Abstract

For developing countries like Pakistan Energy transition paradigm along with sustainable urban mobility are the major steps towards achieving the sustainable development goals under agenda 2030. For this purpose, various sustainable and clean bus technology alternatives have been analyzed for replacement of Diesel fuel powered **bus rapid transit (BRT)** Lahore. The study proposed a novel hybrid assessment model of **Multicriteria decision making method** – Fuzzy AHP-TOPSIS, which analyzed the bus alternatives on certain selected criteria performance. The social, economic, environmental and technical sustainability score of the high performing alternative **A3, A2, A3, A4 is 0.91, 0.96, 0.89, 0.89** respectively. To incorporate the economic feasibility and environmental performance of each bus type **Total Cost of Ownership (TCO) model** and Carbon footprint calculations have been deployed, which indicated that (ii electric buses have significant lowest GHG emissions even with current energy mix, and annual emissions are net zero kg/year for electric buses and contributes to 19% carbon dioxide emission savings. The marginal abatement cost for electric buses found to be **-$199** per ton CO_2, and for biofuel powered buses it is -**$543 per ton CO_2** when externalities are included. The TCO per km for electric, biofuel and diesel bus found to be **$2.52/km,** $1.99/km and **$1.90/km** respectively, which indicated high lifetime cost for electric and biofuel buses. The transition can be achievable if the costs for deploying the electric and biofuel buses decrease and a **break even** with conventional technology can be reached by 2034 with subsidies and cost reductions.