Submission No 13

ELECTRIC BUSES IN REGIONAL AND METROPOLITAN PUBLIC TRANSPORT NETWORKS IN NSW

Organisation: Centre for Air pollution, energy and health Research (CAR)

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Submission on the Electric Buses for Regional and metropolitan public transport network in NSW

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Thank you for the opportunity to comment on the Select Committee on Electric Buses' Terms of Reference. CAR brings together researchers from multiple disciplines focusing on the impacts of renewable energy and air pollution on health. CAR is committed to translating research into positive policy outcomes. We are thus well placed to comment on the impact of electric buses on regional air pollution and public health. This document addresses the Select Committee's first Term of Reference: "1) Benefits of electric buses and factors that limit their wider uptake".

Summary

CAR largely supports the replacement of conventional buses (those driven by an internal combustion engine) with electric buses (driven by electric engines). This replacement may reduce the concentration of air pollutants and greenhouse gas emissions. In turn, this replacement should also reduce the number of negative health effects associated with air pollution. However, while widespread uptake of electric buses would likely improve health outcomes, this effect might be partially offset if the electricity used to charge electric buses is generated from fossil fuels, which contribute significantly to air pollution. CAR therefore recommends that green (zero or low emission) sources of energy are used to power electric buses. It must also be noted that the use of electric buses does not eliminate all air pollution because electric buses still generate non-exhaust emissions from break and tyre wear and suspension of road dust. This is exacerbated by their higher weight compared with conventional buses.

The uptake of electric buses brings other benefits such as increasing population physical activity and reducing public dependency on private cars, which consequently reduces road traffic congestion, and improves accessibility to road services. It is estimated that even a modest increase in physical activity could provide strong health benefits to our community.

Lastly, consideration needs to be given to the manufacture and disposal of batteries used in electric buses so that populations are protected from negative health and environmental risks.

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Electric buses will likely lead to lower air pollution and improved health benefits, but with caveats

The replacement of conventional buses with electric vehicles may result in a range of environmental, health and climate benefits due to a potential decrease in air pollutants and greenhouse gas emissions.

Air pollutants are solid, liquid, or gas particles that are introduced into the Earth's atmosphere naturally or from human activity and which adversely affect the health of humans and ecosystems. Conventional buses represent a considerable source of atmospheric pollution in densely populated, semi-confined spaces as found in city streets. Ground level air pollutants produced by buses include particulate matter less than 2.5 micrometres in diameter ($PM_{2.5}$), particulate matter less than 10 micrometres in diameter (PM_{10}), nitrogen dioxide (NO_2), and carbon dioxide (CO_2) (Knibbs *et al*., 2011). Buses also produce gases which agglomerate and lead to the production of secondary $PM_{2.5}$ (Leliveled *et al*., 2019). Having adverse effects on human health, air pollutants cause allergies, cardiovascular disease, lung issues, and may lead to premature mortality (Marshal *et al*., 2006; Beelen *et al*., 2014; Moreno et al, 2015). Reducing the number of conventional buses in circulation is therefore likely to result in improved health outcomes for our communities.

However, the original source of energy for electric buses is an important consideration in identifying overall pollution and therefore health benefits coming from the use of electric buses. For example, if the energy used is from fossil fuels, any health benefits gained from the replacement of conventional buses may be negated by community exposure to air pollutants associated with the burning of these fossil fuels and increases in greenhouse gas emissions. Fossil fuel-based power stations generate ground level air pollution (i.e. $PM_{2.5}$, PM_{10} and NO_2), and greenhouse gas emissions. Around 90 per cent of electricity in Australia is generated from non-renewable fuels, 75 percent of which is from coal and 16 per cent from natural gas (Geoscience Australia, Australian Gov., 2018). According to a recent study by CAR researchers, in greater Sydney from 2010 to 2011, around one per cent of population mortality (620 years of life lost) was attributable to air pollution coming from electricity power stations (Broome *et al*., 2019). Thus, while widespread uptake of electric buses would likely reduce emissions from buses themselves, this might be partially offset if the electricity used to charge the electric buses is generated from fossil fuels. We recommend therefore that greener sources of energy are used to power electric buses.

Although electric buses play a role in reducing exhaust emissions, a considerable amount of non-exhaust related emissions remain while using electric buses. These include emissions from tyre wear, brakes and road dust (UK.Gov, Department of Transport, 2019). In a recent study, Broome *et al*. (2019) reported that vehicles in greater Sydney are responsible for 17 per cent of population exposure to PM2.5 and 10 per cent mortality burden (Broome *et al*., 2019). Of this 17 per cent of PM2.5 exposure, five per cent came from non-exhaust emissions (i.e. brake and tyre wear as well as road dust). In addition, since electric vehicles are on average approximately 25 per cent heavier than conventional vehicles (Timmers *et al*., 2016), this would lead to higher non-exhaust emissions than conventional buses.

Electric buses will have other health and economic benefits

Investing in electric buses and in public transport more widely would result in substantial social, economic, and health benefits. These include increasing population physical activity, decreasing dependency on private vehicles, reducing traffic congestion and decreasing requirements for more parking areas and roads.

The social benefits of a modest increase in the proportion of people who are physically active could be large. As reported by Giles-Corti *et al*. (2010), a five per cent increase in the proportion of people performing physical activity for 30 minutes per day could reduce approximately 600 premature deaths per year in Australia, consequently leading to substantial savings to the health system. In a similar study conducted in London and New Delhi, Woodcock *et al*. (2009) concluded that combining low-emission vehicle technologies with an increase in active transportation would give the best result in terms of social, environmental, and health concerns.

In terms of improvements to congestion, deployment of highly automated and zero emission vehicles has been investigated before by governmental agencies. For example, Infrastructure Victoria conducted a study on the infrastructure requirements for highly automated and zero emissions vehicles (Infrastructure Victoria, 2018). It reported that zero emission vehicles could improve the "efficiency of Victoria's road network by up to 91% and reduce greenhouse gas emission in Victoria by 25%".

Environmental and health considerations with the uptake of electric buses

While the uptake of electric buses would likely result in positive environmental, social, and health benefits, it may also cause some adverse environmental and health issues.

Electric vehicles run on lithium-ion batteries, which pose concerns on lithium mining and recycling processes. According to Nedjalcove *et al.* (2016), the batteries used in electric vehicles produce toxic gases in case of multifunction or damage. In addition, core ingredients used in battery production of lithium-ion batteries are environmentally unfriendly materials like cobalt and lithium, which are finite, and whose extraction processes raise environmental risks of water pollution and depletion (Nedjalcove *et al*., 2016).

The application of all new technologies has their challenges, risks and uncertainties. For instance, the deployment of electric buses would place new demands on an already old and frail NSW energy infrastructure. They would also require major charging infrastructure across the state and also place an additional burden on waste disposal infrastructure. These challenges could be addressed through development of practical and evidence-based transport planning, updating road spaces, waste management practices, and managing energy infrastructure.

About the Centre for Air pollution, energy and health Research (CAR)

CAR is an NHMRC Centre of Research Excellence that brings together experts studying the links between air pollution, energy transitions and our health**.** We are a virtual centre, with our investigators based in most Australian capital cities. Our researchers are at the cutting edge of science and come from a variety of fields. We are epidemiologists, medical physicians, biologists, toxicologists, statisticians and chemists. Our vision is for a healthier community through cleaner air and cleaner energy sources.

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For more information

This submission has been produced by the Centre for Air pollution, energy and health Research (CAR).

For more information about CAR and our work in energy transitions as well as the health impacts of air pollution: contact us at car@sydney.edu.au or visit our website: www.car-cre.org.au

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