Contribution ID: **25247** Type: **Extended Abstract**

Nuclear Power Plants as a Sustainable Power Source for Electric Vehicle Transition in Saudi Arabia: A Comparative Life Cycle Assessment of Environmental Impacts

Tuesday, 4 November 2025 15:45 (15 minutes)

Saudi Arabia's transition from internal combustion vehicles (ICVs) to electric vehicles (EVs) is a key strategy for reducing greenhouse gas (GHG) emissions and achieving the nation's Vision 2030 sustainability goals. However, the environmental benefits of EV adoption depend critically on the carbon intensity of the electricity used for charging. This study employs a comparative Life Cycle Assessment (LCA) using OpenLCA and the ReCiPe 2016 Midpoint (H) method to evaluate the global warming potential of four scenarios: ICVs, EVs powered by fossil fuels, EVs powered by a 50/50 mix of fossil fuels and nuclear power, and EVs powered exclusively by nuclear power. The analysis is based on a functional unit of 150,000 km traveled by subcompact vehicles, accounting for engine and battery deterioration over a five-year period. Results indicate that ICVs produce the highest CO_2 emissions (69,500 kg CO_2 eq), followed by EVs powered by fossil fuels (24,400 kg CO_2 eq), EVs with mixed electricity sources (15,600 kg CO_2 eq), and EVs powered solely by nuclear energy (6,920 kg CO_2 eq). Transitioning from ICVs to EVs reduces CO_2 emissions by 64.9%, while integrating 50% nuclear power into the grid achieves a 77.5% reduction, and a fully nuclear-powered EV scenario yields a 90.05% reduction. Nuclear power plants (NPPs) thus play a pivotal role, offering a 71.65% emissions reduction compared to fossil-fuel-powered EVs. The findings underscore that coupling EV adoption with a decarbonized electricity supply—particularly via nuclear energy—is essential for maximizing climate benefits in Saudi Arabia's transport sector. This study provides quantitative evidence to support policy decisions on sustainable energy and transportation transitions in the Kingdom.

Technical Track

Nuclear Applications and Radiation Processing

Primary authors: ROMLI, Moch (Department of Environment, Faculty of Environmental Sciences, King Abdulaziz University (KAU), Jeddah, 21441, Kingdom of Saudi Arabia); Mr ABU-SHAMLEH, Amer (Department of Environment, Faculty of Environmental Sciences, King Abdulaziz University (KAU), Jeddah, 21441, Kingdom of Saudi Arabia); YUSUF, Muhammad (Industrial Nuclear Energy (I) - IRC - General); Prof. ABU RIZAIZA, Asaad Siraj Omar (Department of Environment, Faculty of Environmental Sciences, King Abdulaziz University (KAU), Jeddah, 21441, Kingdom of Saudi Arabia)

Session Classification: Nuclear Applications and Radiation Processing