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REVIEWER'S REPORT

Manuscript No.: IJAR- 56116

Title: Life-Cycle Environmental Impact of Thin-Film Silicon Solar Cells

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 Name: **ANAPANA GOPAL**

Reviewer's Comment for Publication.

General Comments

The manuscript provides a descriptive overview of the life-cycle environmental impacts of thin-film silicon solar cells, with particular emphasis on energy payback time and the use of hazardous materials during manufacturing and disposal. The topic is relevant and important, especially in the context of global transitions toward renewable energy and sustainable technologies. The paper successfully introduces key concepts related to life-cycle assessment (LCA) and energy payback time (EPBT). However, the work reads more like a narrative review or introductory technical report than a rigorous research article. Significant improvements are required in analytical depth, methodological clarity, updating of literature, and overall scientific presentation.

Content and Originality

The manuscript addresses a well-established topic in photovoltaic research. While the discussion of environmental impacts and energy payback is relevant, the level of originality is limited. Most of the content is based on previously published studies, with little new synthesis, quantitative comparison, or novel interpretation. The focus on thin-film silicon technologies is stated but not consistently maintained, as the manuscript frequently shifts to general silicon PV systems. To improve originality, the authors should either:

- Clearly frame the paper as a review with a strong comparative or critical analysis, or
- Introduce original calculations, case studies, or region-specific life-cycle assessments.

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Technical Quality
The technical discussion is broadly correct but lacks rigor and precision expected of a scientific paper. Key limitations include:

- Absence of a clearly defined LCA methodology (e.g., system boundaries, functional unit, assumptions).
- No original data or calculations of energy payback time; EPBT values are cited from older studies without normalization or comparison.
- Limited quantitative assessment of environmental impacts beyond qualitative descriptions.
- Thin-film silicon technologies are not sufficiently distinguished from crystalline silicon systems in terms of processing routes, material inputs, or impacts.

In addition, some statements are outdated, particularly regarding recycling technologies and energy payback times, which have significantly evolved in recent years.

Language and Presentation
The manuscript requires minor language revision. There are frequent grammatical errors, awkward phrasing, inconsistent terminology, and formatting issues. Examples include missing spaces, inconsistent capitalization, unclear sentence construction, and improper use of symbols and abbreviations. Scientific tone is sometimes informal, and transitions between sections are weak. Professional English language editing is strongly recommended prior to resubmission.

Structure and Organization
The overall structure follows a logical sequence; however, several organizational issues remain:

- The Abstract is overly descriptive and lacks a clear statement of objectives, methodology, and key conclusions.
- Section headings do not always align with content depth (e.g., life-cycle stages are described qualitatively rather than analytically).
- Figures are referenced but not sufficiently discussed.
- The Conclusion section largely restates earlier content and lacks concise, evidence-based takeaways.
- The paper lacks a dedicated methodology or discussion section, which limits clarity and scientific coherence.

References and Citations
The reference list includes foundational works in photovoltaic life-cycle analysis; however:

- Many references are outdated (1985–2008), with limited inclusion of recent literature.
- Some references are poorly formatted and lack complete bibliographic details.
- Web-based sources are cited without consistent access dates or stable links.
- The manuscript would benefit from incorporating recent peer-reviewed studies (last 5–10 years) on thin-film PV LCA, recycling, and sustainability metrics.

Updating and standardizing references according to journal guidelines is necessary.

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Overall Recommendation

The manuscript addresses an important subject but currently lacks the scientific depth, methodological rigor, and clarity required for publication as a research article. With substantial revision—particularly in updating the literature, clarifying the scope (review vs. original research), strengthening technical analysis, and improving language quality—the paper could be suitable for publication as a review or conceptual paper.

Final Decision:

Minor Revision Required

The authors are encouraged to significantly revise the manuscript by:

- Clearly defining the study type and objectives,
- Strengthening analytical and methodological content,
- Updating references and technical data,
- Improving language, formatting, and overall presentation.

Only after these minor revisions should the manuscript be reconsidered for publication.