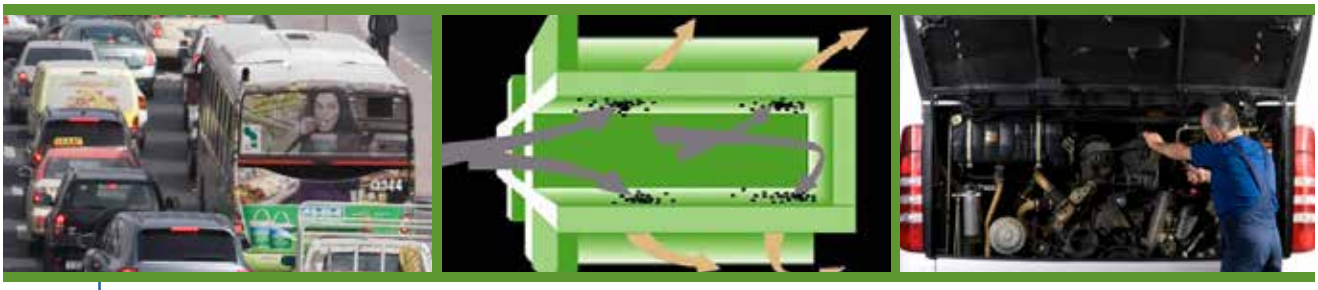
UAE Labor Transportation Fleet Air Pollution Mitigation Concepts



RTI International has provided technical leadership in the implementation of air pollution reduction solutions and regulatory development for more than 35 years. We offer in-depth knowledge of industrial process emissions to solve air pollution problems worldwide.

Opportunity Overview

Thousands of people in the United Arab Emirates (UAE) workforce ride diesel buses (i.e., labor transportation fleet) to and from their jobs. Buses emit pollutants, such as particulate matter (PM), nitrous oxides (NO_X), carbon monoxide (CO), and total hydrocarbons (THC). These harmful emissions increase as vehicles age; however, affordable retrofit technologies to reduce emissions exist.

Emission-Reducing Solutions

Reducing emissions from diesel engines aligns with the UAE Accelerator Program's commitment to deliver transformative solutions through new technologies. Several emission-reducing technologies are commonly implemented in the transportation industry. These solutions vary from diesel retrofits, which are relatively low-cost and straightforward to implement, to long-term approaches such as retiring diesel bus fleets and replacing them with buses that operate on alternative fuels (e.g., propane), hybrid technology, or electricity.

Older models of Tata or Ashok Leyland make up most of the labor transportation fleet. As a short-term solution, we recommend installing pollutant-reducing diesel retrofit technologies. The following diesel retrofit technologies mitigate diesel emissions:

- **Diesel Particulate Filter (DPF).** DPFs remove more than 85% PM in diesel exhaust. Passive regeneration (catalyst) or active regeneration (heated to combustion) burns off the collected PM. A catalyzed DPF also reduces emissions of THC and CO in the 90% range.[1]
- **Flow-Through Filter (FTF).** FTFs trap a portion of the PM and use passive regeneration via catalyst. Catalyzed FTFs offer co-benefits of PM reduction as well as THC and CO reduction.[2]
- **Diesel Oxidation Catalyst (DOC).** DOCs are flow-through devices with catalytic coating on substrate that oxidizes soluble organic fraction of PM resulting in 25%–50% PM reduction and ~90% reduction of THC and CO.[3]

The following technologies reduce NO_X emissions for labor transportation fleet retrofits:

- **Exhaust Gas Recirculation (EGR).** EGR involves recirculating a portion of the engine's exhaust to the charger inlet or intake manifold. EGR is used for retrofit applications because it does not usually require engine modifications. A DPF is used with a low-pressure EGR system to mitigate PM recirculation to the engine. EGR systems can reduce NO_X by more than 40%.[4]
- **Lean NO_X Catalyst (LNC).** LNC controls NO_X emissions by injecting a small amount of diesel fuel or other hydrocarbon reductant into the exhaust upstream of a catalyst. This technology (which is also combined with a DPF) can reduce NO_X by 20%–35%.

100-Day Pilot Study Program

Under the UAE Accelerator Program, a pilot study program could be implemented to retrofit a small percentage of the existing labor transportation fleet with at least one of the aforementioned technologies. Following is a timeline for the pilot program. (Note that budget constraints may impact some of these actions.)

- **Days 1–10:** Determine which pollutant currently has the most adverse health impacts. Identify the best control technology for the pilot study program (i.e., select one of the five technologies mentioned previously).
- **Days 11–20:** Identify vendors for control technology procurement. Identify local maintenance vendors for equipment installation.
- **Days 21–40:** Order and install equipment on select vehicles. Sample pre-control emissions to establish a baseline operating scenario.
- **Days 41–85:** Track the sample vehicle fleet and note any issues with control technology implementation. Sample the post-control emissions to establish a controlled operating scenario.
- **Days 86–100:** Summarize findings, including lessons learned from the pilot program, quantification of actual emissions reductions, and estimation of the level of scale that could be applied.

Projected Costs

Based on Manufacturers of Emission Controls Association data[5], U.S. Environmental Protection Agency cost methods[5], and other published studies[6], the average costs for implementing these technologies are as follows:

- **Diesel Particulate Filter (DPF):** 2 vehicles per 100,000 dirham (AED).
- **Flow-through Filter (FTF):** 5 vehicles per 100,000 AED.
- **Diesel Oxidation Catalyst (DOC):** 14 vehicles per 100,000 AED.
- **Exhaust Gas Recirculation with DPF (EGR + DPF):** 1 vehicle per 100,000 AED.
- **Low-NO_x Catalyst with DPF (LNC + DPF):** 2 vehicles per 100,000 AED.

100-Day Goal

The 100-day pilot study will aim to accomplish the following:

- Identify procurement and installation routes and vendors.
- Demonstrate application of a proven control technology in the UAE environment.
- Quantify the emissions reductions achieved.
- Provide an estimate of the emissions reductions that could be achieved (based on metrics developed from the pilot study) if the technology were applied to the entire labor transportation vehicle fleet.

Follow-on Work

RTI has the capabilities to conduct large-scale labor transportation fleet emissions estimates and modeling. The purpose of this effort is to provide internationally accepted quantification of the labor fleet emissions pre- and post-control. This effort provides tangible estimates of the expected health risk benefits if the program were implemented fleet wide, using one or more of the following models: MOtor Vehicle Emissions Simulator (MOVES), COPERT, AERMOD.

More Information

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[1] http://www.meca.org/diesel-retrofit/what-is-retrofit

[2] http://www.dcl-inc.com/applications/case-studies/flow-through-filter-for-london-lez-retrofit/_

[3] https://sites.google.com/site/rtsdieseltransitbuses/home/control-devices/doc

[4] http://www.meca.org/resources/MECA_diesel_retrofit_white_paper_1114_FINAL.pdf

[5] https://www.epa.gov/sites/production/files/2014-02/documents/5_2011_ctrlcost_memo_exist_ci.pdf

[6] http://www.theicct.org/sites/default/files/publications/Diesel-Retrofits_ICCT_Consultant-Report_13062017_vF.pdf