

Sustainability Assessment of Perovskite Solar Cells

Application for Emergency Shelters

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Abstract

Concise summary of objectives, methods, key findings, and conclusions. Will do last.

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1 Introduction

This study conducts a comprehensive sustainability assessment of emergency shelter tents¹, examining their environmental impact, economic feasibility, social consequences, and socio-environmental trade-offs. Rather than addressing shelters in a broad sense, the focus is specifically on common types of emergency shelter technologies and the energy systems that support them.

The frequency and magnitude of natural disasters around the world highlight the significance of sustainable emergency shelters. Each year, over 100 countries are affected, with more than 200 million people impacted and an estimated 20 to 40 million individuals requiring temporary shelters (Alves, B., 2014). As a *[engineering/design/sustainability]* student, I am motivated by the challenge of balancing humanitarian² needs with environmental responsibility. The ability to provide timely, efficient, and sustainable shelter in disaster situations is life-threatening, making the assessment of emergency shelter technologies highly relevant.

Three distinct power solutions come to mind:

- **Perovskite-integrated shelters:** The primary focus, representing an emerging technology with potential advantages in efficiency and manufacturing cost compared to conventional options.
- **Silicon solar-equipped shelters:** Serving as the baseline renewable alternative, with established performance data and widespread deployment in field operations.
- **Diesel generator systems:** Representing conventional power solutions for shelters in grid-independent scenarios, despite their known environmental drawbacks.

This selection encompasses both mature and emerging technologies to provide a balanced perspective on sustainability trade-offs in disaster response applications.

The primary objective is to compare these power options to understand their implications for both sustainability goals and disaster relief efforts.

¹ An emergency shelter tent is a portable structure, often lightweight and easy to set up, designed to provide temporary protection from the elements in emergency situations. It offers a safe and sheltered space, especially in scenarios where traditional housing is unavailable or inadequate, as noted by Gala Tent (2024) and ICBrindle (2022) ² Concerned with or seeking to promote human welfare. *"groups sending humanitarian aid"*

2 Environmental Assessment

- Selection of environmental indicator
- Following LCA method (goal and scope, inventory, impact assessment, interpretation)
- Data collection (well referenced, data quality, robust assumptions made) for the inventory
- Estimating total emissions (impact assessment)
- Identify largest emissions and key sources (hotspot analysis)

3 Economic Assessment

4 Social Assessment

5 Interpretation / Discussion / Incorporation into Design

6 Conclusions

7 References

1. GalaTent (2024). *Emergency Medical Tents and Shelters*. [online] Available at: <https://www.galatent.co.uk/uses/emergency-medical-tents-and-shelters>.
2. ICBrindle (2022). *Rapid Deployment Inflatable Emergency Shelters*. [online] Available at: <https://icbrindle.com/rapid-response-inflatable-shelters/inflatable-emergency-shelters-tents.html>.
3. Alves, B., (2014). *Topic: Natural disasters*. [online] www.statista.com. Available at: <https://www.statista.com/topics/2155/natural-disasters/>