Reduction of Vehicle Emissions in Malawi

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Introduction - Emissions

Factors affecting vehicles emissions

Reducing vehicle emissions

Role of Research

Introduction - Emissions

Emissions from petroleum fuel contains hundreds of chemical compound partitioned to gaseous and particulate phases

Carbon Emissions

Carbon released in combustion ends up as carbon monoxide, carbon dioxide, particulate matter and hydrocarbons.

Nitrogen oxides

Nitrogen oxide is one of the main contributors of ground-level ozone and smog formation along with hydrocarbons and carbon monoxide.

Nitrogen as di-nitrogen is responsible for stratospheric ozone depletion. And total nitrogen (nitrogen oxide and ammonia) is responsible for eutrophication.

Sulphur oxides

Sulphur dioxide along with ammoniac, nitrogen dioxide and hydrochloric acid is responsible for acidification (acid rain formation).

Acid rain results in corrosion of metal structures, damage to plant leaves and skin.

Particulate matter

Particulate matter emitted from mobile sources is a major concern because of its role in respiratory diseases.

PM emissions from diesel vehicles and heavy equipment result in visible smoke.

Fine particles (with mean diameter less than micrometres - PM2.5) have a high probability of depositing deep in the respiratory truck and are likely to irritate lung tumours and cause respiratory diseases.

Carbon monoxide

Carbon monoxide results from partial combusted fuel. It is a poisonous gas and a component of ground-level ozone formation and photo smog.

Hydrocarbon

Unburned hydrocarbons area significant contributor to ground-level ozone and photo smog formation.

Polycyclic aromatic hydrocarbon (PAH) and nitrated Polycyclic aromatic hydrocarbon (nPAH)

Compounds in these broad groups (includes various benzene, toluene etc) have been identified as potential carcinogens.

Dust

Dust emissions result from vehicles and plant travelling on dusty roads. Dust soils clothing, plants and leads to respiratory infections.

Factors affecting vehicle emissions

- Conditions of roads - the majority of the roads in the country are not tarred as such during dry season dust emissions are emitted.
- Road network/ Road traffic congestion (especially in the major urban centres of Blantyre, Lilongwe, Mzuzu and Zomba). Results in excessive/ prolonged vehicle idling.
- Condition of imported vehicles (the majority of the vehicles are second hand). Old vehicles are less efficiency in combusting the fuel thereby releasing large quantities of unburnt fuel (HC) and Carbon monoxide.
- Fuel standards in place – reduction to low sulphur diesel (from 500 to 50ppm)
- Vehicle emission standards in place – enforcement?

Mineral Dust Emission on Dusty Road

Factors affecting vehicle emissions

- Lack of vehicle standards (Second hand vehicles) – (Year of make).
- Vehicle emission standards in place – enforcement?.
- Heavy reliance on road transport for long distance transportation of goods. (Life Cycle Emissions)
- Inefficient public transport system.
- Reliance on imported fossil fuels for transportation. In general fossil fuel have high levels of emissions.

- Poor maintenance.
- Use of substandard service items such as lubricants and oils. Standards in place – Enforcement?
- Use of vehicles with no emission controls e.g. carburretted systems.
- No monitoring of vehicle.

Reducing Vehicle Emissions

- Cleaner fuels (biofuels – ethanol, biodiesel – blending and neat), Low sulphur fuels
- Minimum standards on imported vehicles (especially second hand vehicles)
- Standards on vehicle maintenance
- Enforcement of the vehicle emissions standards
- Monitoring of vehicle emissions and air quality
- Improving the road network and road conditions and regular maintenance
- Improving and promoting railway and water transport systems for transportation of goods

Reducing Vehicle Emissions

- Reduction of vehicle exhaust emissions (Fitting of catalytic converter; Manifold air injection; Fundamental engine modifications; and Exhaust recirculation)
- Improving and promoting public transport services (mass transit transportation, creating bus lanes, urban bus services, cycle tracks, park and ride)
- Improving road traffic management - providing proper signal coordination among the intersections, this reduces delays, limitation of vehicle movement in high density urban areas
- Detailed studies to determine the effects of vehicle emissions on the quality of life
- Public awareness and education on the impacts of vehicle emission on the quality of life

Role of Research

Gathering of evidence for decision making process

NCST in collaboration with various stakeholder undertook the Ethanol Vehicle Driven Project

- This lead to the amending of the ethanol standard allowing for increased blending and use of 100% ethanol use a vehicle fuel

- The development of the Ethanol Development Programme for Malawi

Research on alternative vehicle fuels and technologies.

Monitoring and mapping of air quality.

Thank you