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REVIEWER'S REPORT

Manuscript No.: IJAR-59198

Title: Digital Transformation of Electrical Transmission Infrastructure Through Smart Grid Technologies: A Saudi Vision 2030 Perspective.

Recommendation:

Accept as it is .....

Accept after minor revision.....

Accept after major revision .....

Do not accept (*Reasons below*) .....

Rating	Excel.	Good	Fair	Poor
Originality		✓		
Techn. Quality		✓		
Clarity		✓		
Significance		✓		

Reviewer Id: JPR-369

Reviewer's Comment for Publication.

The manuscript addresses a timely and significant topic concerning the digital transformation of electrical transmission infrastructure through smart-grid technologies, with particular emphasis on the Saudi Vision 2030 context. The review integrates several important technological domains, including synchrophasor-based observability, digital substations, communication infrastructure, edge-cloud computing, artificial intelligence, digital twins, energy storage, grid-enhancing technologies, cybersecurity, interoperability, and digital governance. The manuscript appropriately emphasizes that digital transformation depends not merely on individual technologies but on their coordinated integration with reliable data, communications, cybersecurity, validation, governance, and human oversight.

The objectives and research questions are clearly stated, and the manuscript provides a logical progression from methodology and digital architecture to renewable integration, cybersecurity, the Saudi Vision 2030 context, implementation roadmap, research gaps, practical implications, limitations, and conclusion. The proposed staged transformation framework provides useful practical direction for transmission-system planning.

The literature-review methodology is adequately outlined, including the databases searched, search terms, inclusion and exclusion criteria, and quality-assessment considerations. However, the methodology would benefit from a more detailed description of the screening and selection process, such as the number of records initially identified, duplicates removed, studies screened, and studies excluded at each stage. This would improve the reproducibility and transparency of the review.

The discussion of Saudi-specific implementation is valuable, particularly the recognition that environmental conditions such as high temperature, dust, salinity, long communication distances, and rapid renewable-energy development require local validation. The manuscript also appropriately identifies the lack of sufficient Saudi-specific evidence as an important research gap.

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A further strength is the explicit discussion of limitations. The authors acknowledge that the review is based on 30 peer-reviewed studies published between 2020 and 2025 and that the proposed framework does not provide specific project costs or quantified benefits for the Saudi transmission network.

Minor revisions are recommended before publication:

1. Expand the review methodology to provide a clearer account of the literature-search and screening process.
2. Clarify how the final 30 studies were selected and how study quality was comparatively assessed.
3. Where recommendations are specifically directed toward Saudi Arabia, distinguish more explicitly between conclusions supported by Saudi-specific evidence and recommendations extrapolated from international literature.
4. Strengthen the discussion of the practical economic implications of the proposed transformation roadmap, even if only through a qualitative framework, since the manuscript identifies economic assessment as an important research gap.
5. Review the manuscript carefully for minor formatting, typographical, and reference-consistency issues before final publication.
6. Ensure that figures and tables are sufficiently explained in the main text and that all cited references are consistently formatted.

Overall, the manuscript is well organized, relevant, and technically informative. It provides a useful synthesis of smart-grid technologies from a transmission-level perspective and develops a staged conceptual roadmap relevant to Saudi Arabia's Vision 2030 objectives. The revisions suggested above are primarily intended to improve methodological transparency, contextual precision, and presentation rather than to require substantial restructuring. **Therefore, the manuscript is recommended for acceptance after minor revision.**