Soot-Free Urban Bus Fleets to Address Diesel Health Impacts

Ray Minjares, Clean Air Program

CSE Conclave: Our Right to Clean Air
19 April 2016
New Delhi, India
New Evidence of Diesel Health Effects
Diesel Engines are a Key Target for Health Reasons

“The scientific evidence was compelling and the Working Group’s conclusion was unanimous: diesel engine exhaust causes lung cancer in humans.”

-Dr. Christopher Portier

Diesel Exhaust Causes

- Lung cancer
- Adverse respiratory effects
- Adverse cardiovascular effects
- Adverse immunological effects

Diesel Exhaust May Cause

- Bladder Cancer
- Adverse reproductive and developmental effects
- Adverse Central Nervous System effects

Health Canada: Health Impacts Assessment of Diesel Exhaust (2016)

- Cause of 710 annual premature mortalities in Canada in 2015
- $5.1 billion social cost in 2015
- Impacts evenly split among on-road and off-road diesel engines

Diesel Sources are 68% of Air Toxics Risk in Los Angeles
70% Reduction in Diesel Particulate Concentrations Accompanied by 57% Reduction in Air Toxics Risk in Los Angeles Basin

2005

2012-2013

Figure 4-7
2005 MATES III CAMx RTRAC Simulated Air Toxic Cancer Risk

Figure 4-6
2012-2013 MATES IV CAMx RTRAC Simulated Air Toxic Cancer Risk
Toxicity of diesel exhaust significantly declined with application of DPF

- No lung tumors
- No soot deposition in the lung
- Lack of genotoxic effects
- Lack of cardiac effects

DPF alone still leaves NO₂ effects

- Small respiratory changes associated with high NO₂ exposure
Seeking Solutions through Soot-Free Urban Bus Fleets
Why Target Urban Bus Fleets?

A Key Target
- Predominantly diesel
- Operate for 20 years or more
- Travel 10 times more than a passenger vehicle
- Emit 250 times more per km than a petrol vehicle

A Key Point of Entry
- Centrally fueled and operated
- Publicly regulated and financed


- Buses 25%
- Other 75%
Technological Shift Towards Soot-Free Diesel Engines

Overview: The exhibits above are actual PM collection samples from an engine testing laboratory used to collect and measure diesel particulate matter (PM) emissions. Test conditions are:

- Test Cycle: UDDS (Urban Dynamometer Driving Schedule)
- Test Distance: 5.5 miles over 17 minutes
- Fuel Consumed During Test: 1.1 gallons
- Test Vehicle: Heavy-duty truck with a 370 hp Cummins engine (1999 model year)
- PM material on collection samples is 1/1,800th of actual

Courtesy of ClearAire, Inc.
Stages of Black Carbon Emissions Control Based on European Regulatory Approach to Urban Bus Fleets

Source: COPERT Emissions Model
CCAC Soot-Free Urban Bus Fleets Project

icct
THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

UNEP
United Nations Environment Programme
environment for development

C40 CITIES
CLIMATE LEADERSHIP GROUP

Centro Mario Molina Chile
Core Project Activities

Inform, motivate, and secure a public commitment from city officials to shift to cleaner buses. Provide implementation support at the request of committed cities and guided by an agreed upon work plan.

Establish an industry partnership with a private sector coalition of clean bus manufacturers and suppliers.

Conduct a data survey of targeted urban bus fleets and develop an urban bus fleets database.

Collect and report data needed to monitor and evaluate progress in the urban bus fleets sector.
Project Strategy

20 Target cities (> 3m pop)

Tier 1 cities:
Access to Euro VI fuels

- Shift new bus purchases to soot-free engines within 3 years
- 6 early committers receive implementation support

Tier 2 cities:
Access to Euro IV fuels

- Shift new bus purchases to Euro IV, Euro III+DPF, or Euro V within 3 years; adopt timeline for Tier 1 status + soot free engines

Tier 3 cities:
No access to Euro VI or IV fuels

- Within 3 years set target date for Tier 1 status
- Pathway to soot-free engines in all 20 target cities

Active engagement through a web presence, meetings and workshops to:
- Provide technical information and advice
- Pool requirements and connect to industry stakeholders
- Connect to financing opportunities
- Build a global picture and track progress

CCAC HDDI support

New Commitments

Implementation

Final outcomes
# 20 Target Cities

<table>
<thead>
<tr>
<th>Name</th>
<th>Country</th>
<th>CCAC Member</th>
<th>2014 Population</th>
<th>Annual PM$_{2.5}$ (µg/m$^3$)</th>
<th>Euro emissions stage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tier 1 Cities</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Mexico City</td>
<td>Mexico</td>
<td>Yes</td>
<td>22,200,000</td>
<td></td>
<td>IV</td>
</tr>
<tr>
<td>2 Sao Paulo</td>
<td>Brazil</td>
<td>No</td>
<td>21,700,000</td>
<td>19</td>
<td>V</td>
</tr>
<tr>
<td>3 Buenos Aires</td>
<td>Argentina</td>
<td>No</td>
<td>15,700,000</td>
<td>16</td>
<td>IV</td>
</tr>
<tr>
<td>4 Istanbul</td>
<td>Turkey</td>
<td>No</td>
<td>14,000,000</td>
<td>32</td>
<td>V</td>
</tr>
<tr>
<td>5 Sydney*</td>
<td>Australia</td>
<td>Yes</td>
<td>4,775,000</td>
<td>5</td>
<td>V</td>
</tr>
<tr>
<td>6 Santiago</td>
<td>Chile</td>
<td>Yes</td>
<td>6,600,000</td>
<td>26</td>
<td>V</td>
</tr>
<tr>
<td><strong>Tier 2 Cities</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Manila</td>
<td>Philippines</td>
<td>No</td>
<td>22,500,000</td>
<td>22</td>
<td>II</td>
</tr>
<tr>
<td>8 Bangkok</td>
<td>Thailand</td>
<td>No</td>
<td>14,900,000</td>
<td>20</td>
<td>III</td>
</tr>
<tr>
<td>9 Lima</td>
<td>Peru</td>
<td>Yes</td>
<td>9,800,000</td>
<td>38</td>
<td>III</td>
</tr>
<tr>
<td>10 Bogotá</td>
<td>Colombia</td>
<td>Yes</td>
<td>9,150,000</td>
<td>27</td>
<td>IV</td>
</tr>
<tr>
<td>11 Dar es Salaam</td>
<td>Tanzania</td>
<td>No</td>
<td>5,000,000</td>
<td></td>
<td>none</td>
</tr>
<tr>
<td>12 Johannesburg</td>
<td>South Africa</td>
<td>No</td>
<td>8,750,000</td>
<td>51</td>
<td>III</td>
</tr>
<tr>
<td>13 Nairobi</td>
<td>Kenya</td>
<td>No</td>
<td>4,950,000</td>
<td></td>
<td>import restriction</td>
</tr>
<tr>
<td>14 Casablanca</td>
<td>Morocco</td>
<td>Yes</td>
<td>4,200,000</td>
<td></td>
<td>none</td>
</tr>
<tr>
<td><strong>Tier 3 Cities</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 Jakarta</td>
<td>Indonesia</td>
<td>No</td>
<td>21,000,000</td>
<td>21</td>
<td>II</td>
</tr>
<tr>
<td>16 Dhaka</td>
<td>Bangladesh</td>
<td>Yes</td>
<td>16,700,000</td>
<td></td>
<td>I</td>
</tr>
<tr>
<td>17 Lagos</td>
<td>Nigeria</td>
<td>Yes</td>
<td>13,500,000</td>
<td></td>
<td>import restriction</td>
</tr>
<tr>
<td>18 Abidjan</td>
<td>Côte d'Ivoire</td>
<td>Yes</td>
<td>4,900,000</td>
<td></td>
<td>none</td>
</tr>
<tr>
<td>19 Accra</td>
<td>Ghana</td>
<td>Yes</td>
<td>4,400,000</td>
<td>49</td>
<td>none</td>
</tr>
<tr>
<td>20 Addis Ababa</td>
<td>Ethiopia</td>
<td>Yes</td>
<td>3,325,000</td>
<td></td>
<td>none</td>
</tr>
</tbody>
</table>

*Incremental costs related to Sydney’s participation would be covered by Australia and not by the CCAC Trust Fund*
Nearly 4,000 early deaths could be avoided from soot-free urban bus fleets in 20 target cities

<table>
<thead>
<tr>
<th>Category</th>
<th>BC Reduction (Kt)</th>
<th>Climate Benefit (MMT)</th>
<th>Early Deaths Avoided</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>GWP-20</td>
<td>GWP-100</td>
</tr>
<tr>
<td>Tier 1 Cities</td>
<td>0.27</td>
<td>0.87</td>
<td>0.23</td>
</tr>
<tr>
<td>Tier 2 Cities</td>
<td>0.96</td>
<td>3.02</td>
<td>0.80</td>
</tr>
<tr>
<td>Tier 3 Cities</td>
<td>0.85</td>
<td>2.66</td>
<td>0.70</td>
</tr>
<tr>
<td>Total</td>
<td>2.09</td>
<td>6.56</td>
<td>1.73</td>
</tr>
</tbody>
</table>
National Government Proposes Euro VI Buses in Santiago Starting in 2017

Las nuevas medidas para el plan de descontaminación para la RM

A partir del año 2017 se le exigirá al Transantiago la norma Euro VI que permitirá disminuir sus emisiones contaminantes en un 75%.

José Irarrázaval
05 de enero del 2016 / 11:17 Hrs

Bogotá, Colombia

Opportunities

• 600-800 bus procurement planned
• Cartagena refinery producing 10ppm S diesel
• 6-12 month BYD electric bus pilot in development

Challenges

• Budget deficit under previous administration
Opportunities

• Limited CNG and 10ppm S diesel available locally
• Ongoing dual-fuel conversion of 150 Euro 5 buses
• Euro VI under consideration for Rea Vaya BRT

Challenges

• Euro 2 standards nationwide
• Affected by strong devaluation of currency
Opportunities

- Planned retrofit and replacement of 6,000 buses
- Discussion of DPF requirement on all new vehicles

Challenges

- Opposition from DPF requirement among European auto manufacturers
- 50ppm S diesel cleanest fuel available
Opportunities

• 2005 Governor’s Decree requires CNG in public transport vehicles

Challenges

• Implementation of decree never completed
• Tax incentives promised but not delivered
• Challenges procuring land to site refueling stations
• Diesel fuel remains subsidized
Opportunities

• NOM044 proposal would require soot-free trucks and buses nationwide by 2018
• 15ppm S diesel available in all major metros
• Verbal commitment from MetroBus to buy Euro VI

Challenges

• Finalization of NOM044 proposal delayed indefinitely
• Ongoing opposition from truck and bus industry
Lessons Learned from Cities

1. **Identify existing procurement requirements** for emissions performance of new buses entering the municipal fleet

2. **Make a public commitment** to procure soot-free urban buses

3. **Procure technical guidance and support from local experts**, industry or international partners

4. **Collect and publicize your data** in order to measure and evaluate progress
Thank You
ray@theicct.org
Additional Slides
Common Challenges

Fuels
- Sensitivity to fuel price
- Limited access to cleaner fuels

Vehicles
- Restricted access to clean technology
- Limited technical knowledge/capacity
- Opposition from private concessionaires/industry
- Access to finance schemes
Common Opportunities

Fuels
- Channel dedicated fuel supply
- Lock-in long-term fuel contracts

Vehicles
- Dedicated maintenance and operations staff
Ongoing Activities

- Establishing web presence with CCAC Secretariat
- Asia sub-regional workshop planned Aug 2016
- Latin America sub-regional workshop planned Q4 2016
- Survey of bus and engine manufacturers ongoing
- Bus fleets data collection beginning
- Bus industry meeting expected 2017
- Identifying target bus fleets and decision makers in all 20 target cities