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REVIEWER'S REPORT

Manuscript No.: IJAR-55490

Title: THERMAL PERFORMANCE OPTIMIZATIONS OF A HEMISPHERICAL SOLAR COOKER WITH ALUMINUM SHEET CONCENTRATORS: APPLICATION TO FOOD COOKING.

Recommendation:
Accept after Minor revision ……

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

Reviewer Name: Dr.K.Arumuganainar **Date:** 30.12.2025

Detailed Reviewer's Report

DETAILED REVIEW REPORT

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1. General Overview

The manuscript presents an **experimental investigation of a hemispherical solar cooker** employing **polished aluminum sheet reflectors**, evaluated **with and without glazing**, for cooking applications such as water heating and frying. The study is motivated by the urgent need for **clean cooking solutions in sub-Saharan Africa**, aligning with **SDG 7 (Affordable and Clean Energy)**.

The work is practically oriented, locally relevant, and demonstrates the **feasibility of achieving cooking and frying temperatures using a low-cost concentrator system**, making it socially and environmentally significant.

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2. Originality and Novelty

Strengths

- Replacement of **imported chrome sticker reflectors** with **locally available aluminum sheets** enhances **practical applicability and scalability**.
- Use of a **hemispherical concentrating geometry** (less common than parabolic systems) adds novelty.
- Comparative analysis **with and without glazing** provides useful performance insights.
- Demonstration of **actual food cooking (potato fries)** strengthens real-world relevance.

Limitations

- The concept is an **incremental advancement** of earlier hemispherical cooker studies, especially by the same research group.
- Novelty lies more in **material substitution and experimental validation** rather than fundamental design innovation.

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3. Relevance and Societal Impact

The manuscript is **highly relevant** for:

- Rural and off-grid cooking solutions
- Reduction of biomass fuel dependency
- Environmental protection and desertification mitigation
- Sustainable energy adoption in developing regions

The paper effectively contextualizes the problem within **Burkina Faso's energy landscape**, making it suitable for journals focusing on **renewable energy, sustainability, and applied thermal engineering**.

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4. Technical Quality and Methodology

4.1 Experimental Setup

✔ Use of:

- **Type-K thermocouples**
- **Hukseflux SR03-05 pyranometer**
- **GRAPHTEC GL200A data logger**

✔ Adequate data acquisition intervals (1–5 minutes)

✔ Real outdoor testing under realistic climatic conditions

Suggestion:

Include a **table summarizing sensor accuracy and uncertainty analysis**, which would improve scientific rigor.

4.2 Device Description

The geometrical parameters of the hemispherical cooker are clearly stated:

- Radius: 0.59 m
- Height: 0.46 m
- Opening area: 1.09 m²
- Reflectivity: ~92–95%

Minor issue:

The **reflectivity value** is mentioned as both **92% and 95%** at different points—this should be clarified.

4.3 Thermal Efficiency Calculation

The manuscript presents a thermal efficiency formula incorporating:

- Oil temperature
- Ambient temperature
- Solar irradiance
- Stefan–Boltzmann radiation losses

Concern:

- The efficiency equation is **not clearly derived**, and some parameters (e.g., emissivity, heat capacity assumptions) are not explicitly defined.

Recommendation:

- Provide a **derivation or reference standard (e.g., ASAE or ISO solar cooker testing protocols)**.
- Clarify whether efficiency refers to **instantaneous or average efficiency**.

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5. Results and Discussion

5.1 Performance Without Glazing

✔ Maximum temperatures achieved:

- Water: **99.9°C**
- Oil: **186.7°C**

✔ Sustained frying temperature (150–186°C) for **over 3 hours**

✔ Strong correlation between solar irradiance and temperature rise

Interpretation is sound, and the results confirm suitability for:

- Boiling
- Frying
- Box cooking

5.2 Performance With Glazing

✔ Achieved:

- Oil temperature: **172.6°C**
- Water temperature: **98.5°C**

Observed reduction in performance due to:

- Cloudy conditions
- Difficulty in focusing solar spot through glazing

Positive aspect:

The authors honestly discuss limitations and experimental challenges, enhancing credibility.

5.3 Data Presentation

✔ Figures clearly show:

- Solar irradiance trends
- Temperature evolution

Issues:

- Some figures lack **axis labels with units**
- Figures are referenced inconsistently (Figure 1 reused multiple times)

Recommendation:

- Improve figure numbering and captions
- Add uncertainty bars if possible

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6. Comparison with Literature

The manuscript effectively compares results with:

- Kossi et al. (2024)
- Ky et al. (2018)

✔ The reported **average efficiency of 21.17%** is higher than previous studies, strengthening the contribution.

Suggestion:

Add a **comparison table** showing:

- Cooker type
- Concentrator geometry
- Peak temperature
- Efficiency
- Cost/materials

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7. Language, Structure, and Presentation

Strengths

- Logical flow: Introduction → Methods → Results → Conclusion
- Adequate referencing (27+ references)
- Clear motivation and conclusion

Areas for Improvement

- Grammar and spacing issues (e.g., “thermal performance optimizations of”)
- Occasional repetition in Introduction
- Minor formatting inconsistencies

Recommendation:

Professional **English language editing** is advised before final publication.

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8. Conclusion Assessment

The conclusions are:

✔ Supported by experimental data

✔ Realistic and well-grounded

✔ Appropriately acknowledge limitations and future work

The suggestion to test during **March–April (higher solar elevation)** is particularly valid.

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9. Ethical Considerations

- No ethical issues identified

- No conflicts of interest reported
- Acknowledgements appropriately included

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10. Overall Recommendation

Final Verdict: ACCEPT WITH MINOR REVISIONS