AIR QUALITY IMPACTS OF CNG FUEL SWITCH FOR VEHICLES IN CHITTAGONG, BANGLADESH

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Introduction

A large part of the vehicle fleet in Bangladesh is currently running on the clean fuel Compressed Natural Gas (CNG). However, CNG demand is high for all sectors in Bangladesh (including energy production) at a time when the CNG supply is static, and possibly decreasing.

There is the future potential of a vehicle fuel switch from CNG to petrol and diesel (such as in 2020). This study investigates the effects of such a fuel switch on air quality in Bangladesh’s second largest city – Chittagong. This work is part of the BAPs (Bangladesh Air Pollution Studies) project Task 2 (Dispersion Modelling).

Methods

The AirQUIS model was used to compile a complete emission inventory for Chittagong (for all source sectors) and dispersion modelling was performed based on the inventory (using EPISODE within AirQUIS, 1x1km² resolution). The vehicle compositions based on fuel type for the 2013 baseline and 2020 scenario used in this study:

<table>
<thead>
<tr>
<th></th>
<th>Cars Baseline</th>
<th>Cars 2020</th>
<th>Trucks Baseline</th>
<th>Trucks 2020</th>
<th>Busses Baseline</th>
<th>Busses 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNG</td>
<td>70%</td>
<td>0%</td>
<td>40%</td>
<td>0%</td>
<td>70%</td>
<td>0%</td>
</tr>
<tr>
<td>Petrol</td>
<td>20%</td>
<td>65%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Diesel</td>
<td>10%</td>
<td>35%</td>
<td>60%</td>
<td>100%</td>
<td>30%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Baby taxies remained 100% CNG, while motorcycles remained 100% Petrol.

Results: Receptor Concentrations

Results show that the 2020 scenario increases annual average concentrations of PM₂.₅ by 30%, PM₁₀ by 40%, and NOₓ by 60% for traffic sources alone at 10 receptor cells in the modelling grid for Chittagong.

Results: NOₓ Dispersion Models

2013 Baseline NOₓ concentrations from traffic sources alone in Chittagong:

60% Increase in annual NOₓ Concentrations at receptors after fuel switch

2020 Projected NOₓ concentrations from all sources in Chittagong:

30% Increase in annual ambient NOₓ Concentrations at receptors after fuel switch

Conclusions

A possible fuel switch from CNG to petrol/diesel for vehicles in the near future in Bangladesh will have detrimental impacts to the ambient air quality. Of most concern is NOₓ, where annual average ambient concentrations are modelled to increase 30% in Chittagong based on a pending fuel switch.

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Results: PM₂.₅ Dispersion Models

2013 Baseline PM₂.₅ concentrations from traffic sources alone in Chittagong:

40% Increase in annual PM₂.₅ Concentrations at receptors after fuel switch

2020 Projected PM₂.₅ concentrations from traffic sources alone in Chittagong:

30% Increase in annual PM₂.₅ Concentrations at receptors after fuel switch

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