

## Virtus Solis Space Based Solar Power Plant

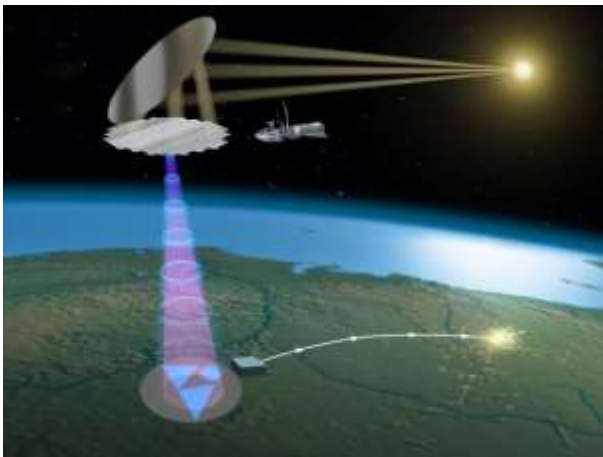
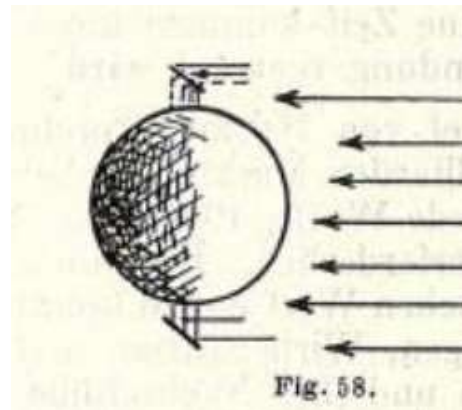


Image credit: Virtus Solis



Oberth: *The Rocket into Planetary Space* [1]

How similar the pictures are: Hermann Oberth's proposal to harness solar energy with a mirror consisting of individually adjustable facets is over 100 years old, promising "colossal effects could be achieved" with a 1.000 km wide mirror— and he even suggested an implementation plan (see Ref.1, page 87). [1]

Now we might have the technology to realize the dream of cheap, unlimited energy supply for our planet.

The **Virtus Solis** company's project with the same name is a space-based solar power plant (SBSP) concept that aims to harness solar energy in space and transmit it to Earth. The idea is to place large solar panel arrays in orbit, where they can collect sunlight 24/7 without the interference of clouds or nighttime. This solar energy is then converted into microwaves or laser beams and transmitted down to receiving stations on Earth, where it is converted into electricity and fed into existing power grids.

Key points about the Virtus Solis concept include:

- **Constant Solar Power:** Unlike ground-based solar plants, space-based solar panels can collect sunlight continuously, offering a reliable energy source.
- **Large-scale Deployment:** The project envisions the deployment of vast solar arrays in a highly eccentric 12 hr medium earth orbit (called *Molnyia* orbit), ensuring a 11.5 hr maximum sunlight exposure.
- **Energy Transmission:** The collected solar energy is transmitted wirelessly to Earth using microwaves or laser technology, allowing for flexible deployment of receiving stations.
- **Environmental Impact:** The system is designed to be eco-friendly, producing clean energy without emitting greenhouse gases or using large land areas on Earth.

Although SBSP projects like Virtus Solis' are still in the conceptual or developmental phase, they represent a potentially revolutionary approach to renewable energy by tapping into the virtually limitless energy of the sun from space. Challenges include high costs, the complexity of deploying and maintaining space infrastructure, and addressing potential risks associated with energy transmission.

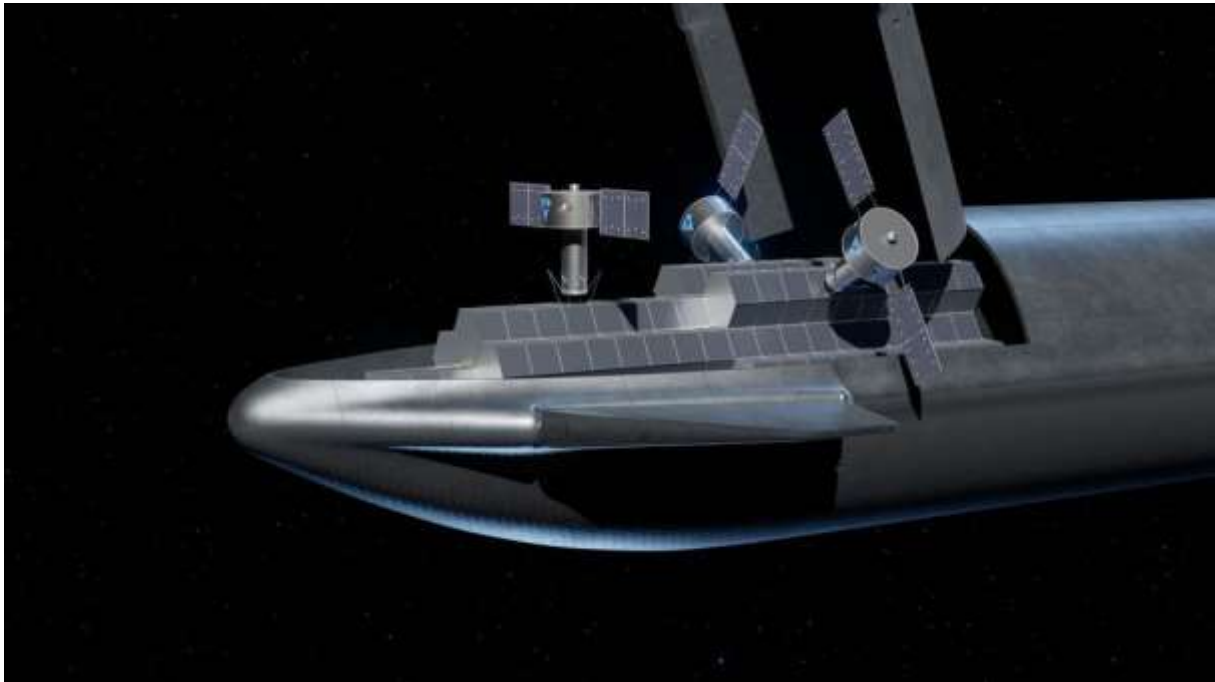
### Virtus Solis Design Approach [2]

Mass manufacturing lessons and a tinge of SpaceX's experimentalist chutzpah are helping the startup design an orbiting solar power plant at an unexpectedly low cost.

The power array will be placed in a highly elliptical 12 hr medium earth orbit using available or future mass transportation systems like the SpaceX Starship.

Industrial robots will assemble Virtus Solis' solar power plant and are commercially available, like Kuka KR6 robots used in car manufacturing all over the world. Virtus Solis' partner company Orbital Composites modified these robots for use in space. Weighing 52 kilograms each, the robotic arms will be dressed in custom-made 'space suits' resembling a corrugated tube to protect them from cosmic radiation and extreme temperatures.

The carrier that will deliver the robots could be the existing 470-kg ESPASatellite bus made by Northrop Grumman that is commonly used to host technology demonstrators and experimental payloads, or the SpaceX *Starship*.



*An illustration of a SpaceX Starship deploying several 'orbital power manufacturing satellites' (solar modules) using modified industrial robots. (Image credit: Virtus Solis)*

The end-effector of the robots —the gripping mechanism will take the honey-combed shaped solar modules (i.e., *thin-tile satellites capable of delivering 1kW of power to Earth*) out of the carrier and click them together in space—is the only part of the robot that Virtus Solis is designing in-house.

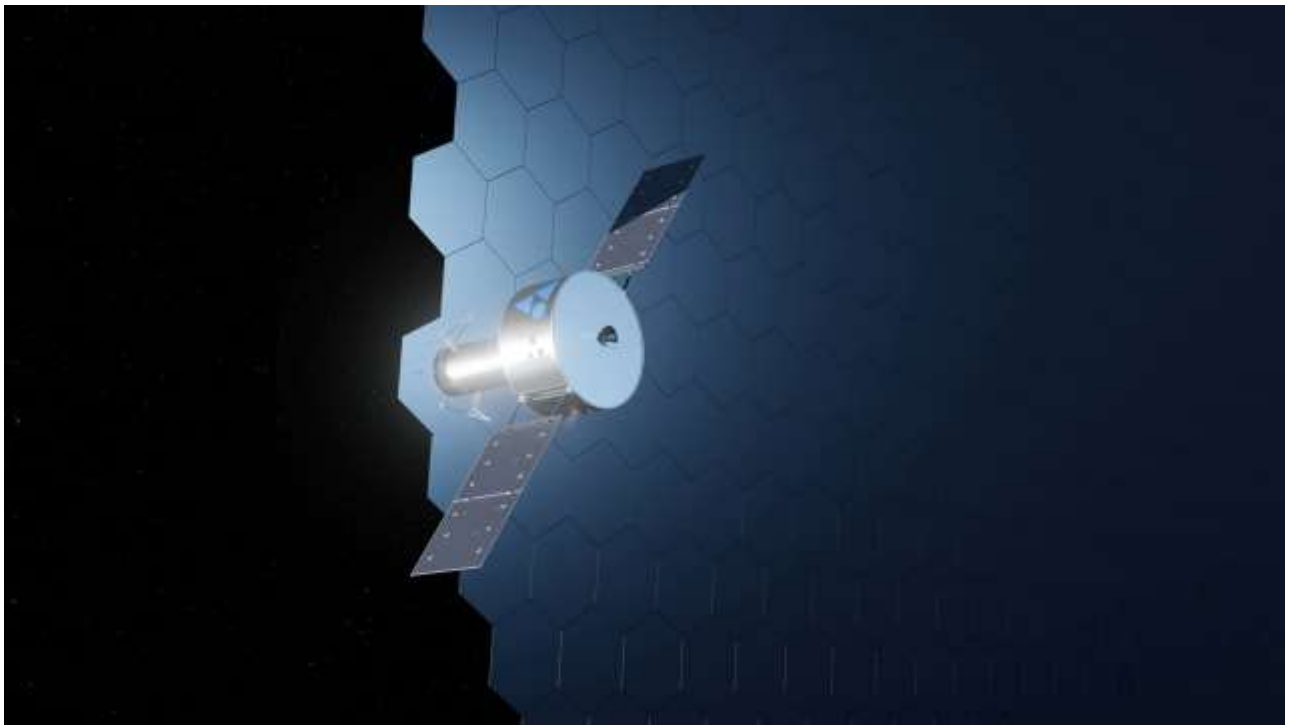
“Moving the arm is easy,” Bucknell told Engineering.com. “But designing the end-effector that grabs the solar modules acting like satellites is tricky. How do you pick up a big flat piece in space? Vacuum doesn't help. You can't just put a sucker on it. You need to be able to grab it and pick it up and do it in time. This time savings can help make space based solar power a reality sooner by removing bottlenecks and keeping the engineering team focused on optimal system performance.

In 2027, if all goes to plan, a couple of car-making robots dressed in 'space suits' and attached to a free-flying satellite bus will assemble a 28-meter-wide solar power plant in Earth's orbit. The plant will consist of 217 hexagonal photovoltaic solar modules, each 1.65 meters wide, that click together like a honeycomb. The assembly will produce 100 kilowatts of clean solar energy and beam it to Earth.

That's just the demonstrator. Three years later, Michigan-based start-up Virtus Solis hopes to build its first commercial-scale power station—1,000 times as large as the demo and capable of generating 200 megawatts. Such a way that is convenient, fast and robust.”

In July 2024 Virtus Solis announced its collaboration with the California based company Artificial Genius (AG) to accelerate their system development using AG's patented design optimization

solution. Virtus Solis expects this unique and patented solution to reduce development times by more than 90% on key parts of software embedded in satellites and manufacturing.



*Depiction of how Virtus Solis plans to build its solar array in space or replace individual defect honey-combed shaped solar modules. (Image: Virtus Solis.)*

What will this project cost? NASA, in a [report on space-based solar power](#) published in January 2024, concluded that made-in-space electricity will be rather expensive—12 times the cost of Earth-based photovoltaics. [A 2022 study by Frazer-Nash Consultancy](#) on behalf of the European Space Agency concluded that a first-generation commercial-scale space-based solar power plant would come with a price tag of at least €9.8 billion (\$10.7 billion).

Virtus Solis CEO and ex-SpaceX rocket engineer John Bucknell thinks his company can pull it off for less than \$1.5 billion. [3]

Bucknell, who founded Virtus Solis in 2018, thinks he can achieve the ambitious price tag and the even more ambitious timeline by applying a combination of principles from automotive mass manufacturing, a field in which he worked for three decades, and SpaceX-inspired experimentation.

*Because the sun always shines in space, a space-based power plant with a correctly selected orbit could provide a constant source of electricity. Government agencies around the world from regions including China, Japan and Europe are exploring the idea of beaming solar power from space.*

***Virtus Solis thinks they can make it work faster, better and cheaper.***

## References

- [1] Herman Oberth: The Rocket into Planetary Space  
<https://www.amazon.com/Rocket-into-Planetary-Space/dp/3486754637>
- [2] Virtus Solis <https://virtussolis.space/our-technology>
- [3] Solar power plant <https://www.engineering.com/how-virtus-solis-plans-to-build-a-solar-power-plant-in-space/>