

Harnessing the Sun The Potential of Beaming Solar Power from Space

The Sun is a 1.4 million km ball of fusion that releases the energy equivalent of **4 million tonnes of matter** every second. However, only a tiny fraction of the Sun's energy can be harnessed on land compared to what could be collected from space.



Did you know that the Sun radiates 4×10^{26} Watts of energy every second—Over 5.5 trillion times what humanity consumed in 2023?

Sources: Big Think, 2024; Statistical Review of World Energy, 2024

So, how much of the Sun's energy could humanity use?

Earth's Energy Budget



16%
Absorbed by Atmosphere

6%
Reflected by Atmosphere

3%
Absorbed by Clouds

20%
Reflected by Clouds

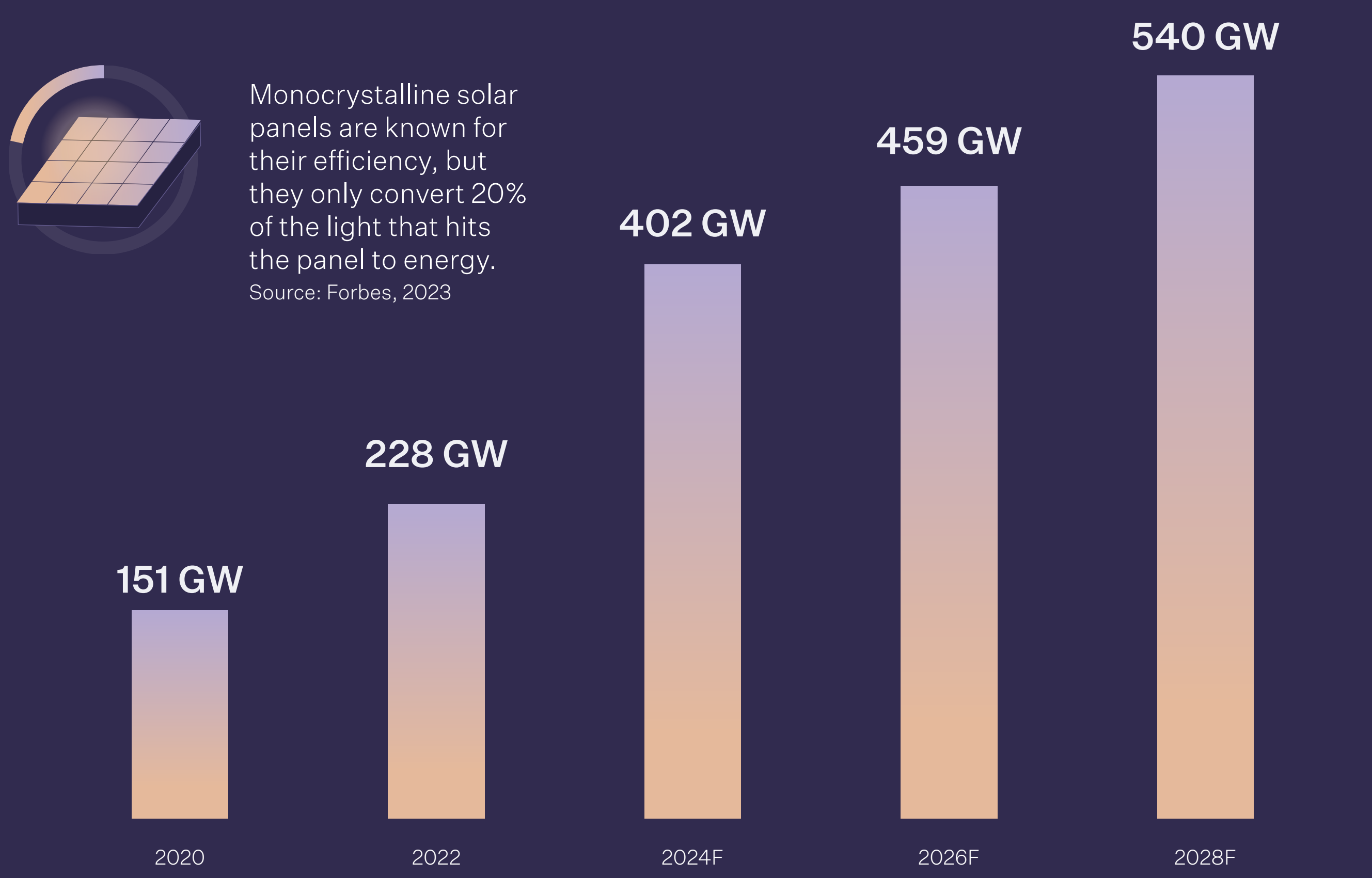
51%
Absorbed by Land and Oceans

4%
Reflected by Earth's Surface

Only 51% of Earth's energy budget from the Sun reaches its surface, and even less is harvested by current solar technology.

Source: NASA GPM via UCAR, 2024

Global Solar Energy Capacity*



*Figures rounded to the nearest whole number. Source: IEA, 2023

Solar energy plays a pivotal role in the transition towards net zero. However, satellites could supply vast amounts of clean energy and avoid obstacles associated with land-based solar power.

What are Space Solar Satellites?

Space solar satellites collect energy similarly to land-based solar energy systems, but they sit in orbit where weather conditions and the time of day don't hamper their ability to gather energy.

Laser Satellites

Groups of satellites beam energy to collecting stations on Earth using lasers.

Deployment Altitude

400 KM

Energy Collection (per satellite)

1-10 MW

Source: Energy.gov, 2024

Microwave Solar Satellite

Light is reflected in the center of the satellite, which is converted to microwaves and beamed to earth.

Deployment Altitude

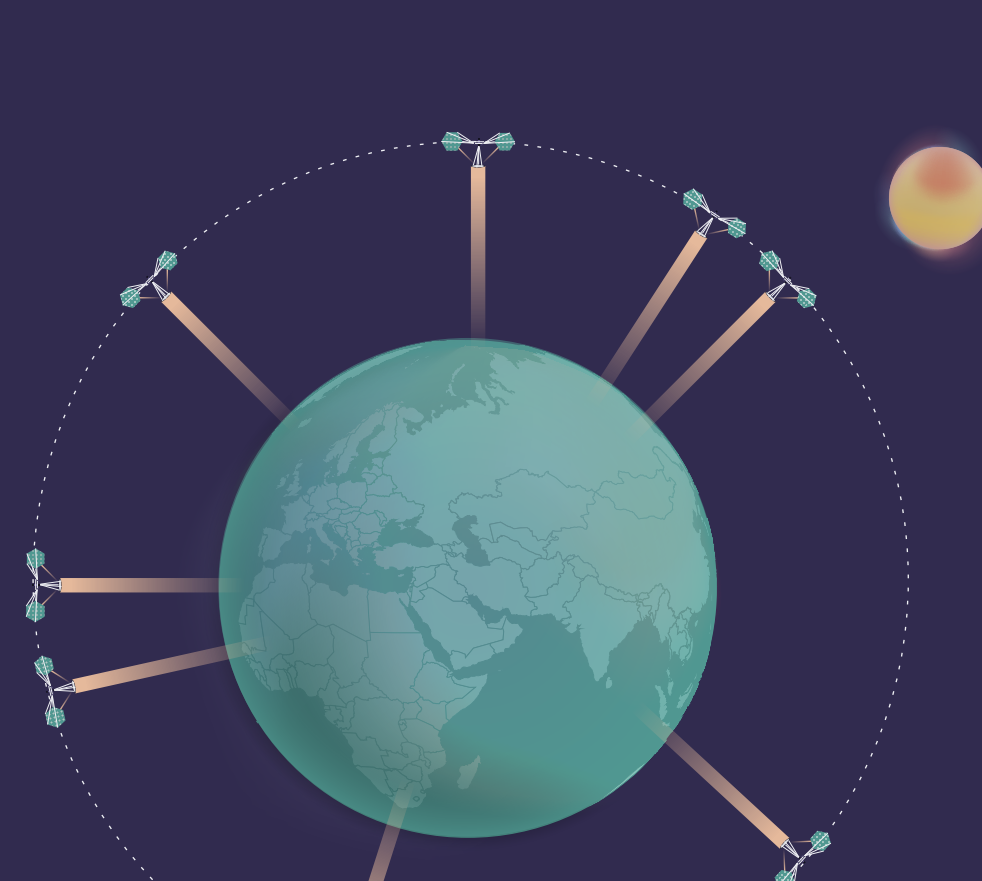
35,000 KM

Energy Collection (per satellite)

1 GW+

Spurred on by the need for clean energy, in 2023, scientists achieved the first successful wireless transmission of solar power from space to Earth.

Source: Space.com, 2023



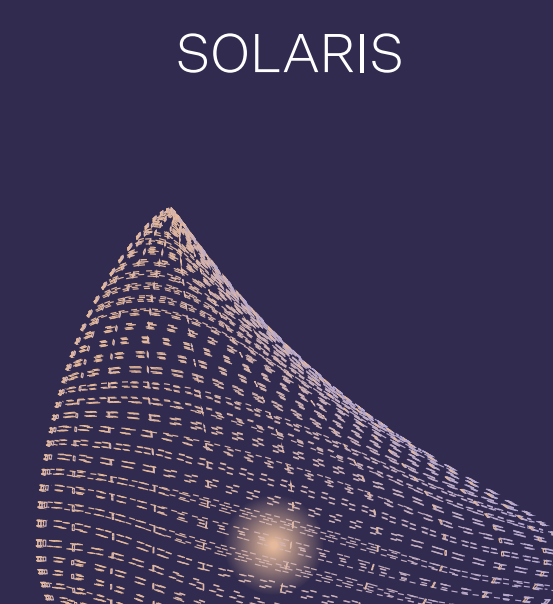
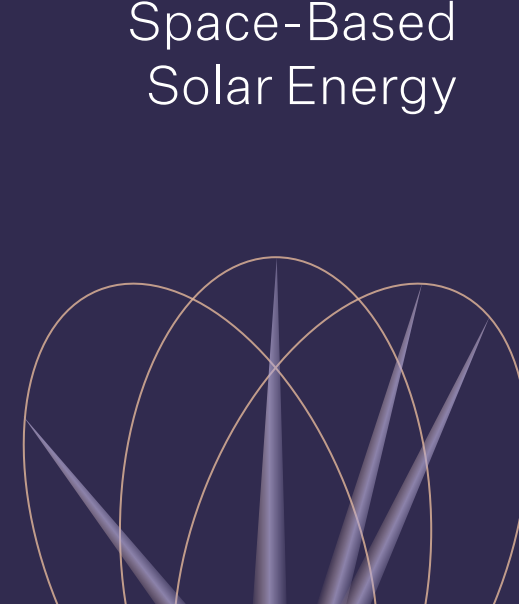
Current Space Solar Projects

CASSIOPEIA

Innovative Heliostat Swarm Concept

Space-Based Solar Energy

SOLARIS



SPACE SOLAR

A

VIRTUS SOLIS x ORBITAL

esa SPACE SOLUTIONS

Sources: Gizmodo, 2023; NASA, 2024; Space.com, 2024; ESA, 2022

By maximizing the potential of the Sun's energy budget, space solar power collection could help us achieve a green and sustainable future and provide near-limitless power for all.

Sign up now for a chance to join the session and dive deeper into this topic at the 2024 Edition.

Join Us at the Session

Deflecting the Sun: Is Geoengineering the Solution to Climate Change?

Is Geoengineering the Solution to Climate Change?