

Rub' al Khali Solar Energy System (RKSES)

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Problem Statement

- Challenges in Solar Energy:** Renewable energy providers in Saudi Arabia face a problem with solar panel inefficiency and high maintenance due to extreme heat, dust, and sandstorms. For energy companies who require efficiency in harsh conditions, Rub al Khali Solar Energy System (RKSES) is a solar energy system that ensures reliability under extreme conditions. Unlike traditional panels, RKSES features advanced cooling and protection, offering sustainable, long-term performance.

Prototype Design

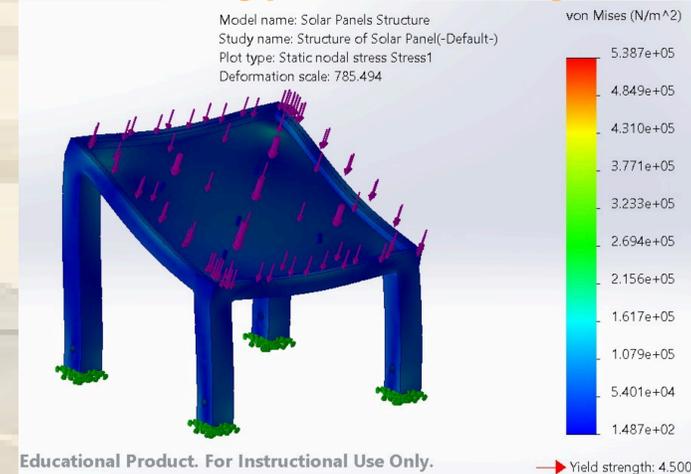


Prototype Design Overview

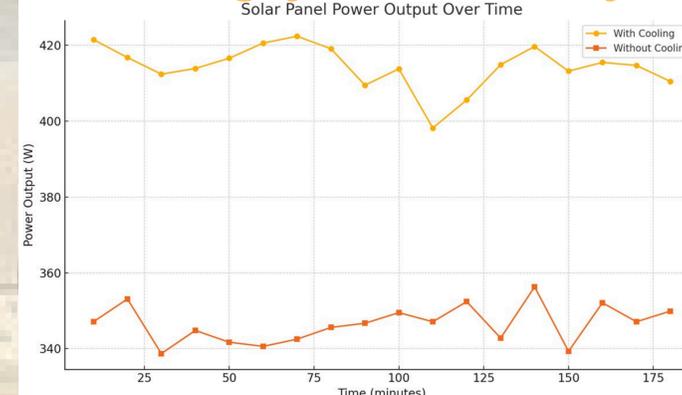
- Structure:** Angled frame with four sturdy legs, optimizing sunlight exposure.
- Environment Suitability:** Designed for deserts, leveraging abundant sunlight.
- Stability:** Blocky leg bases with mounting holes for secure anchoring on uneven or sandy terrain.
- Durability:** Built to withstand windy desert conditions.
- Functionality:** Minimalist design ensures ease of installation.
- Application:** Ideal for large-scale deployment in remote desert locations, as shown in the "RKSES" scene above.

Testing / Validation

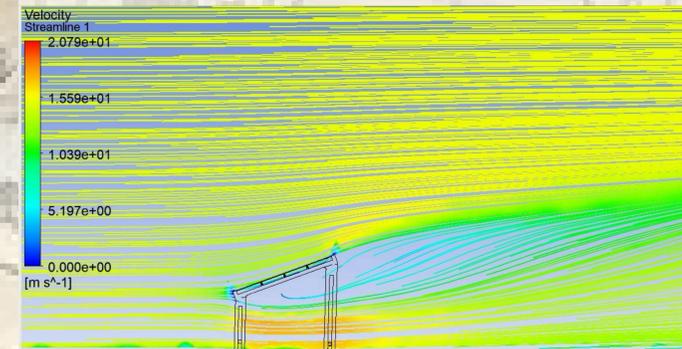
Prototype Stress analysis



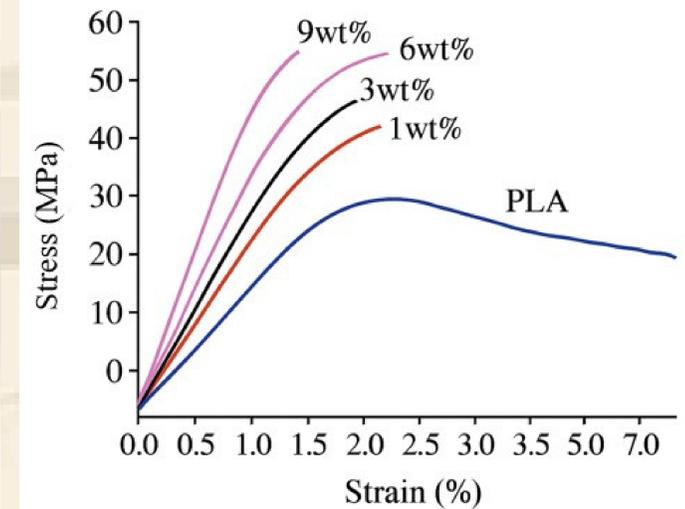
Cooling system efficiency



Airflow simulation



Material Selection



Conclusion

- Efficiency in Extremes:** RKSES overcomes desert challenges (heat, dust, sandstorms) with advanced cooling, IR reflection, and durable materials, ensuring $\geq 85\%$ efficiency at 60°C .
- Innovative Design:** Modular, scalable structure with angled frames and secure anchoring enables easy deployment in harsh terrains.
- Proven Performance:** Validated via airflow simulations, cooling tests, and stress analysis, achieving 25% higher energy capture and $15\text{--}20^\circ\text{C}$ temperature reduction.
- Sustainable Impact:** Enhances Saudi Arabia's renewable energy goals with reliable, low-maintenance solar solutions for remote desert regions.

Constraints & Specifications

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| Reduces panel temperature by $15\text{--}20^\circ\text{C}$. | Maintains $\geq 85\%$ efficiency at 60°C |
| Increases energy capture by 25% | Modular design for 1 m^2 to utility scale |
| Operates reliably at $\geq 60^\circ\text{C}$ | Identifies optimal sites by irradiance |
| Reflects $\geq 85\%$ of infrared radiation. | High resistance to dust, sandstorms |