





Carbon mitigation potential of the airport-based solar PV plants in the Indian context

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ABSTRACT

The atmospheric pollution from the aviation industry can be decreased through the consumption of Renewable Energy (RE)-based electricity generation for airport operations. Among the various RE technologies, the solar PV system is most suitable in the airport environment. The technical performance of the solar PV system installed on the premises of ten Indian airports for onsite electricity generation is analysed in the present study. These airports are Kolkata, Kochi, Delhi, Hyderabad, Bengaluru, Jaipur, Chennai, Mumbai, Calicut, and Vadodara. Using PV software, it was found that the airport's solar PV system operates with a performance ratio of around 75% and the capacity factor between 16.5% and 18.8%. In addition to that, the Green House Gas mitigation potential and corresponding cost savings in terms of Certified Emission Reduction (CER) are estimated for each airport. With more than 400 aerodromes, the potential for airport's solar PV projects is enormous in the Indian scenario.

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Airport solar; CER; GHG mitigation; performance ratio; PV software

1. Introduction

The rise of greenhouse gas (GHG) concentration, particularly carbon dioxide, is the main cause of climate change. The aviation industry plays an important role in the increase in GHG concentration. As per statistics, the exhaust gases from the aviation sector contribute to around 3.5% out of total greenhouse gas emissions. The share of the aviation sector may double in the next 15 years (Clean, green conferencing). The negative impact from the aviation industry, in general, and airports, in particular, includes landscape modification, noise, air pollution, local climate change, excessive water use and effects on the social structures of local communities (Sukumaran and Sudhakar 2018). The electrical energy used in airports is mostly generated from the pollution-causing conventional energy sources. Electricity is consumed for meeting loads such as air conditioning, lighting loads of the building (interior and exterior), electromechanical installations and airfield (Koroneos et al. 2010). In addition to that, airports are energy intensive. The 24 h operation makes even the regional airport into an energy-intensive category. Therefore the energy cost of the airport is high. Nearly 10% to 15% of the operating budget of the airport is allocated for the energy bill (Mills 2011). The electricity demand in airports is met mainly by traditional power plants based on energy sources, namely natural gas, coal, stored water. Thus it can be said that the renewable energy-based electricity generation and utilisation are relevant in airport operation. It helps in the reduction of GHG emission to a greater extent.

When hydrocarbon fuel, such as coal, natural gas, etc., is burnt, its carbon content is converted to carbon dioxide and other carbon compounds. This emission contributes to greenhouse gases and damages the environment and human health.

A carbon tax is levied on the carbon content of fuels. This technique of GHG emission reduction is considered as an effective method. As of 2018, at least 27 countries have implemented carbon taxes, and it was reported that carbon taxes effectively reduce GHG emissions. In India, the carbon tax was imposed on coal in July 2010 (Sukumaran and Sudhakar 2018). Currently, carbon tax stands at 400 Rs per tonne of coal (both produced and imported). Similar taxation may be charged on airports due to its GHG emission. The concept of voluntary carbon markets has been picking up in India. The inclusion of internal price for carbon is being done in some industries and offices. It may become a part of long-term corporate decision making soon. In this scenario, Indian companies and institutions are looking forward to the execution of the same. In 2018, the Partnership for Market Readiness (PMR) under World Bank announced an 8 million US dollar grant to India to prepare for the use of carbon pricing instruments. This will help in the reduction of greenhouse gas (GHG) emissions. Carbon price varies with the year and is market driven. Similarly, if the internal pricing for the amount of GHG emitted from an airport is taken into consideration, a huge amount of money has to be set aside. International Civil Aviation Organisation (ICAO) have framed strategies to stop the further rise in CO₂ emissions from the aviation sector above 2020 levels. The United Nation's Clean Development Mechanism (CDM) permits a nation-state (industrialist) to purchase emission credits from developing nations to meet its commitment under the Kyoto Protocol (i.e. emission reduction or limitation). These credits can be used to contribute to emission reduction commitments of industrialised countries. CER industry entered India in 2006. India is among the largest credit generators. Due to the excessive supply of CER, policymakers may introduce