Sector-Based Workshop

Transportation: Vehicles and Fuels

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December 14, 2007
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$_2$E)

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 Vehicles**
  - (gas & diesel)
  - 74%
- **Heavy Duty**
  - (gas & diesel)
  - 20%
- **Airplanes**
  - (Intrastate only)
  - 2%
- **Locomotives**
  - 2%
- **Ships**
  - (within 24 nm)
  - 2%

*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

• Light Duty Vehicles 23.3 million
  – VMT 279 billion miles
  – GHG emissions 135.8 MMTCO₂E

*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 MMTCO₂E

*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\(_2\)E 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 MMTCO₂E)

- **Heavy Duty Vehicles**
  - Idling restrictions (2020: 1.2 MMTCO₂E)
    - 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\(_2\)E
    - 7% of these emission reductions would occur in California
  - 2020: 20 MMTCO\(_2\)E
    - 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\(_2\)E
  - 2020: 0.20 MMTCO\(_2\)E
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
  – Hybridization of Medium/Heavy Duty Vehicles (2011)
  – Truck Stop Electrification (TBD)
• Energy Efficient Tires (AB844) - CEC/IWMB
• 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$_2$E 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 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 (MMTCO₂E)

- Gasoline: 142.3 (78%)
- Jet Fuel: 2.8 (2%)
- Residual Fuel Oil: 2.0 (1%)
- Aviation Gasoline: 0.2 (0%)
- Lubricants: 0.4 (0%)
- LPG: 0.2 (0%)
- Natural Gas: 0.1 (0%)

Diesel: 34.3 (19%)
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$_2$E 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
<table>
<thead>
<tr>
<th>June 2007</th>
<th>LCFS approved as an AB32 early action measure</th>
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<tbody>
<tr>
<td>Mid 2007</td>
<td>UC completes technical and policy analytical reports</td>
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<tr>
<td>Late 2007-2008</td>
<td>ARB conducts LCFS workshops</td>
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<tr>
<td>Early 2008</td>
<td>Initiate draft regulatory language</td>
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<td>Fall 2008</td>
<td>Regulatory package completed</td>
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<td>End of 2008</td>
<td>LCFS regulation submitted to the Board for consideration</td>
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<td>2009</td>
<td>Regulation submitted to Office of Administrative Law</td>
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<td>2010-2020</td>
<td>Implementation</td>
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• 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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