Low Carbon Transportation Investments and Air Quality Improvement Program

Public Workshop on the Heavy-Duty Three-Year Plan

Sacramento, California
February 10, 2017

Heavy-Duty Three-Year Plan

• “Roadmap” for longer-term heavy-duty investments
• Identify areas to prioritize LCT/AQIP funding
• Develop a strategy for investment
• Develop metrics to measure success of investments
• Help guide our efforts in coordinating with other funding programs
Process for Developing Plan

• Overall framework
  • Guiding principles and goals for the plan
• Preliminary concept
• Process for development and stakeholder interaction
  • Identify key partners for development of the plan
  • Provide opportunities for stakeholder feedback

Vision – Where We Need to Go

• Reduce GHG emissions
  • Reduce to 1990 levels by 2020
  • Reduce 40 percent below 1990 levels by 2030
  • Reduce transportation GHGs by 80 percent below 1990 levels by 2050
• Support Governor’s Pillars
• Meet federal ozone and PM standards by 2023 and 2031
Goals/Outcomes for Investments

- Ensure clean air for all Californians
- Help meet the State’s long-term climate change and clean air goals
- Create green jobs
- Achieve and maintain healthy and sustainable communities

Guiding Principles to Achieve Goals

- Prioritize LCT/AQIP funding so that it spurs and leverages increased private investment
- Accelerate heavy-duty vehicle and equipment technology advancement in targeted areas
- Move technologies through early commercialization process and meet emerging market demand
- Invest in a combination of transformation strategies for on-road and off-road heavy-duty vehicles, equipment, and fueling infrastructure
**Strategies**

- California’s Framework for M/HD Transformation
  - Employ zero-emission vehicles and equipment everywhere feasible, and
  - Near zero-emissions with renewable fuels everywhere else
- Focus on Key Pathways to Achieve Transformation
  - Greater or full electrification
  - Low Nox engines with low carbon fuels
  - Greater efficiencies (both engine and operational)
- Identify funding opportunities for projects at all stages of commercialization arc

**Pathways**

- Key Pathway Technologies
  - Electrification
    - Battery Electric Vehicles and equipment (BEV)
    - Fuel Cell Electric Vehicles and equipment (FCEV)
    - Hybrid vehicles and equipment
  - Low NOx engines
  - Efficiencies
    - Engine Efficiencies
    - Operating Efficiencies
Main Components of Plan

- Plan to prioritize LCT & AQIP investments
  - Move needed technologies through commercialization stages
  - Make use of “beach heads” (first launch markets)
- Case Studies
- Identify investment priorities for the next 3 years
- Metrics for measuring the success of these investments

Commercialization Arc: Stages, Needs, and Programs

<table>
<thead>
<tr>
<th>TRL</th>
<th>Studies &amp; Standards</th>
<th>Technology Development</th>
<th>Tech Demo, Demos</th>
<th>Larger Pilots, Pre-Commercial Demos</th>
<th>Deployment Incentives</th>
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<tbody>
<tr>
<td>1-4*</td>
<td>EPIC (CEC)</td>
<td>ARFVTP (CEC)</td>
<td>CCI HD Demos (ARB)</td>
<td>CCI HD Demos &amp; pilots (ARB)</td>
<td>HVIP (ARB)</td>
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<td>Air Districts</td>
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<td>ARFVTP (CEC)</td>
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<td>Prop 1B</td>
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*TRL: Technology Readiness Level

CONCEPTUAL DISCUSSION ONLY - DRAFT
Status of Technologies

- For each technology category, a discussion of:
  - Technology – general overview, the spectrum of applications across technology readiness levels, etc.
  - Current policies in place to spur technology advancement – local, state, and federal levels
  - Economic/market assessment
  - Specific applications in the on-road and off-road sectors

Strategic Investments – the “Beachhead” Concept

- Identify and leverage key early markets where technology can be successful; use as launching point to then support additional applications
- Success comes from growth of core supply chain, transferring similar powertrain and components
- Beachheads help establish first success cases
  - As technologies mature, they can expand in application and get more affordable
- Each succeeding market builds greater volume
  - Example: transit buses ➔ Refuse trucks ➔ drayage and regional haul
**Example: Beachhead Market Leads to Additional Applications and Larger Markets**

- **BEACHHEAD**
  - First Application Market
  - Similar drivetrain and component sizing can scale to early applications

- **Secondary Market**
  - Application 2

- Steadily build volumes and infrastructure, business case, performance confidence

- **Secondary Market**
  - Application 3

- **Tertiary Market(s)**
  - Application 4(+)
  - Expanded supply chain capabilities, price reductions enable additional applications

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**Case Studies**

- Highlight early success stories
- Show cases where technology advancement is taking place
- Demonstrate measurable achievements
Potential Metrics for Demonstrating Benefits of Investments

- Potential to reduce emissions once fully commercialized
- Disadvantaged community benefits
- Ability to advance technology along commercialization arc
- Technology transferability
- Job, education, and training opportunities

Heavy-Duty Three-Year Plan Development Schedule

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Date</th>
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<tr>
<td>Work group meetings*</td>
<td>Feb – March 2017</td>
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<tr>
<td>Final Workshop</td>
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<tr>
<td>• Discussion document with draft project allocations, project details, and draft heavy-duty three-year plan</td>
<td>April 6, 2017</td>
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<td>Release proposed Funding Plan</td>
<td>May 19, 2017</td>
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<td>Board consideration of proposed Funding Plan</td>
<td>June 22, 2017</td>
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<td>Start implementing 2017-18 projects</td>
<td>July 2017</td>
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*Handout lists preliminary work group meeting schedule

Additional information available at:
http://www.arb.ca.gov/aqip/
http://www.arb.ca.gov/msprog/aqip/meetings/meetings.htm
Comments and Discussion

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Additional Comments or Questions

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