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Integrated Modeling of Transformation of Electricity and Transportation Sectors: A Case Study of Australia

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Abstract : The proposed stringent mitigation targets require an immediate start for a drastic transformation of the whole energy system. The current Australian energy system is mainly centralized and fossil fuel-based in most states with coal and gas-fired plants dominating the total produced electricity over the recent past. On the other hand, the country is characterized by a huge, untapped renewable potential, where wind and solar energy could play a key role in the decarbonization of the Australia’s future energy system. However, integrating high shares of such variable renewable energy sources (VRES) challenges the power system considerably due to their temporal fluctuations and geographical dispersion. This raises the concerns about flexibility gap in the system to ensure the security of supply with increasing shares of such intermittent sources. One main flexibility dimension to facilitate system integration of high shares of VRES is to increase the cross-sectoral integration through coupling of electricity to other energy sectors alongside the decarbonization of the power sector and reinforcement of the transmission grid. This paper applies a multi-sectoral energy system optimization model for Australia. We investigate the cost-optimal configuration of a renewable-based Australian energy system and its transformation pathway in line with the ambitious range of proposed climate change mitigation targets. We particularly analyse the implications of linking the electricity and transport sectors in a prospective, highly renewable Australian energy system.

Keywords : decarbonization, energy system modelling, renewable energy, sector coupling
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