estimate CO_2 reduction of 120-240k metric tons in 2020
- Early Actions
  - Vessel Speed Reduction for Ocean-Going Vessels
    - could include voluntary, incentive-based, or regulatory measures
    - may include additional ports and distances of 24, 40, or 100 nm
  - Anti-idling requirements for cargo handling equipment
  - Transport Refrigeration Units, Electric Standby
    - estimated reductions of 0.04 $MMTCO_2E$ per year
  - In-Use Port Drayage Truck Controls
    - phase-out of pre-1994 trucks by 2009 and achieve CO_2 reductions of ~55,000-89,000 tons/year

Existing Emission Reduction Strategies

- New Engine Standards (US EPA, ARB, IMO)
- California MOUs (1998, 2005) (Locomotives)
- Voluntary efforts to reduce GHG emissions

Emission Reduction Approaches

- **Regulation**
  - Equipment/vehicle level—*i.e.* require hybrid systems for port cranes
  - Facility (port or intermodal rail yard) level—i*.e.* declining GHG cap over all facility operations/efficiency requirement
- **Incentives/Indirect Controls**
  - Incentives for electrification
  - Carbon label/index on retail goods
  - Incentives/programs to encourage goods movement efficiency
  - Modal shifts to less carbon intensive transportation modes
- **Other**
  - MOU
  - Lease/tariff requirements

Potential Emission Reduction Measures: System-wide

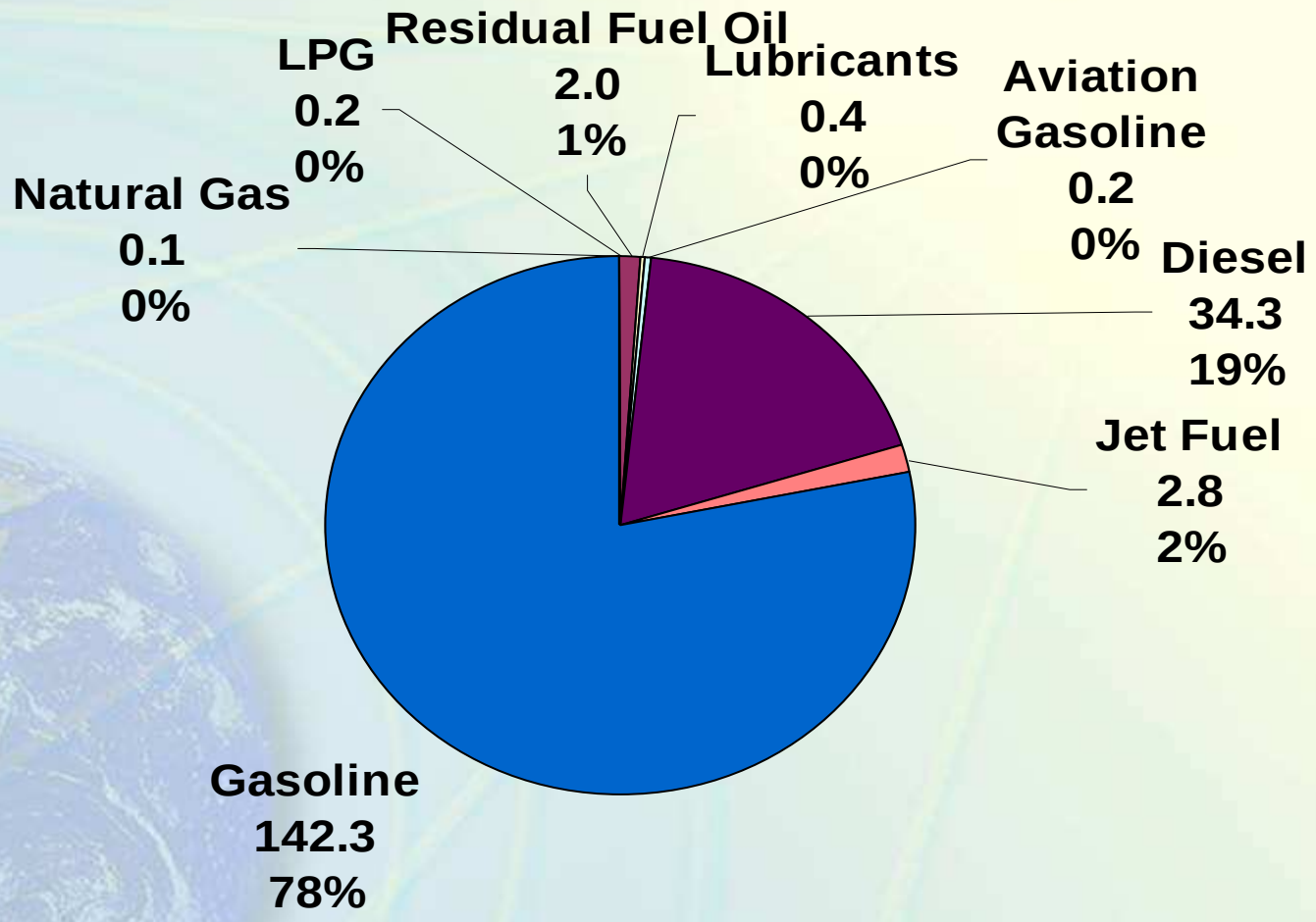
- System-wide measures may maximize GHG reductions from goods movement at lower costs
- Cooperative effort needed to identify possible approaches and implementation mechanisms
- Shared responsibility for emission reduction targets

Potential Emission Reduction Measures: System-wide

- Potential system-wide strategies include:
  - increased operational efficiencies
  - transport mode shifts to less carbon intensive transport modes
  - system-wide caps i.e. port or rail yard GHG emission reduction targets
  - influence change via product labeling i.e. carbon index for goods

Transportation Fuels

2004 Transportation Fuel Emissions ($MMTCO_2E$)



Existing Fuel Programs

- Reformulated Gasoline
  - Reduces emissions of criteria pollutants CO, HC, NOx and air toxics
- Ultra Low Sulfur Diesel
  - Reduces emissions of SOx, HC, PM, NOx, and toxics
- Standards for several alternate fuels
- Policies for diversification of transportation fuels
  - AB 2076 report
  - AB 1007 report

Low Carbon Fuel Standard (LCFS) Objectives

- Achieve 10 percent reduction in carbon intensity by 2020
- Estimated reduction of 15-20 MMTCO_2E by 2020
- Reduce dependency on petroleum-based fuels
- Diversify CA's options for transportation fuels

Low Carbon Fuel Standard

- **Life-cycle-based**
  - Fuel providers to decrease GHG emissions on a life-cycle basis (the carbon-intensity) of average fuel sold
- **Intensity**
  - Governs intensity, not amount sold
- **Performance-based**
  - Sets carbon reduction standards and methods to calculate compliance
- **Market elements**
  - Allows averaging, banking and trading to lower cost and provide flexibility
- **Fuel neutral**
  - Fuel providers can choose which fuels and volumes to sell

Potentially Lower or Very Low Carbon Fuels

- Lower carbon ethanol (more efficient production process) or very low carbon ethanol (“cellulosic”)
- Increase use of ethanol at 10% or at 85% for flex fuel vehicles
- Electricity and Hydrogen
- CNG, LNG, LPG
- Biogas, Biodiesel, Renewable Diesel, Biobutanol

Benefits of LCFS

- **Less dependence on petroleum**

  Displace 20% of petroleum use in California

- **Larger renewable fuels market**

  Expand California's alternative fuels markets by 3 to 5 times, while reducing emissions

- **More alternative fuel and hybrid vehicles**

  Several million advanced technology vehicles, more than 10 times the current level

Current Status

- Low Carbon Fuel Standard approved as an AB 32 Discrete Early Action
- ARB initiated workshops and meetings to enable stakeholders to participate from the beginning
- Program design options now being investigated. Draft concepts expected in February 2008
- Anticipated adoption late 2008

LCFS Timeline

June 2007	LCFS approved as an AB32 early action measure
Mid 2007	UC completes technical and policy analytical reports
Late 2007-2008	ARB conducts LCFS workshops
Early 2008	Initiate draft regulatory language
Fall 2008	Regulatory package completed
End of 2008	LCFS regulation submitted to the Board for consideration
2009	Regulation submitted to Office of Administrative Law
2010-2020	Implementation

Summary

- Transportation Sector has opportunity for significant GHG reductions
  - Direct regulation
  - Incentives
  - Voluntary Measures
- Reductions from this sector are essential to meeting the GHG emission reduction targets
- Consideration of a GHG cap and trade system will evaluate possible inclusion of transportation fuels

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