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ECO-FUTURISM IN SPACE ROBOTICS: ADVANCING ENERGY EFFICIENCY AND  
SUSTAINABILITY IN THE ASIA PACIFIC REGION

**Abstract**

The sustainability and the efficiency of the technologies implemented is the demarcation line for the advancement in space exploration. An escalating field such as sustainable energy sources and their application in space robotics, significantly contribute in order to achieve this. Solar energy technologies, efficiency of solar panels, photovoltaic cell performance are crucial factors in utilizing energy in space. Thus, our study comprehensively examines the Asia-Pacific (AP) regional contribution in these innovative technologies and their integrations. Additionally, pioneer solutions for energy storage, inquire about the latest technologies in batteries and energy retention abilities which are crucial factors to prolong space missions are also explored here. Furthermore, by evaluating the viability, safety, and capacity in space robotics, alternative energy sources like fuel cells, nuclear energy, and how they are efficiently used in a challenging environment like space are also examined. Hence this study emphasizes not only the technological strides but also their sustainability along with the environmental impacts from fabrication to active lifespan followed up by decommissioning. Usage of eco-friendly materials, waste management, material reuse and recycling, and deduction in accumulation of space debris are also discussed here since circular economy model development is underlined for eco futurism in robotics and sustainability in space. Many AP regions' case studies showcased regional innovations and contributions to the global quest. They offer insights to the real-world challenges and solutions in energy efficiency and sustainability. Also, this aims to promote more research in the field and collaboration within the AP region. Our research provides a holistic view of the current state and future potential of sustainable energy solutions in space robotics. This viewpoint underscores the significance of adapting advanced technologies with ecological accountability, arguing for a fundamental transformation towards eco-futurism in space exploration