World Academy of Science, Engineering and Technology
International Journal of Energy and Power Engineering
Vol:19, No:06, 2025

# Harnessing Train-Induced Airflows in Underground Metro Stations for Renewable Energy Generation: A Feasibility Study Using Bayesian Modeling and RETScreen

**Authors :** Lisha Tan, Yunbo Nie, Mohammad Rahnama

**Abstract :** This study investigates the feasibility of harnessing train-induced airflows in underground metro stations as a source of renewable energy. Field measurements were conducted at multiple SkyTrain stations to assess wind speed distributions caused by passing trains. The data revealed significant airflow velocities with multimodal characteristics driven by varying train operations. These airflow velocities represent substantial kinetic energy that can be converted into usable power. Calculations showed that wind power densities within the underground tunnels ranged from 0.97 W/m² to 3.46 W/m², based on average cubed wind speeds, indicating considerable energy content available for harvesting. A Bayesian method was utilized to model these wind speed distributions, effectively capturing the complex airflow patterns. Further analysis using RETScreen evaluated the cost-benefit and environmental impact of implementing energy harvesting systems. Preliminary results suggest that the proposed system could result in substantial energy savings, reduce $CO_2$ emissions, and provide a favorable payback period, highlighting the economic and environmental viability of integrating wind turbines into metro stations.

**Keywords :** train-induced airflows, renewable energy generation, wind power density, RETScreen
**Conference Title :** ICEE 2025 : International Conference on Energy Engineering
**Conference Location :** Toronto, Canada
**Conference Dates :** June 15-16, 2025