**Challenges and Opportunities in the Energy Transition towards 2050: a model-based assessment for Colombia**

**Abstract**

*The energy transition towards 2050 is emerging as a crucial challenge for Colombia. The current prospect shows that while a significant change is being experienced in energy production worldwide, with astonishing growths in renewable sources, remarkable decreases are taking place in all traditional technologies, including hydroelectricity, natural gas and coal generation. In Latin America, out of the total of the new power capacity in place in 2023, 91% were renewable energies.*

*In this context, Colombia faces challenges such as demand increases, high generation costs and oligopolistic concentration. However, it is proposed that the transformation towards a 100% renewable electrical system is achievable through the power of the state and society. Recognition of cost and learning curves, along with technologies such as solar and storage, are key to an efficient transition. Solar energy stands out as a clean and renewable option to reduce dependence on hazardous sources.*

*The energy transition in Colombia raises questions related to costs, demand participation, energy transmission and supply diversification. Defining when and how to make the transition is a challenge, considering the structural configuration of the country.*

*In summary, the energy transition in Colombia towards 2050 requires a comprehensive approach, taking advantage of the potential of renewable energies and overcoming current challenges to achieve a sustainable and reliable electricity system. This paper, taking a model-based approach, assesses possibles paths for the energy transition in Colombia, considering challenges and opportunities.*

**Keywords**: Energy transition, renewables, Latin America, Colombia, modelling, sustainability.