DPF-Retrofit of Bogota and a City Alliance with Latin-American cities: “Climate and Clean Air Program in Latin-American Cities”

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**Secretaria Distrital de Ambiente – Bogota D.C.
1. Overview of Bogota
2. Base line - Particle number and NO2 at steady state
3. Base line – On-road emission factors
4. Upcoming steps
1. OVERVIEW OF BOGOTA

1. PT: before 2001
   Fuel: More than 1.200 ppm [S]

2. PT+ BRT (2001-2014)
   Fuel: Less than 50 ppm [S] since 2010

3. SITP (Starting 2012 - 2014)

## 1. OVERVIEW OF BOGOTA

<table>
<thead>
<tr>
<th>Stage of the Public Transport</th>
<th>2008</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>SITP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage I</td>
<td>1.070</td>
<td>2.213</td>
<td>5.565</td>
<td>12.416</td>
</tr>
<tr>
<td>Stage II</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage III</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zonal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traditional public transport</td>
<td>16.168</td>
<td>15.389</td>
<td>11.160</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>17.238</td>
<td>17.602</td>
<td>16.725</td>
<td>12.416</td>
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</tbody>
</table>

Source: Compile SDA, 2014 by information from Transmilenio S.A, 2013
1. OVERVIEW (AIR QUALITY)

14 Monitoring stations
✓ particulate matter (PM$_{10}$, PM$_{2.5}$),
✓ sulfur dioxide (SO$_2$),
✓ carbon monoxide (CO),
✓ nitrogen dioxide (NO$_2$),
✓ ozone (O$_3$)

Annual average PM$_{10}$ level (µg/m$^3$)

Source: SDA, 2014

Source: RMCAB, 2013
1. OVERVIEW (AIR QUALITY)

14 Monitoring stations
- particulate matter (PM$_{10}$, PM$_{2.5}$),
- sulfur dioxide (SO$_2$),
- carbon monoxide (CO),
- nitrogen dioxide (NO$_2$),
- ozone (O$_3$)

Annual average PM$_{10}$ level (µg/m$^3$)

30 µg/m$^3$ to reduce
1. OVERVIEW: BOGOTA OBJECTIVES AND GOALS

Total PM Emission 2008: 2.500 Ton/year
Mobile source 2008: 1.400 Ton/year

Quantity of Vehicles

- Private cars: 53.9%
- 4X4 and vans: 23.7%
- Trucks: 4.2%
- Taxis: 4.5%
- Motorcycles: 10.2%
- Traditional Public Transport: 1.4%
- Others: 2.0%

Contribution to PM pollution

- Trucks: 33%
- 4X4 and Vans: 1%
- Others: 1%
- BRT-Transmilenio: 0.2%
- Traditional Public Transport: 39%
- Private cars: 2%
- BRT-Transmilenio: 0.1%
1. OVERVIEW: BOGOTA OBJECTIVES AND GOALS

- Reduce the causes of cardio-respiratory diseases
- Reduce $PM_{10}$ by 10% and implementing the equipment for monitoring $PM_{2.5}$ in the city
- Reduce CO, NOx, THC and PM of public transport by 10%.

10 Year Plan of Air Quality Improvement in Bogota

- Air Quality Monitoring
- Control to Mobil and Industrial Sources of emissions and Control to Automotive Diagnostics Centers
- Design an Early Warning System
Climate and Clean Air in Latin-American Cities “Bogotá Diesel Particle Filter Project – BDPF”

Bogotá as part of CALAC, through joint technical cooperation activities between Bogota and SDC

- The Santiago de Chile DPF Follow-Up Project [SFU]
- BDPF Project
- The City Alliance for DPF [CA]
1. OVERVIEW OF BOGOTA

The Bogota DPF Project

Stage 1
DPF retrofit pilot tests
(18 buses)

Stage 2
Extended pilot
(the first 300 buses)

Timeline December/2013-Jun/2015

1. DPF Retrofit Pilot Tests
2. Local approval scheme
3. Implementation targets and modalities for a future massive implementation
4. Emission factors
5. Divulgation of Results
Stage 1 DPF retrofit pilot tests
(18 buses)

1. Vehicle Selection
2. Data-loggin and Fuel consumption measurement
   - Dynamometric testing
   - Route testing
3. DPF Installation
4. DPF and Bus Monitoring (2.5 months)

- Opacity
- Oil and fuel leaks
- Cylinder compression
- OEM fuel systems
- OEM chasis

Model Year

<table>
<thead>
<tr>
<th>Year</th>
<th>Microbus (19 pax)</th>
<th>Feeder (80 pax)</th>
<th>Buseta (40 pax)</th>
<th>Buseton (50 pax)</th>
<th>Articulat e (160 pax)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>15.38%</td>
<td>23.08%</td>
<td></td>
<td>30.77%</td>
<td>20%</td>
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<tr>
<td>2009</td>
<td>15.38%</td>
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<td>20%</td>
<td>27%</td>
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<tr>
<td>2008</td>
<td>7.69%</td>
<td></td>
<td></td>
<td>20%</td>
<td>27%</td>
</tr>
<tr>
<td>2007</td>
<td>7.69%</td>
<td></td>
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<tr>
<td>2006</td>
<td>7.69%</td>
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<td></td>
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<tr>
<td>2005</td>
<td>15.38%</td>
<td></td>
<td></td>
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<td>2001</td>
<td>15.38%</td>
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Dinamic measurements
2. Base line results – Euro II (Steady State)
2. Base line results – Euro III and IV (Steady State)

![Graph showing particle number concentration for VEE166, VEF604, WCR421, and Euro IV. The graph displays the particle number concentration in terms of #/cm³ for different percentages of emissions.]
Nox (Steady State)

Euro III and IV
3. Base line results PM10 (Emission Factor – Onroad Testing)

Average: 0.039 [gr/km]

Out of the project, will be replaced
3. Base line results NOx (Emission Factor – Onroad Testing)

Average: 33.32 [gr/km]
Pre dataloggin temperatures

Temperature [°C]

- Tmax (°C)
- T ave (°C)

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II III II III II III II III II III II III II III II III II
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What’s Next
Thank you...!