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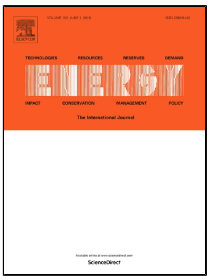

Impact of introducing flexibility in the Colombian Transmission Expansion Planning

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Impact of introducing flexibility in the Colombian Transmission Expansion Planning

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ABSTRACT

Power transmission expansion planning (TEP) is a process affected by uncertainty that requires a long-term vision to anticipate requirements of interconnections among generators and load centers. Flexibility is an alternative to cope with uncertainty that increases social welfare. This article seeks for estimating the value of this flexibility and interpreting its meaning in the Colombian power system. In order to keep this focus clear, we implement a well-known methodology of Real Options (RO) in a simplified version of the Colombian power system. Accordingly, we introduce flexibility using a simple strategy of adding new transmission lines and make a simple comparison with a robust approach, as the one currently used in Colombia. Our results show that introducing this flexibility in the Colombian TEP increases social welfare in around $35 million, which represents an upper bound for the additional investment costs incurred to provide this adapting ability to the power system. These results suggest the need for revising the current paradigm of robust approach to prepare future Colombian transmission plans.

Keywords: Binomial tree; Colombia; flexibility; Option to defer; Real Options; Transmission expansion planning.

1. Introduction

Transmission Expansion Planning (TEP) plays a key role in all power systems around the world because of the requirement of interconnecting load centers and generation units, especially as a mechanism for integrating renewable energy [1]. The increasing penetration of renewable energy poses some challenges on TEP by adding more sources of uncertainty, such as the intermittency of some renewables, and by dealing with shorter construction times of new generation facilities compared to conventional plants [2–5]. As a