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Reliability metrics for generation planning and the role of regulation in the energy transition: case studies of Brazil and Mexico

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Abstract-

In recent years electricity sectors worldwide have undergone major transformations, referred to as the “energy transition”. This has required energy planning to quickly adapt to provide useful inputs to the regulation activity so that a cost-effective electricity market emerges to facilitate the integration of renewables. This paper analyzes the role of system planning and regulations on two specific elements in the energy market design: the concept of firm capacity and the presence of distributed energy resources, both of which can be influenced by regulation. We assess the total cost of different regulatory mechanisms in the Brazilian and Mexican systems using optimization tools to determine optimal long-term expansion for a given regulatory framework. In particular, we quantitatively analyze the role of the current regulation in the total cost of these two electricity systems when compared to a reference “efficient” energy planning scenario that adopts standard cost-minimization principles and that is well suited to the most relevant features of the new energy transformation scenario. We show that two very common features of regulatory designs that can lead to distortions are: (i) renewables commonly having a lower “perceived cost” under the current regulations, either due to direct incentives such as tax breaks or due to indirect access to more attractive contracts or financing conditions; and (ii) requirements for reliability are often defined more conservatively than they should be, overstating the hardships imposed by renewable generation on the existing system and underestimating their potential to form portfolios.

Index Terms- regulation; energy transition; Brazil; Mexico; renewables; reliability; generation system expansion; efficient energy planning

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