

## The right cost-benefit analysis for e-vehicles

It should have been a step towards cleaner city life in the national capital. Recently, the Delhi government announced its interest in buying 200 new electric-powered city buses, each costing Rs2.5 crore compared to Rs85 lakh for a bus running on compressed natural gas (CNG). This was, of course, in the name of a healthier city environment. Perhaps it would also have helped rehabilitate Delhi's battered image as the most polluted major city in the world, outstripping even Beijing.

But here is the unfortunate truth: these e-buses won't help improve the city's air quality. In fact, the opposite will be the case. Let's get some facts on the table.

In the global political discourse about climate change, the regular petrol engine was increasingly being replaced by diesel engines. They produce less CO<sub>2</sub>, are more efficient, and thereby cheaper to operate. However, even though the diesel engine emits lower CO<sub>2</sub> emissions, it emits soot and large amounts of particulate matter. CNG (compressed natural gas) thus became the alternative fuel of choice, with Delhi implementing a transition from diesel to gas in 2001.

Because natural gas is a cleaner-burning fuel, the switch usually results in substantial reduction of hydrocarbons, carbon monoxide, and oxides of nitrogen (NO<sub>x</sub>). But the higher density of vehicles on the roads in Delhi let particulate matter (PM) levels rise to new heights.

PM can be of natural origin or generated by human activity. It differs in size and effect on human beings. PM<sub>10</sub> may penetrate through the nasal cavity into deeper areas of the bronchi. The smaller particles, PM<sub>2.5</sub>, can penetrate into the bronchioles and alveoli and the ultra-fine particles with a diameter of less than 0.1 micron even into the lung tissue and bloodstream.

The health effects differ based on particle size and penetration depth. There are proven associations between PM<sub>2.5</sub> air pollution and diabetes, pre-term birth, cancer and diseases of the central nervous system, including autism in children and dementia in the elderly. PM is a serious issue which reduces both average life span and the national GDP (gross domestic product).

Major sources of particulate matter caused by humans are motor vehicles, power and district heating plants, waste incinerators, furnaces and heaters in homes, bulk cargo handling, livestock and certain industrial processes. Indeed, in urban areas, road transport is one of the major source of particulate matter.

But 70-95% of PM emissions caused by road transportation is not related to tailpipe emissions but to road dust re-suspension and abrasion of brakes and tyres.

E-buses will not eliminate these emissions. Instead, this raises the question of where the energy for the new buses will come from. And there it gets messy.

Delhi's electric power is mainly produced by coal-powered plants. Coal and fly ash contribute around 26% of the PM<sub>2.5</sub> in the city. In winter, vehicular emissions and power plants contribute 30% of PM<sub>2.5</sub>. In other words, the transition to e-buses would not lower emissions levels but make them worse. Generation of energy and emissions only change the place of origin.

While the switch from diesel to CNG made sense with regard of tailpipe emissions, the switch to electric would neither change the air quality in the city nor would it be an environmentally friendly initiative.

Instead, the focus should be on measures which are more sustainable, paired with effective investments to improve air quality. It is imperative to attack the 20% of sources that produce 80% of emissions.

The effective total emissions, social costs, higher electricity prices, and loss of energy caused by production, transport and storage of electricity need to be included in any calculation. It is to be expected that the full electrification of road transportation will occur at some point, simply because EVs have considerably fewer parts and will be cheaper to produce in the future.

Currently, the opposite is the case. The technology is still too expensive. The same amount of money spent for those 200 e-buses could be used to get at least 400 modern, cleaner and more efficient CNG buses or—even better—invest in far more effective initiatives.

With regards to the expected additional energy demand generated by India's 2030 vision of electric vehicles, it might make sense to couple this with renewable energy: every electric vehicle sold should require a dedicated clean source of power to be installed. Both demand and supply would be taken into account. E-vehicle manufacturers would be forced to invest in the future fuel of their own cars but could offer consumers attractive packages.

Furthermore, this policy would prevent a crowding out of renewable energy dedicated for home appliances.

An honest look at the problem might show that renewing the current fleet of CNG buses and investing in truly effective projects is the better solution at this point in time. Introducing e-mobility under these circumstances is nothing more than an expensive and symbolic gesture. Some industry sectors might profit economically from this allegedly green policy—but the inhabitants of Delhi won't.

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