

Assignment 1 Research Methodology

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Research Example: Improving the efficiency of Solar Panels

Scientific Method of doing Research:

1. Pose the Question:

In the above topic the researchers are driven by the need for sustainable energy solutions by the which the question can be posed as "How can the efficiency of solar panels be improved to maximize energy production and reduce costs?" The present Solar Panel technologies have some limitations.

2. Existing Theories and Observations:

Current solar panel technologies, primarily based on silicon photovoltaic (PV) cells, have theoretical efficiency limits around 30%. However, most commercially available panels achieve efficiencies between 15% and 22%. The existing literature highlights various factors affecting solar efficiency, including material properties, panel orientation, shading, and environmental conditions. Studies have shown that improvements in cell design, such as the development of monocrystalline and bifacial panels, can lead to better performance under varying conditions.

3. Formulate Hypotheses:

Based on existing theories and observations, several hypotheses can be formulated:

- **Hypothesis 1:** Utilizing advanced materials, such as perovskite or tandem solar cells, will significantly increase the efficiency of solar panels beyond the current limits.
- **Hypothesis 2:** Implementing optimal installation practices, including proper orientation and avoidance of shading, will enhance the energy output of existing solar panel systems.

4. Deduce Consequences and Make Predictions:

If the hypotheses hold true, we can predict that:

- The adoption of new materials and technologies will lead to solar panels achieving efficiencies of over 30%, making them more competitive with fossil fuels.
- Improved installation practices will result in a measurable increase in energy output, potentially up to 40% more than poorly installed systems.

5. Tests, New Observations, and Proofs:

To test these hypotheses, empirical research is necessary. This could involve:

- Conducting field tests comparing traditional silicon panels with new materials like perovskite and tandem cells to measure efficiency gains under real-world conditions.
- Implementing a series of installations with varying orientations and shading conditions to quantify the impact on energy production.

The study in "Frontiers in Energy Research" discusses various experimental setups that have successfully demonstrated increased efficiencies through innovative designs and materials.

6. Old Theory Confirmed or New Theory Proposed:

The results from these tests may either confirm existing theories regarding the limitations of silicon-based solar cells or propose new theories related to the capabilities of emerging technologies. For instance, if perovskite cells consistently outperform traditional silicon cells, it may necessitate a reevaluation of the materials deemed suitable for solar energy applications.

7. Consistency Achieved:

Achieving consistency in results across multiple studies will be essential for validating the findings. If various independent studies report similar efficiency improvements with the same new technologies, this will strengthen the case for their adoption in commercial applications.

8. Selection Among Competing Theories:

The final step involves comparing the new findings against existing theories and technologies. For example, if tandem solar cells demonstrate superior performance, researchers and industry stakeholders must consider their viability against traditional silicon panels, including factors such as cost, scalability, and long-term reliability.

Conclusion:

The research process as discussed above shows the systematic approach needed to tackle the challenge of improving solar panel efficiency. By posing critical questions, formulating and testing hypotheses, and analysing results, research can be done to contribute to the advancement of solar technology, ultimately leading to more efficient and sustainable energy solutions. The ongoing exploration of materials and installation practices, as discussed in the “Frontiers in Energy Research” article, is vital for achieving these goals and addressing the global energy crisis.

References:

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3. [7 Powerful Tips to Maximize Your Solar Panel Efficiency | Freyr Energy](#)
4. [How to Improve the Efficiency of Solar Panels \(renewableenergyhub.co.uk\)](https://renewableenergyhub.co.uk) - Janet Richardson
5. [Solar cell efficiency and how to improve it — RatedPower](#) - Altair Veiga
6. [Solar panel efficiency to increase 50% with “miracle” cells | Sustainability Magazine](#) - Lucy Buchholz
7. [Solar Performance and Efficiency | Department of Energy](#)