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Steve Bonahoom

Stephen Buchannan

Garrett Clem

Connie Nemec

Jacqueline Deavenport

See next page for additional authors

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Creative Visualization of Space Solar Power

Authors

Steve Bonahoom, Stephen Buchannan, Garrett Clem, Connie Nemec, Jacqueline Deavenport, S. Phanuthep, Victor Sherrick, Jason Showalter, Jessica Staub, Michael Stephens, Douglas Trein, David Young, and Joey Zhang



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Students: Steve Bonahoom, Stephen Buchannan, Garrett Clem, Connie Nemece, Jacqueline Deavenport, S. Phanuthep, Victor Sherrick, Jason Showalter, Jessica Staub, Michael Stephens, Douglas Trein, David Young, Joey Zhang

Mentors: Keith Henson, John Strickland, Dennis Wingo

Instructors: Prof. Don Flournoy, John Bowditch, Tyler Ayres, Kyle Perkins

ABSTRACT

Electricity is one of the most flexible, cost effective and non-polluting sources of power at the point of use. Energy from Space will be key to achieving and sustaining universal access to this form of power, since all known energy supplies on Earth will be insufficient to keep up with projected world demand for electricity

About 80% of our current energy supply is in the form of fossil fuels. Greater diversification and augmentation of energy sources is needed. To protect our planet, our long-term goal must be to find alternative energy supplies that are clean, renewable, affordable, and available to everyone. Guaranteed access to non-polluting energy is a controlling variable for local and national security, economic and social development and a good quality of life for everyone. Thus, as citizens of Planet Earth, we are fortunate that solar power satellites can now be used to reach up and harvest the abundant energy that is available just outside Earth's atmosphere.

[Sol Invictus: The Unconquered Sun - Introduction](#)

[Sol Invictus: The Unconquered Sun - SunSats](#)

[Sol Invictus: The Unconquered Sun - Conclusion](#)

TECHNICAL BRIEF

The idea of using satellites in orbit above the Earth to collect and deliver Energy is not a new idea. But only recently have space scientists and engineers figured out how to build, launch and implement a space-based solar grid capable of generating a source of non-polluting power sufficient to reduce our dependence on fossil fuels.

Terrestrial solar and wind power are moving us in that direction, but depending on the location, about 20-times less energy can be harvested per square meter on Earth than in space. One of the reasons why only about 1% of the world's energy comes directly from the Sun is because of high photovoltaic cell costs and PV inefficiencies in converting sunlight into electricity. With breakthroughs in conversion efficiencies of PV cells and the costs of producing them, these economic and technical limitations are being overcome.

By assembling in space orbit a single solar power satellite, consisting of highly efficient solar arrays spanning 10 Km across, space scientists predict that as much as 1Gw of electricity can be continuously beamed to Earth. This amount of energy is comparable to the productive capability of a single coal-fired or nuclear power generation plant. When multiple solar power satellites are launched into Earth orbit, forming an in-space power grid, 24-hour electrical generation capable of reaching all nations from space becomes a plausible goal. With replacement energy from space, conceivably significant reductions in the burning of fossil fuels can be achieved, addressing a principal cause of run-away climate change.

In November 2011, the International Academy of Astronautics (IAA) made public the findings of its two-year study "The First international Assessment of Space Solar Power: Opportunities, Issues and Potential Pathways Forward," edited by John C. Mankins (USA) and Nobuyuki Kaya (Japan). In its press release at the National Press Club in Washington D.C. in Nov. 2011, the IAA made four points:

1. Space solar power is now technically feasible;
2. Space solar power is within reach as an economic investment;
3. Space solar power can be made environmentally safe; and
4. (from a future perspective) Space Solar Power is now an international necessity.

BUSINESS PLAN

The global satellite industry is a mature business. Communication satellites have been operating safely and profitably in orbit around the Earth for more than 40 years. Weather and geo-positioning satellites and those in service to government and military institutions are now perceived to be indispensable in the modern world.

To that industry, a huge new business is soon to be added; the Energy market is opening for satellite manufacturers, launch providers and space businesses, most likely in collaboration with the utility companies of nations seeking to augment and sustain the power that flows through their electrical grids.

It can be predicted that the emerging solar power satellite (SunSat) industry will position above Earth a new type of energy infrastructure, having many of the features of communication (ComSat) platforms that include orbiting spacecraft powered by solar arrays, each hosting onboard systems for wireless power transmission. Their antennas will be designed to collect and concentrate solar thermal or photovoltaic energy for the purpose of relaying it to Earth, where it can be used on-site or to be fed into terrestrial electrical grids.

The development of thinner, lighter, cheaper PV cells that make terrestrial power production increasingly more efficient also benefits space solar producers looking to reduce the size and weight and increase the productivity of their antennas. These developments also hold down the costs of launching the much larger solar collection arrays into space. Also to be noted are the promising new developments in remote construction, assembly, repair, replacement and refueling of ComSat spacecraft in-orbit that are now catching the attention of SunSat designers and start-ups.

On Earth, the receiving antennas (rectennas) of space-based solar power will inevitably be much larger than those used for communication. With the networked arrays of terrestrial antennas capable of producing electrical rating equivalents of coal fired or nuclear powered plants at 1Gw or larger, solar powered antennas can be expected to stretch 1-10Km across.

Where will these receiver sites be located? Logical locations are at existing utility sites, including placement at abandoned nuclear and mining locations (of which there are thousands around the world). Some designs locate space solar receiving antennas on top of agricultural greenhouses, algae ponds, fish farms, oil well drilling platforms and disaster recovery sites. Others are intended to deliver the sunlight needed to extend the solar day of existing solar farms.

For launch, SunSats can be expected to employ the same private, commercial and government

rockets used by ComSats to lift their payloads into space. Some plans involve assembling solar satellites and their arrays from components lifted by medium power rockets into lower orbit, possibly using the International Space Station (ISS) or other orbiting platform as a staging area prior to transferring the assembled unit into a suitable final orbit. As of 2013, the commercial space industry had earned a 90% success record in delivering its payloads into designated orbits.

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