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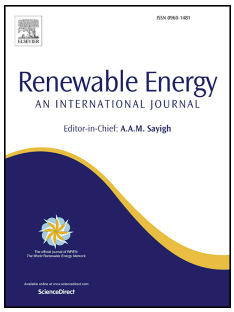

Coal-to-biomass retrofit in Alberta –value of forest residue bioenergy in the electricity system

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Abstract

The use of forest residue may mitigate greenhouse gas emissions by displacing the use of coal or other fossil fuels for electricity generation. However, economic viability of bioenergy requires availability of feedstock at appropriate cost. The current work attempts to quantify delivered biomass cost at plant gate and estimate cost and emission benefits to the electricity system associated with the conversion of coal units to bioenergy. This study is carried out with the optimization model OSeMOSYS, analyzing the Alberta electrical system, its mid-term coal phase-out and renewable energy targets. Alternative scenarios were compared to evaluate the effect of a biomass retrofit option on the incentives needed to achieve 30% renewable penetration by 2030. Results show that although bioenergy has a higher levelized cost than wind power, the system requires less backup capacity and less renewable energy credits to meet renewable energy goals when the biomass retrofit is allowed. In addition, the total system cost to 2060 is found to be 5% less than the scenario without the biomass option. The firm capacity provided by biomass compensates for its higher levelized cost of energy.

Keywords Forest residue; bioenergy; emissions; electrical system; coal conversion

Authors

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1. Introduction

Following the United Nations Framework Convention on Climate Change 2015, a number of countries have announced policies to phase out, or significantly decrease, the use of coal for energy; these include the U.S.A. (1) (2), Finland (3), France (4) and Canada (5) (6). Coal fired electricity is a greenhouse gas (GHG) intensive generator accounting for over 40% of the world's electricity production (7). Given the long operational lifetime of coal generating facilities, accelerated coal phase out can lead to significant stranded capacity and economic cost (8). These factors may impede participation in climate agreements from nations such as China or India where coal represent over 55% of the installed capacity.

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