Best Practices in Reducing Transportation Emissions: Adoption of Vehicle and Fuel Standards in Latin America

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Session: Clean Vehicles and Clean Air in Cities
Quito, October 18th 2016
Why is it important to reduce emissions from the transportation sector?
Transport is a growing sector and important source of emissions detrimental to climate and public health.
Trucks and buses represent 90% of particulates, NO\textsubscript{x} and fine particulates (PM\textsubscript{2.5})

These pollutants are linked to chronic illness – heart disease and stroke (80% of health burden) as well as lung cancer and chronic pulmonary diseases.

Black carbon (e.g. soot from diesel engines) is the second most important contributor to man made climate change.

3.7M deaths annually are attributed to air pollution with local pollutants from HDV particularly to blame.
Mitigating transport emissions has important productivity and equity implications in urban settings

- In Latin America, transportation accounts for 20% of all CO$_2$ emissions and is the main source of GHG emissions in most countries.
- Equity implications in the improvement of public transportation towards zero emission vehicles given exposure in urban settings.
- Adoption of new technologies can lead to economy wide productivity gains – particularly for ZEVs in conjunction with smart city applications.
How do we reduce emissions from the transportation sector?
Emission reduction strategies must be systemic – focusing on fuel and vehicle improvements.

50 ppm sulfur is necessary for diesel filters to function ....

10-15ppm sulfur is necessary for them to work well.
There has been a global convergence towards higher quality fuels - led by major markets.
Cleaner fuels are a prerequisite to technologies that can virtually eliminate tail-pipe emissions.
Major vehicle markets have seen a progression in stringency on vehicle emission standards

- Euro VI equivalent standards will be applicable nationwide in China by 2019 and India by 2020
- In 2015, 47% of new LDV sales globally met Euro VI and 83% were subject to fuel economy standards

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<table>
<thead>
<tr>
<th>EUROPE</th>
<th>Euro 1</th>
<th>Euro 2</th>
<th>Euro 3</th>
<th>Euro 4</th>
<th>Euro 5a</th>
<th>Euro 5b</th>
<th>Euro 6b</th>
<th>Euro 6d-TEMP</th>
<th>Euro 6d</th>
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<td>Jan 98</td>
<td>Jan 01</td>
<td>Jan 05</td>
<td>Sep 09</td>
<td>Sep 11</td>
<td>Sep 14</td>
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Revised ECE + EUDC cycle

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<td>1987</td>
<td>CARB</td>
<td>Tier 0</td>
<td>Tier I</td>
<td>LEV I TLEV LEV ULEV ZEV</td>
<td>2004 LEV II LEV ULEV SULEV PZEV</td>
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<td>2017</td>
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Standards have spurred technology improvements, reduced emissions and improved fuel economy

Passenger car CO₂ emissions and fuel consumption, normalized to NEDC
The incremental costs of meeting new vehicle emission standards are marginal for LDVs & HDVs

- **Per vehicle incremental cost for LDVs**

<table>
<thead>
<tr>
<th>ENGINE TYPE</th>
<th>VEHICLE CLASS</th>
<th>EURO 1 (BASELINE)</th>
<th>EURO 1 TO EURO 2</th>
<th>EURO 2 TO EURO 3</th>
<th>EURO 3 TO EURO 4</th>
<th>EURO 4 TO EURO 5</th>
<th>EURO 5 TO EURO 6</th>
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<tr>
<td>Gasoline</td>
<td>4 cylinders Vd= 1.5 L</td>
<td>$142</td>
<td>$63</td>
<td>$122</td>
<td>$25</td>
<td>$10</td>
<td>--</td>
<td>$362</td>
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<tr>
<td>Gasoline</td>
<td>4 cylinders Vd = 2.5 L</td>
<td>$232</td>
<td>$3</td>
<td>$137</td>
<td>$15</td>
<td>$30</td>
<td>--</td>
<td>$417</td>
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<tr>
<td>Diesel</td>
<td>4 cylinders Vd = 1.5 L</td>
<td>$56</td>
<td>$84</td>
<td>$337</td>
<td>$145</td>
<td>$306</td>
<td>$471</td>
<td>$1,399</td>
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<tr>
<td>Diesel</td>
<td>4 cylinders Vd = 2.5 L</td>
<td>$56</td>
<td>$89</td>
<td>$419</td>
<td>$164</td>
<td>$508</td>
<td>$626</td>
<td>$1,862</td>
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- **Per vehicle incremental cost for 12L diesel HDV**

<table>
<thead>
<tr>
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<th>Euro III</th>
<th>Euro IV</th>
<th>Euro V</th>
<th>Euro VI</th>
<th>TOTAL</th>
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<tr>
<td>European standards</td>
<td>$426</td>
<td>$3,771</td>
<td>$460</td>
<td>$2,280</td>
<td>$6,937</td>
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<td>U.S. standards</td>
<td>$50</td>
<td>$1,421</td>
<td>$1,650</td>
<td>$3,816</td>
<td>$6,937</td>
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- For a US truck with a retail price of $157k, cumulative incremental costs represent ~ 4% of price
Incremental cost for ULS diesel is also small (USA 2007/8; 500ppm to 15ppm ~$3.5 per gallon)
The current state of emission standards and fuel quality in Latin America and the Caribbean
In Latin America and the Caribbean, the experience with low sulfur fuels is mixed
This has delayed progress in adopting more stringent vehicle emission standards.
Low sulfur fuels are increasingly available in select locations across the region and growing.
Lessons for Latin America in the pursuit of clean air, fuels and vehicles
Vehicle and fuel standards can virtually eliminate emissions while driving technology improvements

- Low sulfur fuels are necessary for successful emission controls in conventional vehicles.
- LAC countries should adopt a low sulfur fuels strategy as the foundation of a comprehensive emissions control program.
- Global adoption of Euro 6/VI fuels and vehicles can eliminate 75 percent of future deaths caused by vehicle emissions.
- Globally, the NPV of health gains to 2050 is $18 trillion. Total costs of desulfurization and emission controls are estimated at around $1.1 trillion.
Stringent standards are only as good as their compliance and enforcement – importance of RDE
New low carbon technologies have the potential to substantially reduce transport emissions
Thank You!

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Additional Slides
Importance of complimentary policies that can help reap the full benefits of cleaner fuels and vehicles

New vehicle standards
Must consider emissions from all mobile sources
Limit values only as good as:
- Compliance and enforcement
- Real-world performance

Fuel quality standards
High fuel quality (especially low sulfur levels) enables advanced emission control technologies.
Compliance programs critical to prevent damage to engines and misfueling

“Systems Approach”

In-use vehicle emission control
Measures include:
- Catching gross-emitters (I/M, remote sensing, maintenance)
- Cleaner fuels
- Fleet renewal
- Retrofit programs
- Complementary strategies (low emission zones, driver training, etc.)

Resources for Effective Policy Action:
- Global Fuel Economy Initiative
(http://www.globalfueleconomy.org/)
- Partnership for Clean Fuels and Vehicles – Regulatory Toolkit

Alternative Fuels
- Promotion of EVs
- 2nd & 3rd generation biofuels
Timeline of policy action to reduce transport sector emissions in Chile

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<td>Fuel Economy (FE)</td>
<td>FE Baseline Study</td>
<td>FE Labeling Proposal</td>
<td>Feebate Proposal</td>
<td>Obligatory FE Labeling</td>
<td>Tax on road emissions - NOx</td>
<td>Efficiency Standard Proposal</td>
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<td>Fuel Quality</td>
<td>Diesel 15ppm Santiago and 50ppm nationwide</td>
<td>Gasoline 15ppm Nationwide</td>
<td>Diesel 15ppm Nationwide</td>
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References

- Slide 13: http://www.eia.gov/dnav/pet/pet_pri_gnd_a_epd2d_pte_dpgal_a.htm