OPPORTUNITY #48

What if energy was stored in space?

SPACE AS STORAGE

Space becomes a site for mass energy storage, with supercapacitors transmitting energy to meet all human needs both on earth and in space.

MEGATREND
Energy Boundaries

TRENDS
Future of Space
Transforming Energy

SECTORS AFFECTED
Agriculture & Food
Materials & Biotechnology
Automotive, Aerospace & Aviation
Communication Technologies & Systems
Data Science, AI & Machine Learning
Energy, Oil & Gas & Renewables
Infrastructure & Construction
Insurance & Reinsurance
Logistics, Shipping & Freight
Manufacturing
Metals & Mining
Utilities

WHY IT MATTERS TODAY

Global energy consumption is expected to increase by 50% by 2050, with renewable energy use projected to grow at the same rate[798] as there is a strong trend towards renewable energy as countries seek to reduce their reliance on fossil fuels and cut their emissions while better preserving natural ecosystems.[799]

However, there are certain problems with the production and use of energy from sources such as solar radiation, wind and other natural sources. Energy derived from solar panels or wind needs to be charged in preparation for consumption, and energy needs to be stored properly for long-term availability[800] particularly when there is not enough sunlight or there are unfavourable wind conditions. This is especially the case during long, dark winters, when energy is in high demand.[801]

In space, the need for long-term energy storage is also growing. As of 2021, the space launch market was worth $6.6 billion with a compound annual growth rate (CAGR) of nearly 15%,with market growth primarily driven by rising demand for small satellites.[802] The United States is planning to build a lunar base through its $93 billion Artemis programme.[803] A similar joint venture was announced by Russia and China in 2021. They aim to set up an uncrewed lunar base around 2030.[804] In 2023 at least six countries – India, Japan, Russia, South Korea, United Arab Emirates and the United States – intend to send missions to the moon.[805] And with more people increasingly becoming interested in space tourism and not just to experience space conditions but also to experience living in space,[806] greater capabilities are required for long-term energy storage.

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INDIA
JAPAN
RUSSIA
SOUTH KOREA
UAE
UNITED STATES

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THE OPPORTUNITY

The ability to store energy in space would not just expand what can be done in space but also revolutionise access to energy on earth. Finding robust and efficient methods of long-term energy storage will be important. Storage of energy in space can provide a solution and help to future-proof the planet against a possible energy crisis.

The most notable feature of supercapacitors, when they are used as energy storage devices, is their ability to bridge the gap in energy between conventional capacitors, batteries and fuel cells. They also have high power density and a long life span.[807] The global supercapacitor market was valued at $5 billion in 2021. Expanding at a CAGR of just over 23%, it is expected to reach a valuation of $25 billion by 2030.[808]

With sufficient advances – in areas such as materials science, advanced machine intelligence, nanotechnology and robots – massive energy-storage units with powerful, lightweight supercapacitors can store vast reserves of energy generated in space (via solar or other technologies), benefitting from space's unique conditions (cold and zero gravity). This energy can then be beamed to earth on demand or used for space stations, exploration and bases as a reliable source of power.

BENEFITS

Expanded access to energy on earth, supporting further space activity and contributing to growth.

RISKS

Human-caused or accidental damage (e.g. from space debris) to space energy-generation facilities and supercapacitors. Maintenance costs (due to damage) that make facilities too expensive to maintain.

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