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# Affirmative Strategy Notes

Advantages modules should not all be run at the same time—you should, for example, probably not read oil shocks = adventurism along with the leadership adv (b/c heg impact probably in tension with that).

We didn’t do a lot of impact work in this file. As you refine the aff to run during the season, if you don’t have a lock on the warming debate, the heg debate, please feel free to email Tracy at tmcfarland929@gmail.com for some cites. She’s happy to help.

We also put space based solar power solvency cards in each advantage along with a solvency contention that defends the plan mechanism. In the future, if you wanted to specify a particular agency, we have provided those solvency cards. However, the benefit of the plan as written is that you can claim all of the agencies, including an executive order, would be normal means of the national coordinated policy.

The coordinated policy would also include things like agency demonstration projects—so there are a few of those cards included as well.

# How SBSP works

**SBSP definition/how SBSP works**

**Space Enterprise Council**, US Chamber of Commerce, **2008**

(Space Enterprise Council, July 2008 *Recommendation on Space-Based Solar Power,* [*http://www.nss.org/settlement/ssp/library/2008-SECSpaceBasedSolarPowerWhitePaper.pdf*](http://www.nss.org/settlement/ssp/library/2008-SECSpaceBasedSolarPowerWhitePaper.pdf)*, AJ)*

Definition: The concept of space-based solar power (SBSP) involves generation of electricity from solar power in space and transmitting it to Earth. The most frequently referenced architecture would include satellites orbiting the Earth in geosynchronous or other Earth orbits. SBSP satellites would be exposed to intense sunlight 24 hours per day (except for twice-yearly equinox periods, with eclipses less than 70 minutes per day). Such satellites would wirelessly transmit power continuously to fixed locations on the Earth’s surface. Power would be transmitted to large but low-density antenna arrays, which would allow for safe and productive uses of the surface area beneath the antennas, such as agriculture. There are a variety of other options for energy from space (e.g., optical power transfer) that may also warrant research consideration.

# \*\*\*1AC parts\*\*\*

# Spaced Based Solar Power 1AC

**Inherency: Lack of funding and clear responsibility with the United States federal government results in lack of development, despite viability of technology.**

[**Shea**](http://spacejournal.ohio.edu/about_ed.html#flournoy), Master of Arts in Science Technology and Space Policy at George Washington University, 20**10** (Karen Cramer, Online Space Journal of Communication, December 2010. http://spacejournal.ohio.edu/issue16/shea.html NP)

Space solar power has been studied by both NASA and the DOE. Unfortunately, NASA considers SSP to be an energy issue and the DOE considers it to be a space issue. Neither is currently funding SSP research. Added to this, NASA is in crisis with the retirement of the Space Shuttle, while trying to operate the International Space Station and return to the Moon with a launch system that is behind schedule, over budget and losing capability. The 2009 Augustine Committee called for a $3 billion increase in the NASA budget just to keep up with its current commitments. NASA clearly cannot take the lead in SPS research and development.

In the past, DOE has been interested in nuclear technology because of its connection to defense and DOE was interested in distributed systems for renewable energy. Now the DOE is putting emphasis on clean coal and biofuels. DOE has not shown any renewed interest in Solar Power Satellites. The DOE thinks launch costs are too high to ever be profitable, and space solar power is unproven both in terms of commercial viability and safety. To confirm safety and commercial viability requires funding. Many groups are working on reducing launch costs. SSP development should be funded in anticipation of launch cost reductions.

# Spaced Based Solar Power 1AC

**Thus we offer the following plan: The United States Congress should establish a coordinated national policy for the purpose of creating a space based solar power infrastructure. Requisite funding and enforcement provided.**

# Spaced Based Solar Power 1ac

**Contention Three Solvency:**

**Congress Key—NASA and Department of Energy need Congressional action to increase space based solar power.**

[**Schubert**](http://spacejournal.ohio.edu/about_ed.html#flournoy), Ph.D., P.E., Packer Engineering, Inc., Naperville, IL, 20**10** (Peter J., Online Space Journal of Communication, December 2010. http://spacejournal.ohio.edu/issue16/schubert.html NP)

At present, neither NASA, nor the US Department of Energy (DOE) conduct any appreciable research on SSP. The Defense Advanced Research Project Agency (DARPA) does not presently have any budget for SSP. Although each of these three agencies would have a significant role to play in SSP development, deployment, and security, none is currently doing so. In the case of NASA and DOE, this is largely a political issue. They cannot take on such an initiative without direction from Congress. Another consequence of the unpredictable miracle is that the US Congress must have a champion or coalition to support SSP.

A recent surge in the number of conferences, meetings, and technical tracks related to SSP show that research is being conducted in disparate locations, with different approaches, on limited budgets, and no overall cohesion.[1-11][14] It has been quipped that there are as many SSP architectures as there are principal investigators (PIs) in this field.[12-15][17] Without a central organization to guide and combine research efforts, SSP research is likely to remain fragmented and ineffective. A new organization is needed.

**Coordinated national policy will ensure development of space based solar power. This also means that your xo counterplan won’t work without the coordination provided by the plan.**

**Rogue, Director of National Security Space Office 07**

(Joseph D. Rogue, Phase O Architecture Feasibility Study, JP)

<FINDING: The SBSP Study Group found that SBSP development over the past 30 years has made little progress because it “falls between the cracks” of currently‐defined responsibilities of federal bureaucracies, and has lacked an organizational advocate within the US Government.

The current bureaucratic lanes are drawn in such a way to exclude the likelihood of SBSP development. NASA’s charter and focus is clearly on robotic and human exploration to execute the Moon‐Mars Vision for Space Exploration, and is cognizant that it is not America’s Department of Energy (DOE). DOE rightly recognizes that the hard challenges to SBSP all lie in spacefaring activities such as space access, and space‐to‐Earth power‐beaming, none of which are its core competencies, and would make it dependent upon a space‐capable agency. The Office of Space Commercialization in the Department of Commerce is not sufficiently resourced for this mission, and no dedicated Space Development Agency exists as of yet. DoD has much of the necessary development expertise in‐house, and clearly has a responsibility to look to the long term security of the United States, but it is also not the country’s Department of Energy, and must focus itself on war prevention and warfighting concerns.

A similar problem exists in the private sector. US space companies are used to small launch markets with the government as a primary customer and advocate, and do not have a developed business model or speak in a common language with the energy companies. The energy companies have adequate capital and understand their market, but do not understand the aerospace sector. One requires a demonstrated market, while the other requires a demonstrated technical capability. Without a trusted agent to mediate the collaboration and serve as an advocate for supportive policy, progress is likely to be slow. >

# Spaced Based Solar Power 1ac

**The technology does exists now - similar to communication satellites just needs more investment**

**Goldenberg, US environment correspondent, 09**

(Suzanne Goldenberg, April 16, 2009, <http://www.guardian.co.uk/environment/2009/apr/16/solar-energy-farms-space>, JP)

<Solaren has released relatively few details about the project. But Solaren's CEO, Gary Spirnak, said the company, a group of about 10 former satellite and aerospace engineers, was confident in the technology and timing behind the venture. He argued that the science behind the orbiting solar farms was little different to that of communications satellites. "This is the exact same thing that satellites do every day. The basic technology is there," said Spirnak. "The bottom line is that this is not really a technology issue.">

# \*\*\*Advantage Modules \*\*\*

# 1AC Warming Advantage Module

**Advantage \_\_\_ is Warming**

**Reliance on fossil fuels puts the US at a crossroads – Transition to SPS is key to ensure access to carbon neutral technologies**

**Rogue, Director of National Security Space Office 07**

(Joseph D. Rogue, Phase O Architecture Feasibility Study, JP)

<FINDING:The SBSP Study Group found that in the long run, SBSP offers a viable and attractive route to decrease mankind’s reliance on fossil fuels, as well as provides a potential global alternative to wider proliferation of nuclear materials that will almost certainly unfold if many more countries in the world transition to nuclear power with enrichment in an effort to meet their energy needs with carbon neutral sources. To the extent mankind’s electricity is produced by fossil fuel sources, SBSP offers a capability over time to reduce the rate at which humanity consumes the planet’s finite fossil hydrocarbon resources. While presently hard to store, electricity is easy to transport, and is highly efficient in conversion to both mechanical and thermal energy. Except for the aviation transportation infrastructure, virtually all of America’s energy could eventually be delivered and consumed as electricity. Even in ground transportation, a movement toward plug‐in hybrids would allow a substantial amount of traditional ground transportation to be powered by SBSP electricity. For those applications that favor or rely upon liquid hydrocarbon fuels, America’s national labs are pursuing several promising avenues of research to manufacture carbon‐neutral synthetic fuels (synfuels) from direct solar thermal energy or radiated/electrical SBSP. The lab initiatives are developing technologies to efficiently split energy‐neutral feedstocks or upgrade lower‐grade fuels (such as biofuels) into higher energy density liquid hydrocarbons. Put plainly, SBSP could be utilized to split hydrogen from water and the carbon monoxide (syngas) from carbon dioxide which can then be combined to manufacture any desired hydrocarbon fuel, including gasoline, diesel, kerosene and jet fuel. This technology is still in its infancy, and significant investment will be required to bring this technology to a high level of technical readiness and meet economic and efficiency goals. This technology enables a carbon‐neutral (closed carbon‐cycle) hydrocarbon economy driven by clean renewable sources of power, which can utilize the existing global fuel infrastructure without modification. This opportunity is of particular interest to traditional oil companies. The ability to use renewable energy to serve as the energy feedstock for existing fuels, in a carbon neutral cycle, is a “total game changer” that deserves significant attention. Both fossil and fissile sources offer significant capabilities to our energy mix, but dependence on the exact mix must be carefully managed. Likewise, the mix abroad may affect domestic security. While increased use of nuclear power is not of particular concern in nations that enjoy the rule of law and have functioning internal security mechanisms, it may be of greater concern in unstable areas of rouge states. The United States might consider the security challenges of wide proliferation of enrichment‐based nuclear power abroad undesirable. If so, having a viable alternative that fills a comparable niche might be attractive. Overall, SBSP offers a hopeful path toward reduced fossil and fissile fuel dependence. >

# 1ac Warming Advantage Module

Warming is happening and its anthropogenic

Rahmstorf, Professor of Physics @ Potsdam University, Member of the German Advisory Council on Climate Change, 2008

(Stefan, Global Warming: Looking Beyond Kyoto, ed. Ernesto Zedillo, Prof. IR @ Yale, p. 42-49 accessed [http://books.google.com/books?id=NPUBsNEphrQC&pg=PA42&lpg=PA42&dq=%22+It+is+time+to+turn+to+statement+B:+human+activities+are+altering+the+climate.+This+can+be+broken+into+two+parts.+The+first+is+as+follows:+global+climate+is+warming.+This+is+by+now+a+generally+undisputed+point+%28except+by+novelist+Michael+Crichton%29,+so+we+deal+with+it+only+briefly.+The+two+leading+%22&source=bl&ots=QLUOsFi2z&sig=OTcZXCPG2PltsCuwcg\_xBkM83Pg&hl=en&ei=KNwITqqJNIabtwfZ\_cmjBQ&sa=X&oi=book\_result&ct=result&resnum=1&ved=0CBYQ6AEwAA#v=onepage&q=%22%20It%20is%20time%20to%20turn%20to%20statement%20B%3A%20human%20activities%20are%20altering%20the%20climate.%20This%20can%20be%20broken%20into%20two%20parts.%20The%20first%20is%20as%20follows%3A%20global%20climate%20is%20warming.%20This%20is%20by%20now%20a%20generally%20undisputed%20point%20%28except%20by%20novelist%20Michael%20Crichton%29%2C%20so%20we%20deal%20with%20it%20only%20briefly.%20The%20two%20leading%20%22&f=false](http://books.google.com/books?id=NPUBsNEphrQC&pg=PA42&lpg=PA42&dq=%22+It+is+time+to+turn+to+statement+B:+human+activities+are+altering+the+climate.+This+can+be+broken+into+two+parts.+The+first+is+as+follows:+global+climate+is+warming.+This+is+by+now+a+generally+undisputed+point+%28except+by+novelist+Michael+Crichton%29,+so+we+deal+with+it+only+briefly.+The+two+leading+%22&source=bl&ots=QLUOsFi2z&sig=OTcZXCPG2PltsCuwcg_xBkM83Pg&hl=en&ei=KNwITqqJNIabtwfZ_cmjBQ&sa=X&oi=book_result&ct=result&resnum=1&ved=0CBYQ6AEwAA#v=onepage&q=%22%20It%20is%20time%20to%20turn%20to%20statement%20B%3A%20human%20activities%20are%20altering%20the%20climate.%20This%20can%20be%20broken%20into%20two%20parts.%20The%20first%20is%20as%20follows%3A%20global%20climate%20is%20warming.%20This%20i) 6-27 TM)

It is time to turn to statement B: human activities are altering the climate. This can be broken into two parts. The first is as follows: global climate is warming. This is by now a generally undisputed point (except by novelist Michael Crichton), so we deal with it only briefly. The two leading compilations of data measured with thermometers are shown in figure 3-3, that of the National Aeronautics and Space Administration (NASA) and that of the British Hadley Centre for Climate Change. Although they differ in the details, due to the inclusion of different data sets and use of different spatial averaging and quality control procedures, they both show a consistent picture, with a global mean warming of 0.8°C since the late nineteenth century. Temperatures over the past ten years clearly were the warmest since measured records have been available. The year 1998 sticks out well above the longterm trend due to the occurrence of a major El Nino event that year (the last El Nino so far and one of the strongest on record). These events are examples of the largest natural climate variations on multiyear time scales and, by releasing heat from the ocean, generally cause positive anomalies in global mean temperature. It is remarkable that the year 2005 rivaled the heat of 1998 even though no El Nino event occurred that year. (A bizarre curiosity, perhaps worth mentioning, is that several prominent "climate skeptics" recently used the extreme year 1998 to claim in the media that global warming had ended. In Lindzen's words, "Indeed, the absence of any record breakers during the past seven years is statistical evidence that temperatures are not increasing.")33 In addition to the surface measurements, the more recent portion of the global warming trend (since 1979) is also documented by satellite data. It is not straightforward to derive a reliable surface temperature trend from satellites, as they measure radiation coming from throughout the atmosphere (not just near the surface), including the stratosphere, which has strongly cooled, and the records are not homogeneous' due to the short life span of individual satellites, the problem of orbital decay, observations at different times of day, and drifts in instrument calibration.' Current analyses of these satellite data show trends that are fully consistent with surface measurements and model simulations." If no reliable temperature measurements existed, could we be sure that the climate is warming? The "canaries in the coal mine" of climate change (as glaciologist Lonnie Thompson puts it) ~are mountain glaciers. We know, both from old photographs and from the position of the terminal moraines heaped up by the flowing ice, that mountain glaciers have been in retreat all over the world during the past century. There are precious few exceptions, and they are associated with a strong increase in precipitation or local cooling.36 I have inspected examples of shrinking glaciers myself in field trips to Switzerland, Norway, and New Zealand. As glaciers respond sensitively to temperature changes, data on the extent of glaciers have been used to reconstruct a history of Northern Hemisphere temperature over the past four centuries (see figure 3-4). Cores drilled in tropical glaciers show signs of recent melting that is unprecedented at least throughout the Holocene-the past 10,000 years. Another powerful sign of warming, visible clearly from satellites, is the shrinking Arctic sea ice cover (figure 3-5), which has declined 20 percent since satellite observations began in 1979. While climate clearly became warmer in the twentieth century, much discussion particularly in the popular media has focused on the question of how "unusual" this warming is in a longer-term context. While this is an interesting question, it has often been mixed incorrectly with the question of causation. Scientifically, how unusual recent warming is-say, compared to the past millennium-in itself contains little information about its cause. Even a highly unusual warming could have a natural cause (for example, an exceptional increase in solar activity). And even a warming within the bounds of past natural variations could have a predominantly anthropogenic cause. I come to the question of causation shortly, after briefly visiting the evidence for past natural climate variations. Records from the time before systematic temperature measurements were collected are based on "proxy data," coming from tree rings, ice cores, corals, and other sources. These proxy data are generally linked to local temperatures in some way, but they may be influenced by other parameters as well (for example, precipitation), they may have a seasonal bias (for example, the growth season for tree rings), and high-quality long records are difficult to obtain and therefore few in number and geographic coverage. Therefore, there is still substantial uncertainty in the evolution of past global or hemispheric temperatures. (Comparing only local or regional temperature; as in Europe, is of limited value for our purposes,' as regional variations can be much larger than global ones and can have many regional causes, unrelated to global-scale forcing and climate change.) The first quantitative reconstruction for the Northern Hemisphere temperature of the past millennium, including an error estimation, was presented by Mann, Bradley, and Hughes and rightly highlighted in the 2001 IPCC report as one of the major new findings since its 1995 report; it is shown in figure 3\_6.39 The analysis suggests that, despite the large error bars, twentieth-century warming is indeed highly unusual and probably was unprecedented during the past millennium. This result, presumably because of its symbolic power, has attracted much criticism, to some extent in scientific journals, but even more so in the popular media. The hockey stick-shaped curve became a symbol for the IPCC, .and criticizing this particular data analysis became an avenue for some to question the credibility of the IPCC. Three important things have been overlooked in much of the media coverage. First, even if the scientific critics had been right, this would not have called into question the very cautious conclusion drawn by the IPCC from the reconstruction by Mann, Bradley, and Hughes: "New analyses of proxy data for the Northern Hemisphere indicate that the increase in temperature in the twentieth century is likely to have been the largest of any century during the past 1,000 years." This conclusion has since been supported further by every single one of close to a dozen new reconstructions (two of which are shown in figure 3-6). Second, by far the most serious scientific criticism raised against Mann, Hughes, and Bradley was simply based on a mistake. 40 The prominent paper of von Storch and others, which claimed (based on a model test) that the method of Mann, Bradley, and Hughes systematically underestimated variability, "was [itself] based on incorrect implementation of the reconstruction procedure."41 With correct implementation, climate field reconstruction procedures such as the one used by Mann, Bradley, and Hughes have been shown to perform well in similar model tests. Third, whether their reconstruction is accurate or not has no bearing on policy. If their analysis underestimated past natural climate variability, this would certainly not argue for a smaller climate sensitivity and thus a lesser concern about the consequences of our emissions. Some have argued that, in contrast, it would point to a larger climate sensitivity. While this is a valid point in principle, it does not apply in practice to the climate sensitivity estimates discussed herein or to the range given by IPCC, since these did not use the reconstruction of Mann, Hughes, and Bradley or any other proxy records of the past millennium. Media claims that "a pillar of the Kyoto Protocol" had been called into question were therefore misinformed. As an aside,

**(Rahmstorf continued…no text deleted)**

# 1ac Warming Advantage Module

**(Rahmstorf continued…no text deleted)**

the protocol was agreed in 1997, before the reconstruction in question even existed. The overheated public debate on this topic has, at least, helped to attract more researchers and funding to this area of paleoclimatology; its methodology has advanced significantly, and a number of new reconstructions have been presented in recent years. While the science has moved forward, the first seminal reconstruction by Mann, Hughes, and Bradley has held up remarkably well, with its main features reproduced by more recent work. Further progress probably will require substantial amounts of new proxy data, rather than further refinement of the statistical techniques pioneered by Mann, Hughes, and Bradley. Developing these data sets will require time and substantial effort. It is time to address the final statement: most of the observed warming over the past fifty years is anthropogenic. A large number of studies exist that have taken different approaches to analyze this issue, which is generally called the "attribution problem." I do not discuss the exact share of the anthropogenic contribution (although this is an interesting question). By "most" I imply mean "more than 50 percent.” The first and crucial piece of evidence is, of course, that the magnitude of the warming is what is expected from the anthropogenic perturbation of the radiation balance, so anthropogenic forcing is able to explain all of the temperature rise. As discussed here, the rise in greenhouse gases alone corresponds to 2.6 W/tn2 of forcing. This by itself, after subtraction of the

observed 0'.6 W/m2 of ocean heat uptake, would Cause 1.6°C of warming since preindustrial times for medium climate sensitivity (3"C). With a current "best guess'; aerosol forcing of 1 W/m2, the expected warming is O.8°c. The point here is not that it is possible to obtain the 'exact observed number-this is fortuitous because the amount of aerosol' forcing is still very' uncertain-but that the expected magnitude is roughly right. There can be little doubt that the anthropogenic forcing is large enough to explain most of the warming. Depending on aerosol forcing and climate sensitivity, it could explain a large fraction of the warming, or all of it, or even more warming than has been observed (leaving room for natural processes to counteract some of the warming). The second important piece of evidence is clear: there is no viable alternative explanation. In the scientific literature, no serious alternative hypothesis has been proposed to explain the observed global warming. Other possible causes, such as solar activity, volcanic activity, cosmic rays, or orbital cycles, are well observed, but they do not show trends capable of explaining the observed warming. Since 1978, solar irradiance has

been measured directly from satellites and shows the well-known eleven-year solar cycle, but no trend. There are various estimates of solar variability before this time, based on sunspot numbers, solar cycle length, the geomagnetic AA index, neutron monitor data, and, carbon-14 data. These indicate that solar activity probably increased somewhat up to 1940. While there is disagreement about the variation in previous centuries, different authors agree that solar activity did not significantly increase during the last sixty-five years. Therefore, this cannot explain the warming, and neither can any of the other factors mentioned. Models driven by natural factors only, leaving the anthropogenic forcing aside, show a cooling in the second half of the twentieth century (for an example, See figure 2-2, panel a, in chapter 2 of this volume). The trend in the sum of natural forcings is downward. The only way out would be either some as yet undiscovered unknown forcing or a warming trend that arises by chance from an unforced internal variability in the climate system. The latter cannot be completely ruled out, but has to be considered highly unlikely. No evidence in the observed record, proxy data, or current models suggest that such internal variability could cause a sustained trend of global warming of the observed magnitude. As discussed twentieth century warming is unprecedented over the past 1,000 years, (or even 2,000 years, as the few longer reconstructions available now suggest), which does not 'support the idea of large internal fluctuations. Also, those past variations correlate well with past forcing (solar variability, volcanic activity) and thus appear to be largely forced rather than due to unforced internal variability." And indeed, it would be difficult for a large and sustained unforced variability to satisfy the fundamental physical law of energy conservation. Natural internal variability generally shifts heat around different parts of the climate system-for example, the large El Nino event of 1998, which warmed, the atmosphere by releasing heat stored in the ocean. This mechanism implies that the ocean heat content drops as the atmosphere warms. For past decades, as discussed, we observed the atmosphere warming and the ocean heat content increasing, which rules out heat release from the ocean as a cause of surface warming. The heat content of the whole climate system is increasing, and there is no plausible source of this heat other than the heat trapped by greenhouse gases. ' A completely different approach to attribution is to analyze the spatial patterns of climate change. This is done in so-called fingerprint studies, which associate particular patterns or "fingerprints" with different forcings. It is plausible that the pattern of a solar-forced climate change differs from the pattern of a change caused by greenhouse gases. For example, a characteristic of greenhouse gases is that heat is trapped closer to the Earth's surface and that, unlike solar variability, greenhouse gases tend to warm more in winter, and at night. Such studies have used different data sets and have been performed by different groups of researchers with different statistical methods. They consistently conclude that the observed spatial pattern of warming can only be explained by greenhouse gases.49 Overall, it has to be considered, highly likely' that the observed warming is indeed predominantly due to the human-caused increase in greenhouse gases. ' This paper discussed the evidence for the anthropogenic increase in atmospheric CO2 concentration and the effect of CO2 on climate, finding that this anthropogenic increase is proven beyond reasonable doubt and that a mass of evidence points to a CO2 effect on climate of 3C ± 1.59C global-warming for a doubling of concentration. (This is, the classic IPCC range; my personal assessment is that, in-the light of new studies since the IPCC Third Assessment Report, the uncertainty range can now be narrowed somewhat to 3°C ± 1.0C) This is based on consistent results from theory, models, and data analysis, and, even in the absence-of any computer models, the same result would still hold based on physics and on data from climate history alone. Considering the plethora of consistent evidence, the chance that these conclusions are wrong has to be considered minute. If the preceding is accepted, then it follows logically and incontrovertibly that a further increase in CO2 concentration will lead to further warming. The magnitude of our emissions depends on human behavior, but the climatic response to various emissions scenarios can be computed from the information presented here. The result is the famous range of future global temperature scenarios shown in figure 3\_6.50 Two additional steps are involved in these computations: the consideration of anthropogenic forcings other than CO2 (for example, other greenhouse gases and aerosols) and the computation of concentrations from the emissions. Other gases are not discussed here, although they are important to get quantitatively accurate results. CO2 is the largest and most important forcing. Concerning concentrations, the scenarios shown basically assume that ocean and biosphere take up a similar share of our emitted CO2 as in the past. This could turn out to be an optimistic assumption; some models indicate the possibility of a positive feedback, with the biosphere turning into a carbon source rather than a sink under growing climatic stress. It is clear that even in the more optimistic of the shown (non-mitigation) scenarios, global temperature would rise by 2-3°C above its preindustrial level by the end of this century. Even for a paleoclimatologist like myself, this is an extraordinarily high temperature, which is very likely unprecedented in at least the past 100,000 years. As far as the data show, we would have to go back about 3 million years, to the Pliocene, for comparable temperatures. The rate of this warming (which is important for the ability of ecosystems to cope) is also highly unusual and unprecedented probably for an even longer time. The last major global warming trend occurred when the last great Ice Age ended between 15,000 and 10,000 years ago: this was a warming of about 5°C over 5,000 years, that is, a rate of only 0.1 °C per century. 52 The expected magnitude and rate of planetary warming is highly likely to come with major risk and impacts in terms of sea level rise (Pliocene sea level was 25-35 meters higher than now due to smaller Greenland and Antarctic ice sheets), extreme events (for example, hurricane activity is expected to increase in a warmer climate), and ecosystem loss. The second part of this paper examined the evidence for the current warming of the planet and discussed what is known about its causes. This part showed that global warming is already a measured and well-established fact, not a theory. Many different lines of evidence consistently show that most of the observed warming of the past fifty years was caused by human activity. Above all, this warming is exactly what would be expected given the anthropogenic rise in greenhouse gases, and no viable alternative explanation for this warming has been proposed in the scientific literature. Taken together., the very strong evidence accumulated from thousands of independent studies, has over the past decades convinced virtually every climatologist around the world (many of whom were initially quite skeptical, including myself) that anthropogenic global warming is a reality with which we need to deal.

# 1ac Warming Advantage Module

**Failure to act now leads to runaway warming that collapses civilization – controlling the rate of warming prevents irreversible tipping points in the form of sea level rise and global starvation**

**Brown,** Masters in AE from Maryland & Masters in Econ from Harvard, Director and Founder of the global institute of Environment in the U.S **2008**

(Lester E. Brown, Plan B 3.0: Mobilizing to Save Civilization [http://www.earth-policy.org/books/pb3/PB3ch3\_ss7 accessed 6-27](http://www.earth-policy.org/books/pb3/PB3ch3_ss7%20accessed%206-27) tm )

In 2004, Stephen Pacala and Robert Socolow at Princeton University published an article inThat showed how annual carbon emissions from fossil fuels could be held at 7 billion tons instead of rising to 14billion tons over the next 50 years, as would occur with business as usual. The goal of Pacala, an ecologist, andSocolow, an engineer, was to prevent atmospheric CO2 concentrations, then near 375 ppm, from rising above500 ppm. They described ways, all using proven technologies, that by could each cut carbon emissions by 1 billion tons per year. Any seven of these options could be used together to prevent an increase in carbon emissions through 2054. Pacala and Socolow further theorize that advancing technology would allow for annual carbon emissions to be cut to 2 billion tons by 2104, a level that can be absorbed by natural carbon sinks in land and oceans. The Pacala/Socolow conceptualization has been extraordinarily useful in helping to think about how to cut carbon emissions. During the three years since the article was written, the urgency of acting quickly and on a much larger scale has become obvious. We also need now to go beyond the conceptual approach that treats all potential methods of reducing carbon emissions equally and concentrate on those that are most promising. Researchers such as James Hansen, a leading climate scientist at NASA, believe that global warming is accelerating and may be approaching a tipping point, a point at which climate change acquires a momentum that makes it irreversible. They think we may have a decade to turn the situation around beforethis threshold is crossed. I agree.?3 We often hear descriptions of what we need to do in the decades ahead orby 2050 to avoid "dangerous climate change," but we are already facing this. Two thirds of the glaciers that feedthe Yellow and Yangtze rivers of China will disappear by 2060 if even the current 7 percent annual rate of melting continues. Glaciologists report that the Gangotri glacier, which supplies 70 percent of the ice melt thatfeeds the Ganges River during the dry season, could disappear entirely in a matter of decades.7What could threaten world food security more than the melting of the glaciers that feed the major rivers of Asia during the dry season, the rivers that irrigate the region's rice and wheat fields? In a region with half the world's people, this potential loss of water during the dry season could lead not just to hunger but to starvation on an unimaginable scale. Asian food security would take a second hit because its rice-growing river deltas and floodplains would be under water. The World Bank tells us that a sea level rise of only 1 meter would inundate half of the rice land in Bangladesh. While a 1-meter rise in sea level will not happen overnight, what is worrisome is that if ice melting continues at today's rates, at some point such a rise in sea level will no longer be preventable. The melting that would cause this is not just what may happen if the earth's temperature rises further; this is something that is starting to happen right now with the current temperature. As summer neared an end in 2007, reports from Greenland indicated that the flow of glaciers into the sea had accelerated beyond anything glaciologists had thought possible. Huge chunks of ice weighing several billion tons each were breaking off and sliding into the sea, causing minor earthquakes as they did so.!6 With melt-water lubricating the surface between the glaciers and the rocks on which they rested, ice flows were accelerating, flowing into the ocean at a pace of 2 meters an hour. This accelerated flow, along with the earthquakes, shows the potential for the entire ice sheet to break up and collapse?? Beyond what is already happening, the world faces a risk that some of the feedback mechanisms will begin to kick in, further accelerating the warming process. Scientists who once thought that the Arctic Ocean could be free of ice during the summer by 2100 now see it occurring by 2030. Even this could turn out to be a conservative estimate. This is of particular concern to scientists because of the albedo effect, where the replacement of highly reflective sea ice with darker open water greatly increases heat absorbed from sunlight. This, of course, has the potential to further accelerate the melting of the Greenland ice sheet. A second feedback loop of concern is the melting of permafrost. This would release billions of tons of carbon, some as methane, a potent greenhouse gas with a global warming effect per ton 25times that of carbon dioxide.The risk facing humanity is that climate change could spiral out of control and it will no longer be possible to arrest trends such as ice melting and rising sea level. At this point, the future of civilization would be at risk.  This combination of melting glaciers, rising seas, and their effects on food security and low-lying coastal cities could overwhelm the capacity of governments to cope. Today it is largely weak states that begin to deteriorate under the pressures of mounting environmental stresses. But the changes just described could overwhelm even the strongest of states. Civilization itself could begin to unravel under these extreme stresses.

# 1ac Warming Advantage Module

**All of your DA impacts ranging from disease, immigration, the economy, to terrorism will be exacerbated by climate change – action now prevents runaway warming**

**Becker***,* executive director of the Presidential Climate Action Project (PCAP)*,*worked on energy efficiency and renewable energy programs for 15 years at the U.S. Department of Energy, **2011**

(Bill , “ [Will global warming chill Obama’s legacy?](http://climateprogress.org/2011/01/24/will-global-warming-chill-obama%E2%80%99s-legacy/)” January 24, 2011 http://thinkprogress.org/romm/2011/01/24/207389/will-global-warming-chill-obama%E2%80%99s-legacy/ accessed6-27 TM)

Finishing the job in Afghanistan and Iraq, reforming immigration policy and bringing the economy back to health will be high on the President’s priority list, as they should be. He’s expected to pay special attention to economic recovery in his State of the Union speech tomorrow.

However, unmitigated climate change would almost certainly sabotage the achievements on which he has invested so much time and political capital.  Consider these impacts if climate change goes unchecked:

**Immigration:** Michael Oppenheimer of Princeton estimates that, depending on the severity of climate disruption, as many as [7 million residents](http://www.scientificamerican.com/article.cfm?id=climate-change-may-mean-more-mexican-immigration) of Mexico may immigrate to the United States over the next seven decades because of reduced food production. In other words, the United States is not immune to the problem of climate refugees. There goes immigration reform.**Health Care:** Last September, the leaders of 18 national medical organizations and scores of state health officials wrote to the White House and Congress, warning that because of global warming “more Americans will be exposed to conditions that can result in illness and death due to respiratory illness, heat- and heat-related stress and disease carried by insects. Children, the elderly, the poor and people with serious health conditions will be most adversely affected.” There goes Obama’s historic attempt to control health care costs.

**Terrorism:** Defense and intelligence experts predict that climate change will destabilize many of the world’s most volatile regions, producing new recruiting grounds for terrorists.  “Well before glaciers melt or sea levels rise, global climate change will spur instability on a global scale, which will exacerbate many of the traditional national security challenges with which we are grappling today, including terrorism,” according to experts at the [Center for Strategic and International Studies](http://www.nytimes.com/2007/12/03/opinion/03iht-edsmith.1.8569518.html?_r=1). There go Obama’s efforts – and the enormous investment of American lives and treasure – to defeat terrorism.

**A Healthy Economy**: Just the hydrological impacts of climate change will result in net losses of $1.2 trillion to America’s GDP between 2010 and 2050, cost 7 million jobs and reduce real disposable personal income by $1.7 trillion, according to researchers at [Sandia National Laboratory](http://prod.sandia.gov/techlib/access-control.cgi/2010/100692.pdf). We’re already bearing high collateral costs for fossil energy consumption. The [National Research Council](http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=12794) reports that burning fossil fuels for transportation and electricity resulted in hidden costs of $120 billion in 2005. There goes prosperity.

**Energy Insecurity:** We remain addicted to imported oil and vulnerable to the economic body blows inflicted by oil prices.  [Oil price shocks](http://www.rff.org/Publications/WPC/Pages/11_05_07_Cost_ProtectingOil_PersianGulf_Delucchi.aspx) preceded and contributed to nearly all of our recessions since 1947. There goes economic stability.Because climate change is progressing so rapidly toward tipping points and because it becomes more difficult and expensive to mitigate with each passing year, Obama may be the last U.S. president with the opportunity to head off its worst damages. Two or three decades from now, he is likely to be the leader history judges most responsible if people around the world are suffering from intense, diverse and irreversible stresses.  If the world of 2030 is hard to imagine, look at all the extreme weather events and natural disasters in 2010 – the second-worst year on record – and multiply them by many times. Last year’s fires, floods, mudslides, blizzards and drought, some still underway in this new year, are evidence of what happens when weather variability and climate change combine.

# 1ac Warming Advantage Module

**Now is key – SPS solves climate change and the tech is ready to slow the rate**

**Hadhazy, Staff writer for the Scientific American, 9**

(Adam Hadhazy, scientific american, 4/16/9, <http://www.scientificamerican.com/article.cfm?id=will-space-based-solar-power-finally-see-the-light-of-day>, 6/23/11, KJ)

Pacific Gas & Electric Co. (PG&E) has long invested in [renewable energy sources](http://www.sciam.com/article.cfm?id=how-renewable-energy-and-storage), including geothermal, wind and solar. Earlier this week, the utility company reached for the stars in announcing the first-ever deal of its kind: The California power utility, says spokesperson Jonathan Marshall, plans to purchase clean energy generated by a satellite beaming [solar power](http://www.scientificamerican.com/topic.cfm?id=solar-power) from orbit.  The agreement between PG&E and Solaren Corp., an eight-year-old company based in Manhattan Beach, Calif., still hinges on state regulatory approval. If the deal gets the green light, Solaren must then privately raise billions of dollars to design, launch and operate a satellite as well as an energy-receiving ground station slated for the Fresno County area, says Cal Boerman, director of energy services for Solaren.  The challenges of building this satellite (due to be completed in 2016) and introducing so-called [space-based solar power](http://www.sciam.com/article.cfm?id=plan-b-for-energy-8-ideas&page=4) (SBSP) remain formidable. But driven by the urgency of [climate change](http://www.sciam.com/topic.cfm?id=global-warming-and-climate-change) and the lowering costs of [solar technology](http://www.sciam.com/blog/60-second-science/post.cfm?id=first-alternative-energy-loan-guara-2009-03-21), a growing number of countries and companies believe an energy revolution could be in the offing.  Why bother harvesting solar energy directly from space? It is abundant, and "you can get [this] power 24/7," says Marty Hoffert, an emeritus professor of physics at New York University. Sunlight is some five to 10 times stronger in space, and its shine would reach energy-gathering satellites placed into geostationary (fixed) orbits—the realm of many currently deployed communications [spacecraft](http://www.scientificamerican.com/topic.cfm?id=spacecraft)—more than 99 percent of the time.  SBSP could, according to energy experts, provide constant, pollution-free power—unlike intermittent wind and cloud cover–sensitive ground-based solar, and without the emissions of [fossil fuels](http://www.scientificamerican.com/topic.cfm?id=fossil-fuels) or [radioactive waste](http://www.sciam.com/article.cfm?id=nuclear-waste-lethal-trash-or-renewable-energy-source) from [nuclear power](http://www.scientificamerican.com/topic.cfm?id=nuclear-power). "[SBSP] is a disruptive technology [in that] it could change the whole energy equation," says Frederick Best, director of the Center for Space Power (CSP) at Texas A&M University in College Station, Tex.  The premise (and promise) of SBSP has been considered scientifically feasible since the late 1960s. The basic concept of beaming microwave frequencies to Earth from orbit has already been proved: A fleet of solar-powered communication satellites routinely beam various electromagnetic frequencies to ground receivers, linking cell phone calls or relaying TV signals to rooftop dishes, for example. Converting solar energy beamed from space into electricity in a power grid, however, has not yet been demonstrated.  [Space Energy](http://www.spaceenergy.com/s/Home.asp), a Switzerland-based SBSP start-up, aims to change that by deploying a prototype orbiter in the next several years, possibly before Solaren's pilot plant reaches orbit. "You can argue the physics [of SBSP] all day, but you'll only know with a prototype," says Peter Sage, a co-founder of Space Energy, started in 2008.  Last year, U.S. and Japanese researchers crossed an important SBSP threshold when they wirelessly transmitted microwave energy between two [Hawaiian islands](http://www.sciam.com/article.cfm?id=genetically-modified-hawaii) about 90 miles (145 kilometers) apart, representing the distance through Earth's atmosphere that a transmission from orbit would have to penetrate, says Frank Little, associate director of the CSP.

# 1AC Energy Advantage Module

**Advantage \_\_\_ is Energy**

**Oil shocks coming now because of supply disruptions – perception of instability in the mid east and supply disruptions causes oil prices to soar – that tanks the global economy**

**Economist** 20**11** (3/3/11, “Oil and the economy The 2011 oil shock More of a threat to the world economy than investors seem to think” accessed 6/27/11 <http://www.economist.com/node/18281774> aes)

THE price of oil has had an unnerving ability to blow up the world economy, and the Middle East has often provided the spark. The Arab oil embargo of 1973, the Iranian revolution in 1978-79 and Saddam Hussein’s invasion of Kuwait in 1990 are all painful reminders of how the region’s combustible mix of geopolitics and geology can wreak havoc. With protests cascading across Arabia, is the world in for another oil shock? There are good reasons to worry. The Middle East and north Africa produce more than one-third of the world’s oil. Libya’s turmoil shows that a revolution can quickly disrupt oil supply. Even while Muammar Qaddafi hangs on with delusional determination and Western countries debate whether to enforce a no-fly zone (see article), Libya’s oil output has halved, as foreign workers flee and the country fragments. The spread of unrest across the region threatens wider disruption. The markets’ reaction has been surprisingly modest. The price of Brent crude jumped 15% as Libya’s violence flared up, reaching $120 a barrel on February 24th. But the promise of more production from Saudi Arabia pushed the price down again. It was $116 on March 2nd—20% higher than the beginning of the year, but well below the peaks of 2008. Most economists are sanguine: global growth might slow by a few tenths of a percentage point, they reckon, but not enough to jeopardise the rich world’s recovery. That glosses over two big risks. First, a serious supply disruption, **or even the fear of it, could send the oil price soaring** (see article). Second, dearer oil could fuel inflation—and that might prompt a monetary clampdown that throttles the recovery. A lot will depend on the skill of central bankers. Of stocks, Saudis and stability So far, the shocks to supply have been tiny. Libya’s turmoil has reduced global oil output by a mere 1%. In 1973 the figure was around 7.5%. Today’s oil market also has plenty of buffers. Governments have stockpiles, which they didn’t in 1973. Commercial oil stocks are more ample than they were when prices peaked in 2008. Saudi Arabia, the central bank of the oil market, technically has enough spare capacity to replace Libya, Algeria and a clutch of other small producers. And the Saudis have made clear that they are willing to pump. Yet more disruption cannot be ruled out. The oil industry is extremely complex: getting the right sort of oil to the right place at the right time is crucial. And then there is Saudi Arabia itself (see article). The kingdom has many of the characteristics that have fuelled unrest elsewhere, including an army of disillusioned youths. Despite spending $36 billion so far buying off dissent, a repressive regime faces demands for reform. **A whiff of instability would spread panic in the oil market.** Even without a disruption to supply, prices are under pressure from a second source: the gradual dwindling of spare capacity. With the world economy growing strongly, oil demand is far outpacing increases in readily available supply. So any jitters from the Middle East will accelerate and exaggerate a price rise that was already on the way. What effect would that have? It is some comfort that the world economy is less vulnerable to damage from higher oil prices than it was in the 1970s. Global output is less oil-intensive. Inflation is lower and wages are much less likely to follow energy-induced price rises, so central banks need not respond as forcefully. But less vulnerable does not mean immune. Dearer oil still implies a transfer from oil consumers to oil producers, and since the latter tend to save more it spells a drop in global demand. A rule of thumb is that a 10% increase in the price of oil will cut a quarter of a percentage point off global growth. With the world economy currently growing at 4.5%, that suggests the oil price would need to leap, probably above its 2008 peak of almost $150 a barrel, to fell the recovery. But even a smaller increase would sap growth and raise inflation.

# 1AC Energy Advantage Module

**Additionally, the resulting oil competition causes US China war – Lateral pressure theory proves**

**Hatemi,** professor at the University of Nebraska-Lincoln **and Wedeman,** associate professor and chair of Asian Studies at the University of Nebraska-Lincoln, **2007** ( Peter Hatemi is a professor at the University of Nebraska-Lincoln. Andrew Wedeman is associate professor and chair of Asian Studies at the University of Nebraska-Lincoln., China Security, Vol. 3 No. 3 Summer 2007, pp. 95 - 118 2007 World Security Institute, “Oil and Conflict in Sino-American Relations” accessed 6/27/11 <http://www.wsichina.org/cs7_5.pdf> aes)

Power transition theory is not the only model that posits deteriorating SinoAmerican strategic relations. In recent years, rapidly rising Chinese energy demand has led to speculation about the consequences of increasing competition for oil imports. 4 China and the United States could find themselves at strategic loggerheads not because of shifts in relative power, but over access to oil. This is “lateral pressure theory,” which states that when a country is forced to look beyond its own borders for new supplies, it will likely run into conflict with existing consumers of that resource. 5 Therefore, as the United States and China move closer to power parity, intensifying “lateral pressures” generated by competition for oil imports could become a significant and destabilizing factor in Sino-American relations. It is not the simple combination of lateral pressures and power transition alone, but their timing that will shape the future of Sino-American strategic relations. For example, before power parity is reached between two states, a more powerful state may deter an energy-hungry but weaker one from challenging it for greater access to energy supplies. However, after the point of power parity, a state with a declining power may feel compelled to capitulate to the rising state’s demand for greater access to energy. Conflict will most likely occur when lateral pressures reach critical levels at roughly the same time as two states reach power parity. Despite its inherently speculative nature, such analysis nevertheless suggests that lateral pressures will reach critical levels well before China attains even a minimal level of strategic parity with the United States. 6 As a result, China and the United States are likely to find themselves locked into a zero-sum competition for energy at a point when the likely outcome of a Sino-American confrontation would still favor the United States. In such a situation, China would face a difficult choice. It would have to shy away from confrontation and risk the possibility that the United States could somehow restrict its access to the energy resources. Or, it may opt for a high-risk strategy aimed at forcing the United States to accept restraints on the consumption of imported energy. To further complicate this choice for China, the United States might preemptively act while it retains a power advantage, seeking to somehow deny China equal access to oil supplies.

**This tension into war--China US war escalates and causes nuclear war**

**Johnson,** author and journalist for the nation, **2001** (Chalmers Johnson is the author of more than a dozen books, including Revolutionary Change (Stanford), Blowback: The Costs and Consequences of American Empire (Holt/Owl) and, most recently, The Sorrows of Empire: Militarism, Secrecy, and the End of the Republic (Metropolitan), 5/14/01, “Time to Bring the Troops Home” accessed 6/27/11 <http://www.thenation.com/article/time-bring-troops-home?page=0,0> aes)

China is another matter. No sane figure in the Pentagon wants a war with China, and all serious US militarists know that China's minuscule nuclear capacity is not offensive but a deterrent against the overwhelming US power arrayed against it (twenty archaic Chinese warheads versus more than 7,000 US warheads). Taiwan, whose status constitutes the still incomplete last act of the Chinese civil war, remains the most dangerous place on earth. Much as the 1914 assassination of the Austrian crown prince in Sarajevo led to a war that no one wanted, a misstep in Taiwan by any side could bring the United States and China into a conflict that neither wants. Such a war would bankrupt the United States, deeply divide Japan and probably end in a Chinese victory, given that China is the world's most populous country and would be defending itself against a foreign aggressor. More seriously, it could easily escalate into a nuclear holocaust. Since any Taiwanese attempt to declare its independence formally would be viewed as a challenge to China's sovereignty, forward-deployed US forces on China's borders have virtually no deterrent effect. The United States uses satellites to observe changes in China's basic military capabilities. But the coastal surveillance flights by our twelve (now eleven) EP-3E Aries II spy planes, like the one that was forced down off Hainan Island, seek information that is useful only in an imminent battle. They are inherently provocative and inappropriate when used to monitor a country with which we are at peace. The United States itself maintains a 200-mile area off its coasts in which it intercepts any aircraft attempting similar reconnaissance. America's provocative military posture in East Asia makes war with China more likely because it legitimizes military strategies in both Beijing and Taipei as well as in Washington and Tokyo. Although the spy-plane incident may have provoked new caution in a few Taiwanese who fear becoming the battleground in a China-US war, it also emboldens those who advocate independence from China to continue fostering Chinese-American conflict as a cover for their own aspirations. Former President Lee Teng-hui's controversial visits to both Japan and the United States may be an attempt to do precisely that.

# 1AC Energy Advantage Module

**Additionally, Lack of terrestrial resources spark resources wars, SSP solves for resource security**

**Collins and Autino 08**

Patrick Collins and Andriano Autino, May 25 2008, <http://www.spacefuture.com/archive/what_the_growth_of_a_space_tourism_industry_could_contribute_to_employment_economic_growth_environmental_protection_education_culture_and_world_peace.shtml>, Accessed June 24, 2011, JP)

<As an alternative to the "resource wars" already devastating many countries today, opening access to the unlimited resources of near-Earth space could clearly facilitate world peace and security. The US National Security Space Office, at the start of its report on the potential of space-based solar power ( SSP) published in early 2007, stated: "Expanding human populations and declining natural resources are potential sources of local and strategic conﬂict in the 21st Century, and many see energy as the foremost threat to national security" [38]. The report ended by encouraging urgent research on the feasibility of SSP: "Considering the timescales that are involved, and the exponential growth of population and resource pressures within that same strategic period, it is imperative that this work for "drilling up" vs. drilling down for energy security begins immediately" [38]. Although the use of extra-terrestrial resources on a substantial scale may still be some decades away, it is important to recognise that simply acknowledging its feasibility using known technology is the surest way of ending the threat of resource wars. That is, if it is assumed that the resources available for human use are limited to those on Earth, then it can be argued that resource wars are inescapable [22,37]. If, by contrast, it is assumed that the resources of space are economically accessible, this not only eliminates the need for resource wars, it can also preserve the benefits of civilisation which are being eroded today by "resource war-mongers", most notably the governments of the "Anglo-Saxon" countries and their "neo-con" advisers. It is also worth noting that the $1 trillion that these have already committed to wars in the Middle-East in the 21st century is orders of magnitude more than the public investment needed to aid companies sufficiently to start the commercial use of space resources.>

**These resource wars over energy will escalate, incentivizing terrorism and irregular warfare**

**Moran and Russell 2008**

[Daniel and Jason,Associate Professor in the Department of National Security Affairs at the Naval Postgraduate School, Senior Lecturer at the Naval Postgraduate School and Co-Director of the Center for Contemporary Conflict, “The Militarization of Energy Security” *Strategic Insights*, Feb 2008 http://www.ccc.nps.navy.mil/si/2008/Feb/moranFeb08.asp]

This book does not seek to challenge the prevailing consensus that large-scale conflict among developed states has become unlikely. Its aim is rather to reflect upon conditions in the one area of international life where serious observers still regard it as possible: energy security. It is in the energy sector that strategic planners now find it easiest to imagine major states reconsidering their reluctance to use force against each other. “Energy security” is now deemed so central to “national security” that threats to the former are liable to be reflexively interpreted as threats to the latter. In a world in which territorial disputes, ideological competition, ethnic irredentism, and even nuclear proliferation all seem capable of being normalized in ways that constrain the actual use of military force, a crisis in global energy supply stands out as the last all-weather casus belli when the moment comes to hypothesize worst-case scenarios. This is not a reason to assume that wars over energy are more likely now than in the past. Precisely because such conflicts have been limited and rare up to now,[3] there is good reason to be cautious about estimating their likelihood in the future. The probabilities are further muddled by the fact that over-emphasis on the possibilities for great-power conflict favors important, and generally conservative, institutional interests within the defense establishments of developed states, particularly the United States. In a security environment that presents increasingly strong incentives to shift force structure and doctrine toward irregular warfare, counter-terrorism, constabulary operations, and so on, the possibility of war to seize or defend energy resources provides a much-needed rationale for preserving the heavy conventional forces that still consume the lion’s share of defense spending around the world. This is especially true of naval building programs, whose ostensible purpose is always presumed to include securing the sea lines of communication that connect the producers and consumers of oil.[4] The prominence of energy security for military planning and budgeting may be exaggerated compared to its real salience internationally. Yet the anxiety that this issue is capable of inspiring is itself a measure of its significance, irrespective of one’s estimate of the probabilities. There were only two world wars in the entire twentieth century, after all, yet that is scarcely a reason to discount their importance. The possibility that access to energy resources may become an object of large-scale armed struggle is almost incontestably the single most alarming prospect facing the international system today. The political stability of advanced societies, and the continued prospects for economic and social improvement in developing countries, are both irreducibly dependent on avoiding such a conflict.

# 1AC Leadership Advantage Module

**Advantage \_\_\_ is US leadership**

**SPS inevitable – US involvement key to signal investment and improves the US economy and strengthens military readiness**

**Dinerman, author and journalist, 2007**

(Taylor Dinerman, The Space Review, 7/16/7, <http://www.thespacereview.com/article/910/1> 6/24/11, KJ)

<The first steps in such a program would be to begin work on an experiment to prove that power transmission in space via laser is possible. Already lasers are being used for communications in civil and military applications; taking this one step beyond to encompass power should be within the state of the art. At the same time the US Defense Department and NASA could begin joint work on a new generation of high-capacity power systems for future spacecraft. The power management and thermal control needs of a spacecraft that will carry a human crew to Mars may not be all that different from those of an SPS or an SR satellite. The bulk of the development work on the radars themselves can be left until later in the program. Meanwhile, the US could profitably study less ambitious space radar programs such as Canada’s Radarsat. Launching one or two modest technology development satellites over the next five or ten years would be a helpful way to set the stage for a new SR program. In the long term, say, by around 2010, the GMTI radar could be replaced and supplemented by an Air Moving Target Indicator (AMTI), which would need even more power. Instead of using a single large antenna or multiple smaller ones on the same spacecraft, a future stealthy SR could use radars on multiple satellites. Formation flying is now commonplace and coordinating multiple beams from two or three satellites in different orbits should not be that hard. The biggest problem will be to prove to Congress that the technology is ready for prime time. Almost all of America’s major military space programs are too far along to effectively incorporate the lessons of China’s ASAT test. SR, due to repeated budget cuts, is the great exception. Other satellite programs that could be modified to incorporate the needs of the new space warfare requirements include the T-SAT Transformational Communications project and the possibly the NRO’s problem-plagued Future Imagery Architecture (FIA).If the US were to develop space solar power for military applications it would give the US civilian industry a big head start. As long as the military requirements are legitimate, there is no reason why this cannot be made into a win-win outcome. The stealthiness and robustness of all these programs, or their successors, would benefit from being able to draw electricity from a set of SPSs in GEO. The solar power satellites themselves would not necessarily have to be owned by the US government. They could be built privately based on a contract that promises that the Defense Department would buy a given amount of power at a predetermined price. This would be similar to the “power by the hour” contracts that are sometimes signed with jet engine manufacturers or the privately-financed initiative that the British RAF has established with a consortium for a new squadron of Airbus refueling tanker aircraft. In GEO an SPS is a large and conspicuous target. A realistic new space architecture would have to find ways to give both active and passive protection to such valuable assets. At the same time, these measures must not detract from the commercial profitability of the operation. The Civil Reserve Air Fleet system is a possible model; airlines buy some planes that are modified for possible military use in an emergency and the government compensates them for the extra weight they carry while in normal commercial use. Space solar power is, in the long run, inevitable. The Earth’s economy is going to need so much extra power over the next few decades that every new system that can be shown to be viable will be developed. If the US were to develop space solar power for military applications it would give the US civilian industry a big head start. As long as the military requirements are legitimate, there is no reason why this cannot be made into a win-win outcome.>

# 1AC Leadership Advantage Module

**Scenario one—economic competitiveness**

**SPS solves the economy – creates multiple jobs and saves the space industry**

**Rogue, Director of National Security Space Office 07**

(Joseph D. Rogue, Phase O Architecture Feasibility Study, JP)

**<Finding:** The SBSP Study Group found that SBSP appears to have significant growth potential in the long run, and a national investment in SBSP may return many times its value.

Most of America’s spending in space does not provide any direct monetary revenue. SBSP, however, may create new markets and the need for new products that will provide many new, high‐paying technical jobs and net significant tax revenues. Great powers have historically succeeded by finding or inventing products and services not just to sell to themselves, but to others. Today, investments in space are measured in billions of dollars. The energy market is trillions of dollars, and there are many billions of people in the developing world that have yet to connect to the various global markets. Such a large export market could generate substantial new wealth for our nation and our world. Investments to mature SBSP are similarly likely to have significant economic spin‐offs, each with their own independent revenue stream, and open up or enable other new industries such as space industrial processes, space tourism, enhanced telecommunications, and use of off‐world resources. Not all of the returns may be obvious. SBSP is a both infrastructure and a global utility. Estimating the value of utilities is

difficult since they benefit society as a whole more than any one user in particular—consider what the contribution to productivity and GDP are by imagining what the world would be like without electric lines, roads, railroads, fiber, or airports. Not all of the economic impact is immediately captured in direct SBSP jobs, but also in the services and products that spring up to support those workers and their communities. Historically such infrastructure projects have received significant government support, from land grants for railroads, to subsidized rural electrification, to development of atomic energy. While the initial‐capability on‐ramp may be slow, SBSP has the capability to be a very significant portion of the world energy portfolio by mid‐century and beyond. >

**SPS development uniquely improves US economic sectors necessary for US competitiveness and creates new spin off sectors solidifying the US economic position**

**Mahan, Author and Engineer, No Date Given**

(Rob Mahan, <http://c-sbsp.org/sbsp-faq/#01>, Last Modified 06/24/2011, as)

Yes, several very important ones. U.S. manufacturing and technology companies are concerned about being able to hire enough capable employees to replace the experienced workforce, a large percentage of which will be elgible to retire within the next ten years. Our domestic “intellectual feedstock” is very low, which is one of many reasons we haven’t built any new nuclear facilities in the last twenty-five years. Like the Apollo and other U.S. space programs did so many years ago, space-based solar power will inspire new generations of U.S. science and technology graduates. The U.S. domestic manufacturing base is badly eroded, and while some economists say that we are moving towards a service-based economy, common sense tells me that we should regain our independence and self-sufficiency in many areas necessary to support our society. Now that what seems like the majority of our clothing, computers, cars, oil, toys and electronics are imported, space-based solar power will support the development of new domestic manufacturing industries. We will also benefit from spin-offs similar to the original space program (microelectronics, internet, velcro, Tang, etc.) Better earth-based solar power efficiences will be gained. Low cost and reliable access to space will support many new industries. Perhaps a space tourism industry will be the forerunner of space colonization. Manufacturing in zero gravity and the hard vacuum of space will yield new materials and new products. Moon and asteroid based operations, such as the mining of natural resources from the Moon and asteroids will provide a platform for planetary protection from NEO (meteor / asteroid) strikes. The U.S. could become a major exporter of affordable energy and of energy and conservation technologies. But most importantly, the development of space-based solar power would demonstrate our nation’s belief in democracy and freedom for the entire human race. Space-based solar power gives the United States a great opportunity to regain a respected leadership role, not by force, but by example.>

# 1AC Leadership Advantage Module

**Economic competitiveness key to US leadership Competitiveness is key to leadership**

Rocco **Martino** (Ph.D. in astrophysics from the Institute of Aerospace Studies, Senior Fellow at the Foreign Policy Research Institute) Spring **2007** “A Strategy for Success: Innovation Will Renew American Leadership”, Orbis, Vol. 51, No. 2

Much of the foreign policy discussion in the United States today is focused upon the dilemma posed by the Iraq War and the threat posed by Islamist terrorism. These problems are, of course, both immediate and important. However, America also faces other challenges to its physical security and economic prosperity, and these are more long-term and probably more profound. There is, first, the threat posed by our declining competitiveness in the global economy, a threat most obviously represented by such rising economic powers as China and India.1 There is, second, the threat posed by our increasing dependence on oil imports from the Middle East. Moreover, these two threats are increasingly connected, as China and India themselves are greatly increasing their demand for Middle East oil.2 The United States of course faced great challenges to its security and economy in the past, most obviously from Germany and Japan in the first half of the twentieth century and from the Soviet Union in the second half. Crucial to America's ability to prevail over these past challenges was our technological and industrial leadership, and especially our ability to continuously recreate it. Indeed, the United States has been unique among great powers in its ability to keep on creating and recreating new technologies and new industries, generation after generation. Perpetual innovation and technological leadership might even be said to be the American way of maintaining primacy in world affairs. They are almost certainly what America will have to pursue in order to prevail over the contemporary challenges involving economic competitiveness and energy dependence.

# 1AC Leadership Advantage Module

**Scenario Two is Readiness**

**Military readiness challenged by lack of energy supply**

**NSSO**, Office of Space Security, Oct. **2007**

(National Security Space Office; <http://www.nss.org/settlement/ssp/library/final-sbsp-interim-assessment-release-01.pdf>;Oct. 10,2007;tr)

<FINDING: The SBSP Study Group found that the U.S. Department of Defense (DoD) has a large, urgent and critical need for secure, reliable, and mobile energy delivery to the war‐fighter. • When all indirect and support costs are included, it is estimated that the DoD currently spends over $1 per kilowatt hour for electrical power delivered to troops in forward military bases in war regions. OSD(PA&E) has computed that at a wholesale price of $2.30 a gallon, the fully burdened average price of fuel for the Army exceeds $5 a gallon. For Operation IRAQI FREEDOM the estimated delivered price of fuel in certain areas may approach $20 a gallon. • Significant numbers of American servicemen and women are injured or killed as a result of attacks on supply convoys in Iraq. Petroleum products account for approximately 70% of delivered tonnage to U.S. forces in Iraq—total daily consumption is approximately 1.6 million gallons. Any estimated cost of battlefield energy (fuel and electricity) does not include the cost in lives of American men and women. • The DoD is a potential anchor tenant customer of space‐based solar power that can be reliably delivered to U.S. troops located in forward bases in hostile territory in amounts of 5‐50 megawatts continuous at an estimated price of $1 per kilowatt hour, but this price may increase over time as world energy resources become more scarce or environmental concerns about increased carbon emissions from combusting fossil fuels increases.>

# 1AC Leadership Advantage Module

**Solar powered systems save resources and funding for the military**

**Goel, 11**

(Tarun Goel, brighthub, 5/17/11, <http://www.brighthub.com/environment/renewable-energy/articles/89238.aspx>

, 6/23/11, KJ)

In the US, a huge amount is spent every year on military operations. Security and military spending sometimes exceeds public spending, which creates an unnecessary burden on the public and tax payers. However, recently the Department of Defense has announced that it is going to use solar devices for military applications, which is a welcome step as it is going to reduce defense spending and save resources. Major research, security, and defense outfits like NASA and the American Army are going green by installing solar grids for general lighting and heating purposes. This is not only cutting down electricity consumption, but also giving free time to the army personnel as the solar panels and devices do not require any maintenance, unlike conventional devices which have to be monitored (and refueled) every now and then. However, the use of solar power is not restricted to solar panels and grids only. The military and defense services are using solar charged devices like mini-solar-computers, GPS devices, night vision goggles, solar torches, other portable devices, and even solar-recharging tents. Thin film solar modules are specially designed for lightweight portable gadgets with rugged features that ideally suit military and defense applications. Since the cost of traditional energy sources used by the military is already high, solar modules can be produced at substantially lower costs for special purpose military uses. Components of Solar Devices for Military Applications The solar powered devices make use of latest inventions that make these devices portable and lightweight. Reliability is the most important factor because if a device is to be used in military operations, it ought to be perfect because failing in the time of need could be fatal. Mention below mentioned are the major elements used in these portable devices. 1 Chlorophyll-F pigment - Chlorophyll-F pigment is a new discovery that has the special property of capturing sunlight beyond the red end of the wavelength band. Harnessing the pigment can enhance bio-fuel generating algae which are very efficient. It has a larger spread of sunlight absorption than any anticipated organism. The new pigment is capable of absorbing sunlight efficiently at wavelengths around 706 nanometers, which is beyond the red end of the visible spectrum and human perception. 2 Graphene - Researchers are finding graphene an incredible material suitable for high speed electronics, microchips, and touch screen technology. Nanotechnology graphene is successfully produced in small size having high quality electrical characteristics. It is a new form of carbon made of a single layer of atoms configured in a honeycomb shaped lattice. It is highly conductive and extremely strong despite being one atom thick. A major breakthrough of the graphene project for intensifying solar energy was measuring electrical characteristics with ultra-high precision to accurate standards. The Quantum Hall Effect phenomenon is an international standard for accurately measuring electrical properties in 2D materials. 3 Nano Composite Capacitors - Films are created from barium titanate (BaTiO3) nano-particles. These nano-particles are held in a polymer matrix. In this new technique, the nanocomposite materials are tested at high frequencies to the extent of one megahertz. This fabrication of improved versions of these capacitors has twice the energy of existing capacitors.

**SPS solves readiness – energy on demand and surveillance aspects key to maintaining appropriate force structures**

**Rogue, Director of National Security Space Office 07**

(Joseph D. Rogue, Phase O Architecture Feasibility Study, JP)

<For the DoD specifically, beamed energy from space in quantities greater than 5 MWe has the potential to be a disruptive game changer on the battlefield. SBSP and its enabling wireless power transmission technology could facilitate extremely flexible “energy on demand” for combat units and installations across an entire theater, while significantly reducing dependence on vulnerable over‐land fuel deliveries. SBSP could also enable entirely new force structures and capabilities such as ultra long‐endurance airborne or terrestrial surveillance or combat systems to include the individual soldier himself. More routinely, SBSP could provide the ability to deliver rapid and sustainable humanitarian energy to a disaster area or to a local population undergoing nation‐building activities. SBSP could also facilitate base “islanding” such that each installation has the ability to operate independent of vulnerable ground‐based energy delivery infrastructures. In addition to helping American and allied defense establishments remain relevant over the entire 21st Century through more secure supply lines, perhaps the greatest military benefit of SBSP is to lessen the chances of conflict due to energy scarcity by providing access to a strategically secure energy supply. >

# 1AC Leadership Advantage Module

**Hegemony key to prevent nuclear war**

**Kagan 2007**

[Robert-, Sr. Assoc. @ the Carnegie Endowment for International Peace, Sr. Transatlantic Fellow @ the German Marshall Fund, Real Clear Politics, “End of Dreams, Return of History”, <http://www.realclearpolitics.com/articles/2007/07/>end\_of\_dreams\_return\_of\_histor.html]

The current order, of course, is not only far from perfect but also offers no guarantee against major conflict among the world 's great powers. Even under the umbrella of unipolarity, regional conflicts involving the large powers may erupt. War could erupt between China and Taiwan and draw in both the United States and Japan. War could erupt between Russia and Georgia, forcing the United States and its European allies to decide whether to intervene or suffer the consequences of a Russian victory. Conflict between India and Pakistan remains possible, as does conflict between Iran and Israel or other Middle Eastern states. These, too, could draw in other great powers, including the United States. Such conflicts may be unavoidable no matter what policies the United States pursues. But they are more likely to erupt if the United States weakens or withdraws from its positions of regional dominance. This is especially true in East Asia, where most nations agree that a reliable American power has a stabilizing and pacific effect on the region. That is certainly the view of most of China 's neighbors. But even China, which seeks gradually to supplant the United States as the dominant power in the region, faces the dilemma that an American withdrawal could unleash an ambitious, independent, nationalist Japan. In Europe, too, the departure of the United States from the scene -- even if it remained the world's most powerful nation -- could be destabilizing. It could tempt Russia to an even more overbearing and potentially forceful approach to unruly nations on its periphery. Although some realist theorists seem to imagine that the disappearance of the Soviet Union put an end to the possibility of confrontation between Russia and the West, and therefore to the need for a permanent American role in Europe, history suggests that conflicts in Europe involving Russia are possible even without Soviet communism. If the United States withdrew from Europe -- if it adopted what some call a strategy of "offshore balancing" -- this could in time increase the likelihood of conflict involving Russia and its near neighbors, which could in turn draw the United States back in under unfavorable circumstances. It is also optimistic to imagine that a retrenchment of the American position in the Middle East and the assumption of a more passive, "offshore" role would lead to greater stability there. The vital interest the United States has in access to oil and the role it plays in keeping access open to other nations in Europe and Asia make it unlikely that American leaders could or would stand back and hope for the best while the powers in the  region battle it out. Nor would a more "even-handed" policy toward Israel, which some see as the magic key to unlocking peace, stability, and comity in the Middle East, obviate the need to come to Israel 's aid if its security became threatened. That commitment, paired with the American commitment to protect strategic oil supplies for most of the world, practically ensures a heavy American military presence in the region, both on the seas and on the ground. The subtraction of American power from any region would not end conflict but would simply change the equation. In the Middle East, competition for influence among powers both inside and outside the region has raged for at least two centuries. The rise of Islamic fundamentalism doesn 't change this. It only adds a new and more threatening dimension to the competition, which neither a sudden end to the conflict between Israel and the Palestinians nor an immediate American withdrawal from Iraq would change. The alternative to American predominance in the region is not balance and peace. It is further competition. The region and the states within it remain relatively weak. A diminution of American influence would not be followed by a diminution of other external influences. One could expect deeper involvement by both China and Russia, if only to secure their interests. 18 And one could also expect the more powerful states of the region, particularly Iran, to expand and fill the vacuum. It is doubtful that any American administration would voluntarily take actions that could shift the balance of power in the Middle East further toward Russia, China, or Iran. The world hasn 't changed that much. An American withdrawal from Iraq will not return things to "normal" or to a new kind of stability in the region. It will produce a new instability, one likely to draw the United States back in again. The alternative to American regional predominance in the Middle East and elsewhere is not a new regional stability. In an era of burgeoning nationalism, the future is likely to be one of intensified competition among nations and nationalist movements. Difficult as it may be to extend American predominance into the future, no one should imagine that a reduction of American power or a retraction of American influence and global involvement will provide an easier path.

# \*\*\*Inherency\*\*\*

# Inherency: SQ export controls limit development

**US imposes restrictions that make cooperation necessary to get project off grond**

**Xin et al**, Masters degree in aerospace management, **2009**

(Sun Xin , Evelyn Panier, Cornelius Zünd, and Raul Gutiérrez Gómez, Toulouse Business School, May 2009 <http://www.nss.org/settlement/ssp/library/2009-FinancialAndOrganizationalAnalysisForSSP.pdf>, *AJ*)

The SSPS will most likely require cooperation from different countries and corporations from

around the world. As with any large aerospace project there will be limitations on who can

work on what, and what can be sent where. Also of importance will be the division and sharing

of new technologies that emerge through this project. Does everyone benefit from

participation, or only a few key players?

Considering present day controlled goods initiatives and trade restrictions by the United States

against certain countries, it is certain that moving forward on a large project like the SSPS will

require dedicated and rigorous negotiations between partners to ensure it comes to fruition

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# Inherency-No funding SPS SQ

**Technology / plans exist – funding ceased after 9/11 NASA and DOE cutting funding limiting R and D in the US**

**Smith, president of the Long Island Space Society, 04**

(Arthur P. Smith, November 1 2004, National Space Society, <http://www.nss.org/adastra/volume16/smith.html>, JP)

Gathering power in space and transmitting it to Earth should not be a mystery to us in this 21st century. Communications satellites already do it routinely. One significant obstacle to power applications, however, is regulatory oversight. There is no spectrum allocated to power transmission, as there is for communications. Since frequency of operation has a significant impact on transmitter design, which may alter the design of the overall solar power system, the earlier we have a frequency allocation decision, the better. The Federal Communications Commission and the International Telecommunications Union should be prodded to start work on this issue now.

The potential for power from space has been recognized for more than 30 years. Studies in the late 1970's by NASA and the Department of Energy produced a [reference design for solar power satellites](http://www.nss.org/settlement/ssp/library/doe.htm) using then-current technology that proved technically feasible, but expensive. NASA returned to the subject with an exploratory study from 1999 to 2001. A [review by the National Research Council](http://www.nss.org/settlement/ssp/library/index.htm#nrc) found the program to have a credible plan that required significant funding increases. Rather than strengthening the program, however, all funding for the space solar power group ceased after September 2001, and essentially no R&D work on power from space is now being clone in the United States.

# Inherency- No SPS Catalyst

**Technical challenges are closing, but no catalyst remains to stimulate SPS**

Boyle, Science Editor, 07

(Alan Boyle, 10/12/2007, MSNBC, <http://www.msnbc.msn.com/id/21253268/ns/technology_and_science-space/t/power-space-pentagon-likes-idea/>, accessed June 24, 2011, JP)

<In conjunction with the Pentagon report's release, 13 space advocacy and research organizations announced the formation of the [Space Solar Alliance for Future Energy](http://ssafe.wordpress.com/), which pledged to push for implementation of the space power plan.

"While the technical challenges are real, significant investment now can build space solar Power into the ultimate energy source: clean, green, renewable, and capable of providing the vast amounts of power that the world will need. Congress, federal agencies and the business community should begin that investment immediately,” Mark Hopkins, senior vice president of the National Space Society, said in a written statement.

It's up to policymakers, business leaders and voters to decide whether space-based solar power, or SBSP, is worth pursuing, according to the acting director of the Pentagon's National Security Space Office, Joseph Rouge.

"It appears that technological challenges are closing rapidly and the business case for creating SBSP is improving with each passing year," Rouge said in his foreword to the report. "Still absent, however, is an appropriate catalyst to stimulate the various interested parties toward actually developing a SBSP capability."

The Solar Electric Power Association's Taylor, who advises utilities and other organizations on trends in terrestrial solar power, said the space option "is not something that's on the current solar industry's radar."

He told msnbc.com that putting a large power-generating system in space would pose huge technical challenges — and the potential payoff would have to be similarly huge to justify the risk and expense.

"I'm not sure there'd be a great need to move into space unless it had some exponential cost improvement," Taylor said. "It can't be just a marginal improvement.">

# Inherency: SPS Funding Low

**Inherency: SPS funding is low**

**Hsu, Systems Engineering & Risk Management, 10**

(Dr. Feng Hsu, “Harnessing the Sun”, Winter 2010, <http://spacejournal.ohio.edu/issue16/hsu.html>, KJ)

<Our society has repeatedly overlooked (or dismissed) the potential of space based solar power. The U.S. government funded an SPS study totaling about 20 million dollars in the late 1970s at the height of the early oil crisis, and then practically abandoned this project with nearly zero dollars spent up to the present day. A government funded SPS demonstration project is overdue. Ralph Nansen, a friend of mine, who was the former project manager of the Apollo program at Boeing and who later managed the DOE-NASA funded SSP proof of concept study in the late 1970s, detailed the Boeing study in his excellent 1995 book Sun Power: The Global Solution for the Coming Energy Crisis[6]. In 2009, he authored another book entitled Energy Crisis: Solution From Space[7]. I highly recommend the reading of each of these two books for those interested in this topic. Of course, Dr. Peter Glaser's 1968 book and other papers[8] are superb reading on this topic as well.>

# \*\*\*\*\*Solvency\*\*\*\*\*

# Solvency—Dept of Commerce lead on sps \*1ac

**The Department of Commerce is capable of SSP R&D – launch costs still remain an issue**

[**Shea**](http://spacejournal.ohio.edu/about_ed.html#flournoy), Master of Arts in Science Technology and Space Policy at George Washington University, 20**10** (Karen Cramer, Online Space Journal of Communication, December 2010. http://spacejournal.ohio.edu/issue16/shea.html NP)

The Department of Commerce is an agency that deals with space and is concerned about the nation's energy future. The Commerce Department currently hosts the National Oceanic and Atmospheric Administration (NOAA), one of the world's largest civilian space agencies. Commerce is concerned with all aspects of the U.S. economy and energy definitely affects the US economy.

The Department of Commerce is the perfect agency to take the lead on space solar power. From its Web site, one can see that Commerce's mission includes "promoting the Nation's economic and technological advancement," "strengthening the international economic position of the United States," "improving comprehension and uses of the physical environment," and "ensuring effective use and growth of the Nation's scientific and technical resources." Space solar power development will be key to U.S. future economic and technological development. SPS is an excellent example of a way to help strengthen our international economic position, to improve use of our physical environment and effectively exploit our scientific and technical resources. Space solar power is clearly within the mandate of the Department of Commerce.

Secretary of Commerce Gary Locke is in a good position from which to champion space solar power development. He was the two-time governor of the State of Washington; thus is very aware of the importance of aerospace to the U.S. economy since Boeing is a pillar of the state's economy. He has strong leadership skills. The Commerce Department currently hosts the Office of Space Commercialization, National Oceanic & Atmospheric Administration (NOAA), National Institute of Standards & Technology, National Telecommunications & Information Administration, National Technical Information Service and Economic Development Administration. All of these can be expected to contribute to and benefit from the effort to develop a system of Solar Power Satellites. The Office of Space Commercialization is presently the only civilian government group interested in space solar power.

The Department of Commerce has a history of cooperation with both DOE and NASA. Today, NOAA works closely with NASA on its weather satellite launches. Gary Locke and Dr. Steven Chu, Secretary of the Department of Energy, work together well, making many joint appearances.

If Commerce will fund SSP development, the issue of launch costs will still need to be addressed. Launching satellites and related materials into space has remained extremely expensive for decades because the current market isn't big enough to justify the major investment required to develop new technology. Given the potential size of this new energy source, it would make sense for the US government to put money into R&D. It would also help if the government subsidized launch costs for the first four full scale solar power satellites in return for a percent of the power produced for the life of the satellite. This could help to get the energy market moving in the direction of space. It may also help to address some of the power needs of our Department of Defense.

# Solvency – NASA or DOD

**NASA and DOD development SPS**

**Mohammed and Ramasamy,** Politicians and former Members of the Legislative Assembly**, ‘09**

(S. Sheik Mohammed and K.Ramasamy, proceedings of international conference on energy and environment, [Ebsco](http://web.ebscohost.com/ehost/detail?vid=10&hid=112&sid=5ac440de-7fdb-4dec-93a0-4edc0039db57%40sessionmgr13&bdata=JnNpdGU9ZWhvc3QtbGl2ZSZzY29wZT1zaXRl#db=a9h&AN=40086283), AJ)

The SPS concept development and evaluation program tasked by U.S. Department of Energy (DOE) and National Aeronautics and Space Administration (NASA) started in 1978 is remarkable in the history of power transmission in the United States. This study examined technical, environmental and societal aspects of the SPS concept. During 1995-97, NASA re-examined the concept of Space Solar Power (SSP) in the fresh look study and in SSP concept definition study during 1998[24, 25]. Space Solar Power Exploratory Research and Technology Program (SERT) to evaluate the studies of general feasibility, design and requirements to develop a Solar Power Satellite (SPS) concept was conducted by NASA in the year 1999. The SSP Concept and Technology Maturation(SCTM) program has been conducted by NASA from 2001-02. During 2001-2003 NASA and National Science foundation jointly conducted SSP research and Technology Program. Exploration Systems Research and Technology (ESR & T) Program was conducted from 2004- 2005. On October 2007, the Pentagon’s National Security Space Office intended its interest to a study on SPS and which simultaneously announced the formation of the Space Solar Alliance for Future Energy (SSAFE), a new organization advocating investment in space-based solar power technologies to address the planets future energy needs.

# Solvency—NASA and DOD

**The DOD wants Solar Powered Satellites for military NASA, the Pentagon and DOE have done significant research**

[**Shea**](http://spacejournal.ohio.edu/about_ed.html#flournoy), Master of Arts in Science Technology and Space Policy at George Washington University, 20**10** (Karen Cramer, Online Space Journal of Communication, December 2010. http://spacejournal.ohio.edu/issue16/shea.html NP)

Over 40 years ago, Dr. Glaser of Arthur D. Little Company first proposed the concept of placing satellites in geosynchronous orbit to collect energy from the Sun for the purpose of transmitting the energy back to the earth. Possible implementation of Dr. Glaser's idea was studied by DOE and NASA during the 1970's. In 1975, the Goldstone Deep Space Communications Complex did experiments in wireless power transmission. In 1999, NASA undertook further review of space solar power. In 2007, the Pentagon's National Security Space Office issued a report on space based solar power that included a discussion of its use to power forward military bases. In 2008, the Discovery Channel aired a television documentary featuring John Mankins and his Japanese colleagues testing wireless power transmission between two Hawaiian Islands, a key space solar power technology. In 2009, Pacific Gas and Electric (PG&E) announced an agreement to buy 2000 MW of space solar power starting in 2016.[4] Also in 2009, the Japanese made SSP a national priority and indicated they may spend $21 billion to build a space solar power satellite over the next 30 years.[5]

The United States is estimated to have invested $80 Million (adjusted for inflation) studying SPS since the idea was first proposed. This includes funding from DOE and NASA for 3 years during the 1970's[2] and the NASA funding in 1999 and 2000.[3] As a comparison, DOE is estimated to have invested $21 Billion in fusion energy research since the 1950s.[1]

Space Solar Power has suffered from a policy dilemma. The Department of Defense (DOD) wants to use solar power satellites (SPS) to deliver electrical power to its forward military bases but that agency cannot build them, since SPS is clearly not in its mission. The DOD is developing lasers and microwave beams for offensive military purposes, but taking a lead in using lasers and microwaves for the beaming of electrical power would be politically unacceptable. The DOD is very interested in being an SSP customer because this satellite energy application would dramatically improve efficiency and reduce costs of supplying power to its troops in the field. Another consideration is in reducing costs in lives, as the generator fuel trucks are easy targets.

# Solvency – Demonstration thru DOD

**USFG demonstrations key to development—especially through DOD**

**Coopersmith, Historian of Technology at Texas A&M University 2009**

(Jonathan Coopersmith, thespacereview.com, 9/28/09, <http://www.thespacereview.com/article/1475/1>, retrieved 6/22/11, HLM/AS)

<One consensus was the need for key demonstrations to demonstrate the viability of SBSP concepts and attract interest from possible funders, investors, and customers. Proving technical feasibility would not be enough. Demonstrations should also generate near-term financial return. Applying microwave power transmission to terrestrial applications to replace conventional transmission lines would demonstrate the feasibility of wireless power transmission while generating income and attention.

Actually transmitting small but meaningful amounts of power from space—tens or hundreds of kilowatts from LEO instead of hundreds of megawatts from GEO—would provide a dramatic proof of possibility, especially if the recipients were developing countries that sorely needed the electricity. Funding these early projects will be expensive and the traditional financial patron of aerospace technologies, the military, might play a major role, especially if SBSP could provide power to bases.

The sessions confirmed that the last decades have produced impressive technological advances in every area except launch costs. Launch costs could doom SBSP to remaining only on paper. At current costs of $10,000 a pound, placing the 3,000 tons needed for a one-gigawatt station into GEO would cost $60 billion, three times NASA’s current annual budget. At $1,000 a pound, launching would demand $6 billion, the cost of a new nuclear plant. At $100 a pound, $600 million would be needed, a large but not implausible amount.

Nonetheless, here too optimism abounded. Presentations on low-cost launch options ranged from operations-optimized chemical rockets to radical ground-based technologies like magnetic levitation and beamed energy propulsion. All suffered from the same problem: developing new systems would cost billions of dollars, investments that would not flow unless there was much greater demand than currently ecxists. SBSP would provide the demand that would justify the new investment. The creation of a low-cost launch system could in turn dramatically expand access to space exploration and exploitation.>

# Solvency—DOD sparks civilian industry

**DOD investment increase civilian industry—and SPS solves for power sources for long range space exploration**

**Dinerman, author and journalist, 2007**

(Taylor Dinerman, The Space Review, 7/16/7, <http://www.thespacereview.com/article/910/1> 6/24/11, KJ)

<The first steps in such a program would be to begin work on an experiment to prove that power transmission in space via laser is possible. Already lasers are being used for communications in civil and military applications; taking this one step beyond to encompass power should be within the state of the art. At the same time the US Defense Department and NASA could begin joint work on a new generation of high-capacity power systems for future spacecraft. The power management and thermal control needs of a spacecraft that will carry a human crew to Mars may not be all that different from those of an SPS or an SR satellite.

The bulk of the development work on the radars themselves can be left until later in the program. Meanwhile, the US could profitably study less ambitious space radar programs such as Canada’s Radarsat. Launching one or two modest technology development satellites over the next five or ten years would be a helpful way to set the stage for a new SR program. In the long term, say, by around 2010, the GMTI radar could be replaced and supplemented by an Air Moving Target Indicator (AMTI), which would need even more power.

Instead of using a single large antenna or multiple smaller ones on the same spacecraft, a future stealthy SR could use radars on multiple satellites. Formation flying is now commonplace and coordinating multiple beams from two or three satellites in different orbits should not be that hard. The biggest problem will be to prove to Congress that the technology is ready for prime time.

Almost all of America’s major military space programs are too far along to effectively incorporate the lessons of China’s ASAT test. SR, due to repeated budget cuts, is the great exception. Other satellite programs that could be modified to incorporate the needs of the new space warfare requirements include the T-SAT Transformational Communications project and the possibly the NRO’s problem-plagued Future Imagery Architecture (FIA).If the US were to develop space solar power for military applications it would give the US civilian industry a big head start. As long as the military requirements are legitimate, there is no reason why this cannot be made into a win-win outcome.

The stealthiness and robustness of all these programs, or their successors, would benefit from being able to draw electricity from a set of SPSs in GEO. The solar power satellites themselves would not necessarily have to be owned by the US government. They could be built privately based on a contract that promises that the Defense Department would buy a given amount of power at a predetermined price. This would be similar to the “power by the hour” contracts that are sometimes signed with jet engine manufacturers or the privately-financed initiative that the British RAF has established with a consortium for a new squadron of Airbus refueling tanker aircraft.

In GEO an SPS is a large and conspicuous target. A realistic new space architecture would have to find ways to give both active and passive protection to such valuable assets. At the same time, these measures must not detract from the commercial profitability of the operation. The Civil Reserve Air Fleet system is a possible model; airlines buy some planes that are modified for possible military use in an emergency and the government compensates them for the extra weight they carry while in normal commercial use.

Space solar power is, in the long run, inevitable. The Earth’s economy is going to need so much extra power over the next few decades that every new system that can be shown to be viable will be developed. If the US were to develop space solar power for military applications it would give the US civilian industry a big head start. As long as the military requirements are legitimate, there is no reason why this cannot be made into a win-win outcome.>

# Solvency--DOD

**DOD and military advocate for sps**

**Nansen, quals,10**

(Ralph H. Nansen, “Low Cost Access to Space is Key to Solar Power Satellite Depoloyment”, [**http://spacejournal.ohio.edu/issue16/nansen.html**](http://spacejournal.ohio.edu/issue16/nansen.html), 6/22/11, KJ)

<The technology has evolved. Solar cell costs have come down and performance options have improved, particularly with the development of the thin filmed cells printed on metal foil. These cells are very light weight, low cost and have a long life potential in the radiation environment of geosynchronous orbit. Potential for use by the military, for supplying space based solar energy to advanced bases from small satellites using lasers, has created a new advocate for the concept.[6] Also the potential of using very high frequency wireless power transmission opens the option of much smaller output satellites. Such an approach would reduce the cost of the first-generation commercial satellites and demonstrations.>

# Solvency--US key to SPS

**US action key on SPS—restores US leadership and energy independence**

**Space Enterprise Council,** US Chamber of Commerce, **2008**

(Space Enterprise Council, July 2008 *Recommendation on Space-Based Solar Power,* [*http://www.nss.org/settlement/ssp/library/2008-SECSpaceBasedSolarPowerWhitePaper.pdf*](http://www.nss.org/settlement/ssp/library/2008-SECSpaceBasedSolarPowerWhitePaper.pdf)*, AJ)*

The expected cost of deploying SBSP is ~$7,400/kW, including the rectenna as well as construction and launch of Block II satellites. Amortized over an expected life of 30 years at a discount rate of 5%, the contribution of this capital cost to the delivered cost of electric energy would be 5.6 cents/kWh. SBSP is thus much more promising than terrestrial solar as a replacement for fossil fuels or nuclear power.

A strong US commitment to SBSP could

 Solve the energy problem permanently, in the USA and around the world.

 Offer clean, inexhaustible solar power almost anywhere on Earth.

 Restore the status of the United States as an energy-exporting nation.

 Create large international markets for export of our technology as well as energy.

 Offer greatly reduced launch costs to all users of space, including the DoD, NASA and commercial interests.

 Restore US preeminence in launch services.

 Permit explosive growth in extraterrestrial enterprises.

 Open the solar system as the domain of our species, eliminating most concerns about resource exhaustion.

Serious studies of SBSP are under way in several countries, including Japan, China, India and the European Union. Continued US neglect of this vital technology means that we will not only suffer all the economic, political and strategic consequences of abdicating our leadership in space but also abandon control of our energy future. What we do about these issues in the next few years will determine whether we will restore American initiative or become a debt-ridden, second-rate nation that must import electricity as well as petroleum.

# solvency—coordinated national policy

**US agencies should coordinate action to increase sps**

**Space Enterprise Council,** US Chamber of Commerce, **2008**

(Space Enterprise Council, July 2008 *Recommendation on Space-Based Solar Power,* [*http://www.nss.org/settlement/ssp/library/2008-SECSpaceBasedSolarPowerWhitePaper.pdf*](http://www.nss.org/settlement/ssp/library/2008-SECSpaceBasedSolarPowerWhitePaper.pdf)*, AJ)*

There are three important roles for government agencies in making SBSP happen: „h NASA and ARPA-E should be working on advanced enabling technologies that can make SBSP even more effective, as NACA once did for aviation. Examples include improvements to reusable, economical rocket engines, reentry systems, gossamer space structures, and lightweight, efficient microwave transmitters. „h NASA, NOAA and the DoD should offer performance-based contracts in advance for a sufficient number of commercial launches to justify private development of suitable reusable vehicles. This will save money, compared to continued reliance on expendable launch vehicles. This policy is analogous to the use of airmail contracts in promoting the airline industry. „h The Congress should reduce risks for large private investments in power satellites by offering loan guarantees, tax holidays and other incentives. Note that these functions do not include large upfront Federal expenditures on system studies or power satellite development programs.

# Solvency- Coordinated National program for SPS

**Coordinated national program for SPS involving NASA and DOD keeps SPS from falling through government cracks**

**Cox, prosecutor and public interest lawyer, 11**

(William Cox, May 32 2011, The Public Record, <http://pubrecord.org/politics/9116/race-space-solar-energy/>, JP)

<With increases in electricity demand and costs, NASA took a “fresh look” at the concept between 1995 and 1997. The NASA study envisioned a trillion-dollar project to place several dozen solar-power satellites in geostationary orbits by 2050, sending between two gigawatts and five gigawatts of power to Earth.

The NASA effort successfully demonstrated the ability to transmit electrical energy by microwaves through the atmosphere; however, the study’s leader, John Mankins, now says the program “has fallen through the cracks because no organization is responsible for both space programs and energy security.”

The project may have remained shelved except for the military’s need for sources of energy in its campaigns in Iraq and Afghanistan, where the cost of gasoline and diesel exceeds $400 a gallon. A report by the Department of Defense’s National Security Space Office in 2007 recommended that the U.S. “begin a coordinated national program” to develop space-based solar power>

# Solvency: coordinated national policy

**SPS requires integrated approach—sustained advocacy required for development**

**Obama-Biden Transition Project 07**

(Obama-Biden Transition Project, October 10 2007, <http://www.acq.osd.mil/nsso/solar/solar.htm>, JP)

<A National Security Space Office (NSSO) study concluded in October of 2007 that “The magnitude of the looming energy and environmental problems is significant enough to warrant consideration of all options, to include ... space-based solar power.”

This NSSO report also concluded that SSP has “enormous potential for energy security, economic development, improved environmental stewardship, advancement of general space faring, and overall national security for those nations who construct and possess a (SSP) capability.”

We urge the next President of the United States to include SSP as a new start in a balanced federal strategy for energy independence and environmental stewardship, and to assign lead responsibility to a U.S. federal agency.

• SSP Falls through the Cracks as Nobody is Responsible: No U.S. federal agency has a specific mandate or clear responsibility to pursue SSP. The U.S. Department of Energy (DOE) says SSP is a space project, and thus NASA’s job. NASA says SSP is an energy project, and thus DOE’s job. The NSSO-report found that SSP “’falls through the cracks’ of federal bureaucracies, and has lacked an organizational advocate within the US Government.”

• SSP has Significant Long-Term Advantages: SSP is unusual among renewable energy options as it satisfies all of the following criteria:

o Immensely Scalable — SSP can scale to provide the energy needs of the entire human civilization at America’s standard of living. Most other near-term renewable options are strictly limited in scalability. As the NSSO report states “A single kilometer-wide band of geosynchronous Earth orbit experiences enough solar flux in one year to nearly equal the amount of energy contained within all known recoverable conventional oil reserves on Earth today.”

o Safe Global Availability — Nuclear power technology cannot be safely shared with most of the countries on this planet because of proliferation concerns.

o Steady & Assured — SSP is a continuous, rather than intermittent, power source. It is not subject to the weather, the seasons, or the day-night cycle.

o No Fundamental Breakthroughs — SSP does not require a fundamental breakthrough in either physics or engineering, such as those required by fusion.

o Highly Flexible and Optimal for Export — SSP could enable America to become a net energy exporter. We could be the world’s largest exporter of energy for the 21st and 22nd Centuries, and beyond.

• Economics is the Key Barrier. The extremely high-cost of space transportation and building spacecraft is the principal barrier. Some believe the cost of SSP is so high that it will never be economical for baseload power. Never is a long time and we disagree. More importantly, the NSSO disagrees. The solution to the cost challenge is straightforward: 1)

Achieve cheap & reliable access to space, 2) Apply high-volume mass-production assembly-line techniques to spacecraft construction, 3) Reduce the technical risk with basic research and technology demonstrations, and 4) Adopt proven government approaches to incentivize private industry investment, development and operation.

RECOMMENDATIONS

• Establish Development of SSP in National Policy: Establish in national policy the explicit goal to develop Space-Based Solar Power as an energy resource, consistent with our existing national policies to invest in other energy sources like wind, ground solar, geothermal, clean coal, advanced nuclear power, geothermal, fusion, and bio-fuels.

• Assign a Lead Federal Agency: Assign lead responsibility for developing SSP to a federal agency. This agency should be tasked to work with other federal agencies, private industry, and our international friends and allies.

• Focus First on High-Value Niche Power Applications: The federal government should focus first on very high-value energy requirements such as in-space power, emergency power services to devastated regions for humanitarian purposes, and delivering power to forward military bases.

• Incremental Step-by-Step SSP Research Program: The Administration should develop a program that is focused on developing and proving key technologies and a series of incrementally more challenging technology demonstrators that

can be scaled to much larger systems by mass production techniques.

• SSP Should be Funded at the Level of Fusion Energy Research: The U.S. federal government has invested over $21 Billion in fusion research in the last 50 years, and the DOE is currently spending $300 million per year on fusion energy research. When choosing a lead agency for SSP, the Administration should establish an SSP research budget within that agency that grows to at least the level of the DOE’s fusion energy research program. >

# Solvency-demonstration project

**Demonstration projects allow for development of sats**

**Globus, NASA Ames Research Center Scientist, 10/10**

(Al Globus, Towards an Early Profitable PowerSat, October 2010, http://space.alglobus.net/papers/SSI2010SSPpaper.pdf, June 21, 2011, AJ)

 [The most ambitious pre-operational development would be to build and fly a version of the Ikaros satellite with more area devoted to power production. This could produce about 9kw, sufficient to prove the technology. The Ikaros satellite is reported to have cost only $16 million, and a second similar satellite should cost far less. Covering the sail with solar cells will increase the cost, as would development and integration of an infra-red laser, optics and the ground system. However, this may be an extremely cost-effective approach to demonstrating SSP. While such a mission is probably well beyond the financial capabilities of SSI, phase A studies may not be.

The Ikaros demonstrated packing and deployment of an operational thin-film solar array 14m on a side. It may be that the same techniques will not work well for a 200m-on-a-side sail. Preliminary studies of various options should be relatively inexpensive.

Finally, the proposed system weighs only 100g/m2 and will respond substantially to light pressure from the sun. While this pressure sums to zero over the course of a year, other perturbations, such as lunar gravity, can amplify changes to orbital parameters and cause the system to drift over long periods of time. Preliminary simulations with AGI’s Satellite Toolkit suggest that a 100g/m2 spacecraft in GEO will oscillate around its initial location and the orbital parameters will drift, but at the end of a year the spacecraft will return to nearly the same orbital parameters it started with, suggesting that minimal stationkeeping fuel will be needed. However, a 20g/m2 satellite will become very unstable, with large changes in orbital parameters that do not return after a year. The minimal reasonably-stable mass per unit area is not known. This is a relatively easy study to undertake.

Although critics, such as Fetter,5 have suggested that SSP is orders-of-magnitute from profitability, this does not seem to be the case. Specifically, using IR power beaming similar to that which won the NASA-sponsored power beaming contest, very light-weight solar power collection based on the Ikaros solar sail heliogyro and thin-film solar cells may bring SSP within a small factor of financial feasibility. Indeed, total system cost may be less than a few times greater than life-time nuclear power cost per watt of installed capacity; and high end markets, such as forward military bases, are willing to pay such high prices for power that profitable space solar power may be within our grasp.]

# Solvency—Demonstration projects

**Pentagon study plans demonstration by 2012, but no funding exists, demo leads to commercial SPS**

Boyle, Science Editor, 07

(Alan Boyle, 10/12/2007, MSNBC, <http://www.msnbc.msn.com/id/21253268/ns/technology_and_science-space/t/power-space-pentagon-likes-idea/>, accessed June 24, 2011, JP)

<The commercial systems discussed in the past would deliver 5 to 10 gigawatts of power. In contrast, the Pentagon study calls for military systems providing 5 to 50 megawatts of continuous power — roughly a thousandth as much.

The report's roadmap calls for ground-based technology development over the next few years, leading up to a demonstration in low Earth orbit in the 2012-2013 time frame, and in geosynchronous orbit by 2017. However, the report makes no commitment for funding such a demonstration. Smith said that would be up to other agencies — such as the Pentagon's own Defense Advanced [Research Projects](http://www.msnbc.msn.com/id/21253268/ns/technology_and_science-space/t/power-space-pentagon-likes-idea/) Agency, or NASA, or the proposed [Advanced Research Projects Energy](http://www.aip.org/fyi/2007/046.html).

Damphousse said the program could use an "incremental approach," starting with experiments to transmit power wirelessly between ground stations placed miles apart. "If you can do that, then you're well on your way to proving you can do it from space," he said.

A follow-up experiment could try transmitting power from the international space station to Earth. "I actually met with a bunch of folks at NASA Ames last week ... and they warmed to the idea immediately," Damphousse said.

Damphousse said the geosynchronous system would require an investment on the order of $10 billion, but would serve as a proof of concept for commercial space power systems.

Smith said such systems could eventually deliver electricity to places that lack the infrastructure for traditional power transmission grids, and turn the decades-old dream of wireless power into reality. "It's using space for an actual tradeable commodity — not for a rover on Mars, which is also necessary — but actually delivering a commodity that can be given to anybody in the world," he said.>

# Solvency- Private Capital / Demonstration

**Private sectors have enough capital to finance SBSP construction, but need government assistance**

**Rogue, Director of National Security Space Office 07**

(Joseph D. Rogue, Phase O Architecture Feasibility Study, JP)

**<FINDING:** The SBSP Study Group found that adequate capital exists in the private sector to finance construction, however private capital is unlikely to develop this concept without government assistance because the timeframe of reward and degree of risk are outside the window of normal private sector investment.

Capital in the energy and other sectors is available on the level needed for such a large project, but capital flows under fairly conservative criteria, and SBSP has not yet experienced a suitable demonstration, nor have the risks been adequately characterized to make informed business plan decisions. >

# Solvency--DOE office of solar power

**Creation of DOE office of solar power , coordinate NASA and DOE, solves SPS**

**Gauger, PhD at UCLA in cosmic ray studies, professional life in the aerospace industry, 2010**

(Joleroy, Online Journal of Space Communication

<http://spacejournal.ohio.edu/issue16/gauger.html>, date accessed 6/20/11, as)

<We need first to convince the present administration that this effort is of prime importance, far exceeding the demands of any other efforts in space. President Obama in a speech at the Florida Power and Light utility on October 6, 2009, made reference to the Federal Government funding of efforts of this nature. Government participation is necessary. In my opinion, the Department of Energy should establish at the undersecretary level an office of Solar Power. It should be financed with sufficient funds and talent to initiate the following efforts.

1. Establish an advisory group consisting of civilian space advisors, representatives from NASA, DOE, and the State Department. This group would sponsor participation and guide the efforts to identify relevant policies, national and international limitations and to fund competitive well-defined tasks selected to move along a path to the full development and placement of operational solar power satellites in space.>

# Solvency – AT No Tech now

**U- SPS moving towards reality market is ready**

**Salkever, author for Daily Finance, 2009**

(Alex Salkever, <http://www.dailyfinance.com/2009/12/04/california-gives-green-light-to-space-based-solar-power-project/>, 12/04/09, as)

The concept is not new. Satellites orbiting far enough outside our atmosphere can capture solar energy around the clock, and without power-reducing cloud cover or atmospheric interference. The satellites use photovoltaic panels, much like those that are installed on ordinary buildings, to capture solar energy and convert it into electricity.

What happens next, though, is a bit different than what occurs on your average rooftop: The electricity is used to generate microwaves, which are beamed at large antennas on Earth. The antennas recapture the energy of the microwaves and convert it back into electricity. It all may sound like science fiction, but space-based power appears to be quickly moving towards reality.

**Tech has been around a long time—seriously**

**Mahan, author for Citizens for Space Based Solar Power, No Date Given**

(Rob Mahan, <http://c-sbsp.org/sbsp-faq/#01>, Last Modified 06/24/2011, as)

Space-based solar power first conceived of in the late 1960′s, during the widely supported Apollo program. It was patented by Dr. Peter Glaser in 1968, when gasoline was a quarter a gallon, access to space was still a new frontier and technologies like photovoltaics and wireless power transmission were new and undeveloped. World population was much lower than today and so was the demand for energy. The business case for space-based solar power no where near closing. The world has changed in significant ways since then.

Space-based solar power has been studied several times by government agencies over last 40 years. It was examined extensively during the late 1970s by the D.o.E. and NASA and then reexamined by NASA from 1995-1997 in the “fresh look” study. The concept was studied again in 1998 in a “concept definition study” by NASA, which was followed in 1999-2000, when NASA undertook the SSP Exploratory Research and Technology (SERT) program. During 2001-2002, NASA pursued an SSP Concept and Technology Maturation (SCTM) program follow-on to the SERT and also in 2001, the U.S. National Research Council (NRC) released a major report, providing the results of a peer review of NASA’s SSP strategic research and technology study.

# Solvency AT: Tech Not Ready

**Tech developments allow for multiple transmission methods**

**Coopersmith, Historian of Technology at Texas A&M University** 20**09**

(Jonathan Coopersmith, thespacereview.com, 9/28/09, <http://www.thespacereview.com/article/1475/1>, retrieved 6/22/11, HLM/AS)

<A wide range of challenges confronts SBSP. Perhaps the easiest to solve are the technological. SBSP technology has matured greatly since first studied in the 1970s. Advances in solar cells, wireless power transmission, robotics, construction techniques, and other areas have made SBSP much more attractive technically. As the workshop made abundantly clear, a wide range of options exist for most systems and components.

Transmitting power to Earth, for example, could be done by microwave or laser or a combination. In the latter, an infrared laser on the station would transmit power to a balloon at 70,000 feet (21,000 meters), to avoid having the lower atmosphere absorb the laser’s power; the balloon would then retransmit the energy by microwave to a rectenna on the ground. The combination would send smaller amounts of power to more substations, just as a modern communications satellite uses several spot beams to numerous ground stations.>

# Solvency AT: “No Technology”

**Squo: SBSP techno ready to go with investment**

**Rogue, Director of National Security Space Office 07**

(Joseph D. Rogue, Phase O Architecture Feasibility Study, JP)

<FINDING:The SBSP Study Group found that Space‐Based Solar Power is a complex engineering challenge, but requires no fundamental scientific breakthroughs or new physics to become a reality.

Space‐Based Solar Power is a complicated engineering project with substantial challenges and a complex trade‐space not unlike construction of a large modern aircraft, skyscraper, or hydroelectric dam, but does not appear to present any fundamental physical barriers or require scientific discoveries to work. While the study group believes the case for technical feasibility is very strong, this does not automatically imply economic viability and affordability—this requires even more stringent technical requirements.>

# Solvency AT: SPS Technology Doesn’t Exist

**Technology exists- similar to communication satellites**

**Goldenberg, US environment correspondent, 09**

(Suzanne Goldenberg, April 16, 2009, <http://www.guardian.co.uk/environment/2009/apr/16/solar-energy-farms-space>, JP)

<Solaren has released relatively few details about the project. But Solaren's CEO, Gary Spirnak, said the company, a group of about 10 former satellite and aerospace engineers, was confident in the technology and timing behind the venture. He argued that the science behind the orbiting solar farms was little different to that of communications satellites. "This is the exact same thing that satellites do every day. The basic technology is there," said Spirnak. "The bottom line is that this is not really a technology issue.">

# Solvency AT no SPS tech now

**technological advancements sparked by investment lead to disruptive tech**

**Medin, Chief Industrial Designer, 10**

(Kristin Medin, “Disruptive Technology: A Space-Based Solar Power Industry Forecast”, Winter 10, <http://spacejournal.ohio.edu/issue16/medin.html>, 6/22/11, KJ)

<Advancements in human civilization can be marked by the appearance of disruptive technologies, those unanticipated innovations that rapidly surpassed current state-of-the-art and dramatically improved quality of life. Development of the printing press illustrated this principle as the rapid reproduction of books enabled public literacy and the invention of steam engines for trains and ships enabled faster travel and quicker distribution of information. Advancements associated with transporting commodities launched revolutions that forever changed society.

When the United States of America was in its infancy, and its populations were clustered predominantly on its eastern Atlantic coast, the development of a Transcontinental Railroad enabled the import and export of goods to and from its western Pacific Coast. Instead of waiting for ships to sail around the tip of South America, goods were loaded onto the railroads and shipped across the continent. What is important to remember about this example is that the construction of the Transcontinental Railroad was backed by the government, but operated as a commercial enterprise initiated by the private sector.[1]

With the comparatively quicker exchange of commodities between the east and west coasts, entrepreneurs found themselves with increased access to the materials needed to achieve their vision. The completion of the Transcontinental Railroad sped along the American industrial ascendancy. The rail innovation encouraged the manufacturing of products for distant markets, prompting mass production. The development of new water, coal and oil powered machines helped to fabricate the items that made life seem more civilized. From the mid-1800's to the turn of the century, the mass-production of goods - ranging from hairpins to horseless carriages - and the introduction of new technologies affecting the lifestyle of average citizens marked a time when there was a significant leap in socioeconomic well being.>

# Solvency: SSP Energy Efficiency

**Solvency: SSP more cost and energy efficient than terrestrial energy sources**

**Nasa, 2001**

(Nasa , 5/23/11, “ Beam it Down, Scotty! Beam it Down, Scotty! Solar power collected in space and beamed to Earth could be an environmentally friendly solution to our planet's growing energy problems.” , 6/23/11, KJ)

NASA's involvement in space solar power, or SSP for short, began after the oil embargo of the mid-1970's when the space agency (working under the leadership of the US Department of Energy) began to study alternative energy sources that might result in less dependence on foreign oil. Proposed space solar power systems utilize well-known physical principles -- namely, the conversion of sunlight to electricity by means of photovoltaic cells. (You can see such cells on many neighborhood rooftops and on small sidewalk lighting fixtures.) Giant structures consisting of row after row of photovoltaic (PV) arrays could be placed either in a geostationary Earth orbit or on the Moon. A complete system would collect solar energy in space, convert it to microwaves, and transmit the microwave radiation to Earth where it would be captured by a ground antenna and transformed to usable electricity. According to an April 2000 article in the Electric Power Research Institute (EPRI) Journal, photovoltaic arrays in a geostationary Earth orbit (at an altitude of 22,300 miles) would receive, on average, eight times as much sunlight as they would on Earth's surface. Such arrays would be unaffected by cloud cover, atmospheric dust or by the Earth's day-night cycle. When the idea was first proposed more than 30 years ago, [PV technology](http://www.eren.doe.gov/millionroofs/whatispv.html) was still in its infancy. The conversion efficiency rate -- the fraction of the sun's incident energy converted into electricity -- was only 7 to 9 percent. "We now have the technology to convert the sun's energy at the rate of 42 to 56 percent," said Marzwell. "We have made tremendous progress." Even so, launching thousands of tons of solar arrays into space will be expensive. But there may be a way to reduce the needed area of the arrays -- by concentrating sunlight. "If you can concentrate the sun's rays through the use of large mirrors or lenses you get more for your money because most of the cost is in the PV arrays," said Marzwell.

# Solvency—funding key

**SPS needs funding for success**

**Hsu, Systems Engineering & Risk Management, 10**

(Dr. Feng Hsu, “Harnessing the Sun”, Winter 2010, <http://spacejournal.ohio.edu/issue16/hsu.html>, KJ)

<The overwhelming initial cost of development and deployment has remained the primary obstacle. As noted, number one on the list of cost barriers is the cost of space transportation. Solar power satellites are only economically feasible if there is low cost space transport. For SPS to be successful, we need an organized consortium consisting of private businesses, venture capitalists from major international partners, along with government support of R&D and technology demonstrations by industrial nations. We need this concerted effort to bring down associated risks in safety, reliability and technology maturity. The Comsat model for the successful launching and commercialization of communications satellite industry should be a viable approach for Solar Power Satellite implementation.>

# Solvency—international cooperation

**SPS causes international cooperation**

**Hsu, Systems Engineering & Risk Management, 10**

(Dr. Feng Hsu, “Harnessing the Sun”, Winter 2010, <http://spacejournal.ohio.edu/issue16/hsu.html>, KJ)

<SPS component technologies will also enable human economic expansion and settlement into space, which is important for the permanent survival of our species. To this end, a "vertical expansion of humanity" into our solar system in the new millennium can be every bit as important as the "horizontal expansion" achieved by our ancestors beginning in the 1400s. Indeed, SPS will provide a natural platform for promoting human collaboration in an area that has the potential to make a real difference in smoothing out global economy imbalances due to gross disparities in energy resources, thereby preventing inevitable confrontations. SPS can be also a major steppingstone in transforming our current combustion world economy into a sustainable and clean world economy that is solar-electric powered.>

# \*\*\*\*Warming Advantage\*\*\*\*

# Warming ADV – SPS solves climate change

**SPS solves energy concerns and solves global warming**

**Mohammed and Ramasamy,** Politicians and former Members of the Legislative Assembly**, ‘09**

(S. Sheik Mohammed and K.Ramasamy, proceedings of international conference on energy and environment, Ebsco AJ)

A. Advantages 1) Solar Energy is Renewable, Clean and Exhaustless The main causes which prevent using fossil fuels for power generation are the limited availability of fossil fuels and they emit CO2, green house gases which results global warming. The CO2 emission is almost zero as compared with fossil fuels and nuclear power [13]. So, the SPS system could be the promising solution for global warming. 2) High Transmission and Conversion Efficiency Major amount of electrical power is wasted during transmission due to the resistance of cables and wires. The power is transmitted from SPS without using wires. So, the transmission efficiency will be much better. The power conversion efficiency of ground system is also above 90%. 3) SPS Could Meet Power Demand of the Future The world population was 6.1 billion in 2000 and the rise could be expected more than 9 billion in next 50 years [14]. According to the rise of population the energy demand will be several times larger than today in next 50 years. The Solar Power Satellites generate power from sun 24 hours a day for most of the year, the greater amount of power generated by SPS could compensate the power demand across the globe.

# Warming Advantage—new tech key

**Despite efforts to combat climate change, countries require new system to combat emissions from electricity generation**

**Xin et al**, Masters degree in aerospace management, **2009**

(Sun Xin , Evelyn Panier, Cornelius Zünd, and Raul Gutiérrez Gómez, Toulouse Business School, May 2009 <http://www.nss.org/settlement/ssp/library/2009-FinancialAndOrganizationalAnalysisForSSP.pdf>, *AJ*)

The idea of global warming and the need to take action has finally started to take a serious hold in the culture of world governments. A fundamental paradigm shift from previous decades, governing bodies the world over have started to pass laws and regulations in support of the growing green movement. Examples of international agreements and initiatives include the IPCCi, the Kyoto Protocolsii, EU Emissions Trading Schemeiii, EU Climate Change Programiv, etc. Perhaps the most famous of such agreements, the Kyoto Protocol, can be seen to have faltered since only 63.7% of countries that signed it have actually ratified its contents into their own political system. Furthermore none of these countries have managed to meet the targets that were to have been met by 2005.v Despite this difficult first step, many governments have indicated a strong redoubling of interest in the environment, and have begun to shape their domestic policies to suit. For example many national (and regional) governments have begun to offer incentives and frameworks which encourage citizens and businesses to work towards a greener future. Examples of this are the growing wind energy industry in Germany & Chinavi, as well as the ability for ordinary Canadian citizens to build their own renewable generation projects which can be fed into the normal consumer power grid.vii The main idea here is that governments are finding themselves more and more inclined to work towards a green future, and that they are more willing to work towards mitigating climate change than ever before in the past. World reliance on oil from children’s toys to aircraft and motor vehicles is indisputable; however what many people perhaps do not realize is the extent to which fossil fuels, specifically oil and coal, are used to feed the global demand of electricity. According to the International Energy Association (IEA) viii, combustible fuels currently account for 64% of the electricity generation mix for OECD (Organization for Economic Cooperation and Development) countries as measured in 2007 and 2008ix. The heavy reliance on this form of energy indicates just how susceptible the world economy is to the fortunes of oil and coal, to say nothing of their environmental impact. This can affect an SSPS system in different ways. Certainly it is conceivable that the current established industry of fossil fuel energy production will offer up different kinds of roadblocks, but also that many governments may still be reluctant to shift their generation mix to other things due to costs and concerns about strategic positioning despite the growing green movements.

# Warming Advantage— SPS solves emissions

**SPS solves carbon emissions and climate change**

**Xin et al**, Masters degree in aerospace management, **2009**

(Sun Xin , Evelyn Panier, Cornelius Zünd, and Raul Gutiérrez Gómez, Toulouse Business School, May 2009 <http://www.nss.org/settlement/ssp/library/2009-FinancialAndOrganizationalAnalysisForSSP.pdf>, *AJ*)

Considered as a potential clean and sustainable power supply option, the great advantage of

SSPS, is that, once in place and operating, its contribution to greenhouse gases in the

atmosphere is zero. But the consumer survey, showed that most consumers care more about

health, safety and environment issues when thinking about using electricity produced by SSPS.

So Environmental, health, and safety issues have been recognized as essential concerns to be

addressed as early as possible in a program to develop SSPS technology, with particular

emphasis on public awareness and public perception. These results can be seen in Figure 14.

# Warming Adv- SPS solves

**SPS Solves resource wars and global warming**

**Rogue, Director of National Security Space Office 07**

(Joseph D. Rogue, Phase O Architecture Feasibility Study, JP)

<Since the “Fresh Look” Study much has changed. The events of 9/11 dramatically altered the world strategic security environment. Major energy producing areas of the world are perceived as being unstable, and the risks of dependence on unstable areas of the world for energy supplies are increasingly less acceptable to both citizens and policymakers. The rising demand of the developing world—in particular the burgeoning economies of China and India—are increasing energy competition. Growing concern over long‐term climate change has become a mainstream issue. Globalization, begun at the end of the last century has created an extremely rapid and accelerating pace of change in the technological, informational, and business sectors. These changes are being driven by the aggregate decisions of billions of people, millions of companies, thousands of governments, and huge international markets that cross the borders of over a hundred countries. The ability to stop, or even slow, this change is beyond the ability of any single nation, company, or organization. The DoD, as the nation’s largest institutional consumer of technology and energy, has determined that long‐term energy security is now a forefront issue. The early developments of the 21st Century have created conditions that merit that this nation takes a relook of SBSP. >

# Warming Advantage Solvency: climate change

**Should act on SPS to ensure global change on climate**

Space Enterprise Council**, US Chamber of Commerce, 2008**

(Space Enterprise Council, July 2008 *Recommendation on Space-Based Solar Power,* [*http://www.nss.org/settlement/ssp/library/2008-SECSpaceBasedSolarPowerWhitePaper.pdf*](http://www.nss.org/settlement/ssp/library/2008-SECSpaceBasedSolarPowerWhitePaper.pdf)*, AJ)*

Conclusion: The appropriate policy question is: “Should the U.S. Government invest in SBSP research, as part of a diversified portfolio of renewable energy programs, including consideration of new approaches that may not have been previously studied?” Our answer to that question is yes. We must explore all potentially significant sources of sustainable energy that might contribute, even if only to a limited extent in the near term, to assurance of security and prosperity. Facing this challenge represents a responsibility not only to our own nation but also to the global community in which we live.

# Warming ADV – replace fossil fuels

**SBSP solves Global Warming—better than fossil fuels**

**Mahan, author for Citizens for Space Based Solar Power, No Date Given**

(Rob Mahan, <http://c-sbsp.org/sbsp-faq/#01>, Last Modified 06/24/2011, as)

Comparing space-based solar power to fossil fuels (oil, coal, natural gas, etc.), both provide baseload power but the burning of fossil fuels create harmful emissions which may be contributing to global warming. Space-based solar power creates emissions only upon construction of the equipment and launching it into orbit. Fossil fuels will eventually run out and the demand is increasing with population growth and increases in per capita energy consumption around the world. Space-based solar power will run out when the sun burns out … and when that happens, we’ll have bigger fish to fry!

# Warming ADV – SPS solves warming

**SBSP lowers global warming – limits carbon emissions**

**Rogue, Director of National Security Space Office 07**

(Joseph D. Rogue, Phase O Architecture Feasibility Study, JP)

<FINDING:The SBSP Study Group found that to the extent the United States decides it wishes to limit its carbon emissions, SBSP offers a potential path for long‐term carbon mitigation.

This study does not take a position on anthropogenic climate change, which at this time still provoked significant debate among participants, but there is undeniable interest in options that limit carbon emission. Studies by Asakura et al in 2000 suggest that SBSP lifetime carbon emissions (chiefly in construction) are even more attractive than nuclear power, and that for the same amount of carbon emission, one could install 60 times the generating capacity, or alternately, one could replace existing generating capacity with 1/60th the lifetime carbon emission of a coal‐fired plant without CO2 sequestration.>

# Warming Advantage: SPS solves environment

**Environment ADV: SPS solves pollution and comparatively better to other alt energies**

**Globus, 10**

(Al, Globus, Online Journal of Space Communication, Winter 10, <http://spacejournal.ohio.edu/issue16/globus2.html>, KJ)

<Plans for mining and processing lunar regolith have been developed.[3] Converting lunar regolith on the surface into powersats in orbit is an extremely demanding engineering problem, but that's the fun part. The pay off is eliminating the terrestrial environmental cost of the SSP space segment entirely, leaving only the cost of the power beam and the receiving antenna. These appear to have minor environmental impact relative to their contribution to developing a continuous non-polluting source of energy.

As the largest environmental impact of a non-fuel-based energy source is generally the construction and eventual disposal of terrestrial power plants, including mining and processing the materials, completely eliminating the environmental impact on earth of the most demanding portion of the system should give SSP built from lunar materials a substantial environmental cost edge over other systems. Those tradeoffs can also be calculated.

Alternative Sources vs. SSP

Consider the environmental impact of other power production technologies, such as oil, coal, natural gas, fission, fusion, ground solar, biomass, wind, tides and waves. Hydro and geothermal are taken out of this analysis as they have limited total energy production potential. All of these systems must be built on the ground and their materials mined, processed, and fabricated into their contributing parts. None of these systems are typically mass constrained, as satellites are, so producing 10 TW of power by any of them will require producing far more than 125 million tons of power plant. Furthermore, at end of life all this material must be either remanufactured or disposed of in the biosphere. It is safe to say that for any of these options, this environmental impact alone is as great or greater than SSP ground antennas. In some cases, such as disposing of irradiated components of nuclear power plants, it may be much greater.

Today's terrestrial solar cells appear to produce the equivalent of two watts continuously per kg of panel.[4] This means that five billion tons of solar cells would be required to generate 10TW of power. Furthermore, assuming a generous 50-year life, producing 10 TW of power requires that 100 million tons of solar cells annually must be manufactured and disposed of. Producing that same 10TW of power would require 10,000 one gigawatt (1GW) nuclear or fossil fuel power plants. Assuming a 50-year life, 200 new plants would have to be built and 200 decommissioned every year – almost one every day forever.>

# Warming Advantage: Terrestrial energy cause pollution

**Terrestrial energy sources create pollution, SPS produces none.**

**Globus, 10**

(Al, Globus, Online Journal of Space Communication, Winter 10, <http://spacejournal.ohio.edu/issue16/globus2.html>, KJ)

<Oil, natural gas, and coal-powered plants all require a continuous supply of fuel, which must be extracted from the earth. These fuels must be processed and then burned releasing CO2 and other, often more noxious, materials into the atmosphere. Maintaining a clean and healthy atmosphere, of course, is literally essential for our minute-to-minute survival. The environmental impact of these emissions is so great that entire forests and watersheds are put at risk by acid rain, millions of people are being sickened by urban air pollution, and there is substantial evidence that CO2 emissions are noticeably warming the entire planet, especially the polar regions. Operation of solar power satellites produce no atmospheric emissions at all. Powersat beams will slightly warm a column of air, but even this effect can be minimized by the density of the beam and choice of the frequency used.>

# Warming advantage—renewables key

**Renewable energy sources prevents global warming.**

**Hsu, Systems Engineering & Risk Management, 10**

(Dr. Feng Hsu, “Harnessing the Sun”, Winter 2010, <http://spacejournal.ohio.edu/issue16/hsu.html>, KJ)

<As the measure of risk is a product of "likelihood" and "consequence," when consequence or risk of a potential human extinction (due to catastrophic climate change) is to be compared with the potential consequence or risk of loss of jobs or slowing the growth of economy (due to restriction of fossil-based energy consumption), I believe the choice is clear. My view is that by making a paradigm shift in the world's energy supply over time through extensive R&D, technology innovations and increased production of renewable energy, we will create countless new careers and jobs and end up triggering the next level of economic development, the kind of pollution free industrial revolution mankind has never before seen.

The aggravation and acceleration of a potential anthropogenic catastrophic global climate change, in my opinion, is the number one risk incurred from our combustion-based world economy. At the International Energy Conference in Seattle, I showed three pairs of satellite images as evidence that the earth glaciers are disappearing at an alarming rate.[2] Whether this warming trend can be reversed by human intervention is not clear, but this uncertainty in risk reduction doesn't justify the human inactions in adapting policies and countermeasures on renewable energy development for a sustainable world economy, and for curbing the likelihood of any risk event of anthropogenic catastrophic climate changes. What is imperative is that we start to do something in a significant way that has a chance to make a difference.>

# Warming advantage—solar solves

**Solvency: Solar energy is the most efficient energy source**

**Hsu, Systems Engineering & Risk Management, 10**

(Dr. Feng Hsu, “Harnessing the Sun”, Winter 2010, <http://spacejournal.ohio.edu/issue16/hsu.html>, KJ)

<Learning how to harness our sun for solutions to our energy problems will not be unlike our ancestors harnessing the wild fire. I believe it will lead to an inevitable leapfrog in the process of human evolution. Bill Michael, a University of Chicago professor, wrote "Use of fire illustrates that human evolution is a gradual process; modern humans did not emerge overnight in a 'big bang' of development, but rather slowly adapted from their primitive origins. The use of fire by humans throughout time to overcome environmental forces is a fundamental and defining aspect of human nature."[3]

Before we reach that tipping point of negative sustainability, there is still time for humankind to tame the natural forces of the sun and harness it for the well-being and survival of our species. The best place, of course, for a nuclear fusion reactor is about 149E6 km (149 x 106 km) away. This one happens to be free of charge and we can count on it being around for a long time. The sun's energy only takes 8 minutes to arrive on earth and leaves no radioactive waste (and it is terrorist proof). Our sun puts out about 3.8E11TWh of energy per hour. Our planet receives about 174,000 terawatt each second. Every minute, earth's surface gets more solar power than we human beings can use in a whole year.

We must learn how to bypass the solar-to-fossil inefficiency. About 4.6 billion years ago, the earth was just formed, and it was 3.5 billion years ago that there was the first sign of life. Not until 1.5 billion years ago was there multicell biology; real life started just about 500 million years ago. The dinosaur lived about 150 million years ago and went extinct. Human beings have lived maybe a few hundred thousand years. You can see that it took about 3.5 billion years and rare geologic events to sequester hydrocarbons and build up hydrogen in the atmosphere. If you do a little calculation, you will find that using direct solar energy is about 1,200,000,000,000 times more efficient than using a secondary solar energy, such as oil. Why not go directly to the well of the sun?>

# Warming advantage--Solar Power limited in SQ

**Uniqueness: Solar power makes up a small percentage energy production.**

**Hsu, Systems Engineering & Risk Management, 10**

(Dr. Feng Hsu, “Harnessing the Sun”, Winter 2010, <http://spacejournal.ohio.edu/issue16/hsu.html>, KJ)

<We must set priorities and choose wisely. Within the next 30 years, we're going to have an explosive increase in demand for new sources of fuel. According to recent U.S. Department of Energy data, all renewable sources of energy including biomass, hydropower, geothermal, wind and solar represent only about 6 percent of total U.S. energy production in the US. Nonrenewable energies, namely fossil fuels, represent the other 94 percent.>

# Warming ADV – SPS Solves

**SSP efficient sustainable energy source solves for energy demands and greenhouse gas emissions**

**National Space Society**, 20**07** (“Space Solar Power: An Investment for Today – An Energy Solution for Tomorrow”, October 2007. Accessed on June 22, 2011. NP)

The United States and the rest of the world need to find alternative sources of energy besides fossil fuels. The National Space Society believes that one of the most important long-term solutions for meeting those energy needs is Space Solar Power (SSP), which gathers energy from sunlight in space and sends it to Earth. We believe that SSP can solve our energy and greenhouse gas emissions problems. Not just help, not just take a step in the right direction; solve. SSP can provide large quantities of energy to each and every person on Earth with very little environmental impact. The NSS recommends that SSP be considered along with ground-based solar collectors and wind turbines as a safe, renewable, and clean energy option. Solar energy is routinely used on spacecraft today, and the solar energy available in space is literally billions of times greater than we use today. The lifetime of the sun is an estimated 4 to 5 billion years, making SSP a truly long-term energy solution. Space solar power can have an extremely small environmental footprint, perhaps competitive with ground-solar and wind, because with sufficient investments in space infrastructure, the SSP can be built from materials from space with *zero* terrestrial environmental impact. Only energy receivers need be built on Earth. As Earth receives only one part in 2.3 billion of the sun's output, SSP is by far the largest potential energy source available, dwarfing all others combined. Development cost and time, of course, are considerable. This makes SSP a long-term solution rather than a short-term stop-gap, although there are some intriguing near-term possibilities. In any case, SSP can potentially supply all the electrical needs of our planet.

# Warming Adv – climate change now

**U-Global Warming happening now**

**Strickland Jr., founder and chairman for the Austin Space Frontier Society, 2010**

(John K. Strickland Jr., <http://spacejournal.ohio.edu/issue16/strickland1.html>, Winter 2010, as)

Freeman Dyson, a prominent physicist and the creator of the Dyson Sphere concept, points out that CO2 and methane have a much greater effect where the air is cold and dry, mainly in the Arctic and Antarctic and on high mountains, since water vapor is also a very strong greenhouse gas. Thus global warming tends to make cold places warm, rather than making warm, humid places hotter.[12] This makes average global temperature values, which are about 55 degrees F, a misleading metric. If all we had to measure was temperature, we would not think there is any problem, since global average temperature tends to fluctuate. The levels of carbon dioxide are now about 30% greater than in pre-industrial times and are rising. Even if we could suddenly stop the release of extra greenhouse gases, what has already been released will take a very long time to be absorbed by slow geological and chemical processes. This momentum means that the current warming trend is likely to continue for decades and probably cannot be stopped immediately without human intervention.

# Warming Advantage—warming now

**Science overwhelmingly proves that warming is real, anthropogenic, and a result of fossil fuel use**

**IPCC 2007**

[“Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change”]

Global atmospheric concentrations of carbon dioxide, methane and nitrous oxide have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years (see Figure SPM.1). The global increases in carbon dioxide concentration are due primarily to fossil fuel use and land use change, while those of methane and nitrous oxide are primarily due to agriculture. {2.3, 6.4, 7.3} • Carbon dioxide is the most important anthropogenic greenhouse gas (see Figure SPM.2). The global atmospheric concentration of carbon dioxide has increased from a pre-industrial value of about 280 ppm to 379 ppm in 2005. The atmospheric concentration of carbon dioxide in 2005 exceeds by far the natural range over the last 650,000 years (180 to 300 ppm) as determined from ice cores. The annual carbon dioxide concentration growth rate was larger during the last 10 years (1995–2005 average: 1.9 ppm per year), than it has been since the beginning of continuous direct atmospheric measurements (1960– 2005 average: 1.4 ppm per year) although there is year-to-year variability in growth rates. {2.3, 7.3} • The primary source of the increased atmospheric concentration of carbon dioxide since the pre-industrial period results from fossil fuel use, with land-use change providing another significant but smaller contribution. Annual fossil carbon dioxide emissions4 increased from an average of 6.4 [6.0 to 6.8]5 GtC (23.5 [22.0 to 25.0] GtCO2) per year in the 1990s to 7.2 [6.9 to 7.5] GtC (26.4 [25.3 to 27.5] GtCO2) per year in 2000– 2005 (2004 and 2005 data are interim estimates). Carbon dioxide emissions associated with land-use change are estimated to be 1.6 [0.5 to 2.7] GtC (5.9 [1.8 to 9.9] GtCO2) per year over the 1990s, although these estimates have a large uncertainty. {7.3} • The global atmospheric concentration of methane has increased from a pre-industrial value of about 715 ppb to 1732 ppb in the early 1990s, and was 1774 ppb in 2005. The atmospheric concentration of methane in 2005 exceeds by far the natural range of the last 650,000 years (320 to 790 ppb) as determined from ice cores. Growth rates have declined since the early 1990s, consistent with total emissions (sum of anthropogenic and natural sources) being nearly constant during this period. It is very likely6 that the observed increase in methane concentration is due to anthropogenic activities, predominantly agriculture and fossil fuel use, but relative contributions from different source types are not well determined. {2.3, 7.4} • The global atmospheric nitrous oxide concentration increased from a pre-industrial value of about 270 ppb to 319 ppb in 2005. The growth rate has been approximately constant since 1980. More than a third of all nitrous oxide emissions are anthropogenic and are primarily due to agriculture. {2.3, 7.4} The understanding of anthropogenic warming and cooling influences on climate has improved since the TAR, leading to very high confidence7 that the global average net effect of human activities since 1750 has been one of warming, with a radiative forcing of +1.6 [+0.6 to +2.4] W m–2 (see Figure SPM.2). {2.3., 6.5, 2.9} • The combined radiative forcing due to increases in carbon dioxide, methane, and nitrous oxide is +2.30 [+2.07 to +2.53] W m–2, and its rate of increase during the industrial era is very likely to have been unprecedented in more than 10,000 years (see Figures SPM.1 and SPM.2). The carbon dioxide radiative forcing increased by 20% from 1995 to 2005, the largest change for any decade in at least the last 200 years. {2.3, 6.4} • Anthropogenic contributions to aerosols (primarily sulphate, organic carbon, black carbon, nitrate and dust) together produce a cooling effect, with a total direct radiative forcing of –0.5 [–0.9 to –0.1] W m–2 and an indirect cloud albedo forcing of –0.7 [–1.8 to –0.3] W m–2. These forcings are now better understood than at the time of the TAR due to improved in situ, satellite and ground-based measurements and more comprehensive modelling, but remain the dominant uncertainty in radiative forcing. Aerosols also influence cloud lifetime and precipitation. {2.4, 2.9, 7.5} • Significant anthropogenic contributions to radiative forcing come from several other sources. Tropospheric ozone changes due to emissions of ozone-forming chemicals (nitrogen oxides, carbon monoxide, and hydrocarbons) contribute +0.35 [+0.25 to +0.65] W m–2. The direct radiative forcing due to changes in halocarbons8 is +0.34 [+0.31 to +0.37] W m–2. Changes in surface albedo, due to land cover changes and deposition of black carbon aerosols on snow, exert respective forcings of –0.2 [–0.4 to 0.0] and +0.1 [0.0 to +0.2] W m–2. Additional terms smaller than ±0.1 W m–2 are shown in Figure SPM.2. {2.3, 2.5, 7.2} • Changes in solar irradiance since 1750 are estimated to cause a radiative forcing of +0.12 [+0.06 to +0.30] W m–2, which is less than half the estimate given in the TAR. {2.7} Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level (see Figure SPM.3). {3.2, 4.2, 5.5} • Eleven of the last twelve years (1995–2006) rank among the 12 warmest years in the instrumental record of global surface temperature9 (since 1850). The updated 100-year linear trend (1906 to 2005) of 0.74°C [0.56°C to 0.92°C] is therefore larger than the corresponding trend for 1901 to 2000 given in the TAR of 0.6°C [0.4°C to 0.8°C]. The linear warming trend over the last 50 years (0.13°C [0.10°C to 0.16°C] per decade) is nearly twice that for the last 100 years. The total temperature increase from 1850–1899 to 2001–2005 is 0.76°C [0.57°C to 0.95°C]. Urban heat island effects are real but local, and have a negligible influence (less than 0.006°C per decade over land and zero over the oceans) on these values. {3.2} • New analyses of balloon-borne and satellite measurements of lower- and mid-tropospheric temperature show warming rates that are similar to those of the surface temperature record and are consistent within their respective uncertainties, largely reconciling a discrepancy noted in the TAR. {3.2, 3.4} • The average atmospheric water vapour content has increased since at least the 1980s over land and ocean as well as in the upper troposphere. The increase is broadly consistent with the extra water vapour that warmer air can hold. {3.4} • Observations since 1961 show that the average temperature of the global ocean has increased to depths of at least 3000 m and that the ocean has been absorbing more than 80% of the heat added to the climate system. Such warming causes seawater to expand, contributing to sea level rise (see Table SPM.1). {5.2, 5.5} • Mountain glaciers and snow cover have declined on average in both hemispheres. Widespread decreases in glaciers and ice caps have contributed to sea level rise (ice caps do not include contributions from the Greenland and Antarctic Ice Sheets). (See Table SPM.1.) {4.6, 4.7, 4.8, 5.5} • New data since the TAR now show that losses from the ice sheets of Greenland and Antarctica have very likely contributed to sea level rise over 1993 to 2003 (see Table SPM.1). Flow speed has increased for some Greenland and Antarctic outlet glaciers, which drain ice from the interior of the ice sheets. The corresponding increased ice sheet mass loss has often followed thinning, reduction or loss of ice shelves or loss of fl oating glacier tongues. Such dynamical ice loss is sufficient to explain most of the Antarctic net mass loss and approximately half of the Greenland net mass loss. The remainder of the ice loss from Greenland has occurred because losses due to melting have exceeded accumulation due to snowfall. {4.6, 4.8, 5.5} • Global

**IPCC 2007 continued**

# Warming Advantage—warming now

**IPCC 2007 continued**

average sea level rose at an average rate of 1.8 [1.3 to 2.3] mm per year over 1961 to 2003. The rate was faster over 1993 to 2003: about 3.1 [2.4 to 3.8] mm per year. Whether the faster rate for 1993 to 2003 reflects decadal variability or an increase in the longer term trend is unclear. There is high confi dence that the rate of observed sea level rise increased from the 19th to the 20th century. The total 20th-century rise is estimated to be 0.17 [0.12 to 0.22] m. {5.5} • For 1993 to 2003, the sum of the climate contributions is consistent within uncertainties with the total sea level rise that is directly observed (see Table SPM.1). These estimates are based on improved satellite and in situ data now available. For the period 1961 to 2003, the sum of climate contributions is estimated to be smaller than the observed sea level rise. The TAR reported a similar discrepancy for 1910 to 1990. {5.5} At continental, regional and ocean basin scales, numerous long-term changes in climate have been observed. These include changes in arctic temperatures and ice, widespread changes in precipitation amounts, ocean salinity, wind patterns and aspects of extreme weather including droughts, heavy precipitation, heat waves and the intensity of tropical cyclones.10 {3.2, 3.3, 3.4, 3.5, 3.6, 5.2} • Average arctic temperatures increased at almost twice the global average rate in the past 100 years. Arctic temperatures have high decadal variability, and a warm period was also observed from 1925 to 1945. {3.2} 10 Tropical cyclones include hurricanes and typhoons. 11 The assessed regions are those considered in the regional projections chapter of the TAR and in Chapter 11 of this report. • Satellite data since 1978 show that annual average arctic sea ice extent has shrunk by 2.7 [2.1 to 3.3]% per decade, with larger decreases in summer of 7.4 [5.0 to 9.8]% per decade. These values are consistent with those reported in the TAR. {4.4} • Temperatures at the top of the permafrost layer have generally increased since the 1980s in the Arctic (by up to 3°C). The maximum area covered by seasonally frozen ground has decreased by about 7% in the Northern Hemisphere since 1900, with a decrease in spring of up to 15%. {4.7} • Long-term trends from 1900 to 2005 have been observed in precipitation amount over many large regions.11 Significantly increased precipitation has been observed in eastern parts of North and South America, northern Europe and northern and central Asia. Drying has been observed in the Sahel, the Mediterranean, southern Africa and parts of southern Asia. Precipitation is highly variable spatially and temporally, and data are limited in some regions. Long-term trends have not been observed for the other large regions assessed.11 {3.3, 3.9} • Changes in precipitation and evaporation over the oceans are suggested by freshening of mid- and highlatitude waters together with increased salinity in low latitude waters. {5.2} Mid-latitude westerly winds have strengthened in both hemispheres since the 1960s. {3.5} • More intense and longer droughts have been observed over wider areas since the 1970s, particularly in the tropics and subtropics. Increased drying linked with higher temperatures and decreased precipitation has contributed to changes in drought. Changes in sea surface temperatures, wind patterns and decreased snowpack and snow cover have also been linked to droughts. {3.3} • The frequency of heavy precipitation events has increased over most land areas, consistent with warming and observed increases of atmospheric water vapour. {3.8, 3.9} • Widespread changes in extreme temperatures have been observed over the last 50 years. Cold days, cold nights and frost have become less frequent, while hot days, hot nights and heat waves have become more frequent (see Table SPM.2). {3.8} There is observational evidence for an increase in intense tropical cyclone activity in the North Atlantic since about 1970, correlated with increases of tropical sea surface temperatures. There are also suggestions of increased intense tropical cyclone activity in some other regions where concerns over data quality are greater. Multi-decadal variability and the quality of the tropical cyclone records prior to routine satellite observations in about 1970 complicate the detection of long-term trends in tropical cyclone activity. There is no clear trend in the annual numbers of tropical cyclones. {3.8} A decrease in diurnal temperature range (DTR) was reported in the TAR, but the data available then extended only from 1950 to 1993. Updated observations reveal that DTR has not changed from 1979 to 2004 as both day- and night-time temperature have risen at about the same rate. The trends are highly variable from one region to another. {3.2} • Antarctic sea ice extent continues to show interannual variability and localised changes but no statistically significant average trends, consistent with the lack of warming reflected in atmospheric temperatures averaged across the region. {3.2, 4.4} • There is insufficient evidence to determine whether trends exist in the meridional overturning circulation (MOC) of the global ocean or in small-scale phenomena such as tornadoes, hail, lightning and dust-storms. {3.8, 5.3} A Palaeoclimatic Perspective Palaeoclimatic studies use changes in climatically sensitive indicators to infer past changes in global climate on time scales ranging from decades to millions of years. Such proxy data (e.g., tree ring width) may be influenced by both local temperature and other factors such as precipitation, and are often representative of particular seasons rather than full years. Studies since the TAR draw increased confi dence from additional data showing coherent behaviour across multiple indicators in different parts of the world. However, uncertainties generally increase with time into the past due to increasingly limited spatial coverage. Palaeoclimatic information supports the interpretation that the warmth of the last half century is unusual in at least the previous 1,300 years. The last time the polar regions were significantly warmer than present for an extended period (about 125,000 years ago), reductions in polar ice volume led to 4 to 6 m of sea level rise. {6.4, 6.6} • Average Northern Hemisphere temperatures during the second half of the 20th century were very likely higher than during any other 50-year period in the last 500 years and likely the highest in at least the past 1,300 years. Some recent studies indicate greater variability in Northern Hemisphere temperatures than suggested in the TAR, particularly finding that cooler periods existed in the 12th to 14th, 17th and 19th centuries. Warmer periods prior to the 20th century are within the uncertainty range given in the TAR. {6.6} • Global average sea level in the last interglacial period (about 125,000 years ago) was likely 4 to 6 m higher than during the 20th century, mainly due to the retreat of polar ice. Ice core data indicate that average polar temperatures at that time were 3°C to 5°C higher than present, because of differences in the Earth’s orbit. The Greenland Ice Sheet and other arctic ice fi elds likely contributed no more than 4 m of the observed sea level rise. There may also have been a contribution from Antarctica. {6.4} Most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations.12 This is an advance since the TAR’s conclusion that “most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations”. Discernible human influences now extend to other aspects of climate, including ocean warming, continental average temperatures, temperature extremes and wind patterns (see Figure SPM.4 and Table SPM.2). {9.4, 9.5} • It is likely that increases in greenhouse gas concentrations alone would have caused more warming than observed because volcanic and anthropogenic aerosols have offset some warming that would otherwise have taken place. {2.9, 7.5, 9.4} • The observed widespread warming of the atmosphere and ocean, together with ice mass loss, support the conclusion that it is extremely unlikely that global climate change of the past 50 years can be explained without external forcing, and very likely that it is not due to known natural causes alone. {4.8, 5.2, 9.4, 9.5, 9.7} • Warming of the climate system has been detected in changes of surface and

**IPCC 2007 continued**

# Warming Advantage—warming now

**IPCC 2007 continued**

atmospheric temperatures in the upper several hundred metres of the ocean, and in contributions to sea level rise. Attribution studies have established anthropogenic contributions to all of these changes. The observed pattern of tropospheric warming and stratospheric cooling is very likely due to the combined influences of greenhouse gas increases and stratospheric ozone depletion. {3.2, 3.4, 9.4, 9.5} • It is likely that there has been significant anthropogenic warming over the past 50 years averaged over each continent except Antarctica (see Figure SPM.4). The observed patterns of warming, including greater warming over land than over the ocean, and their changes over time, are only simulated by models that include anthropogenic forcing. The ability of coupled climate models to simulate the observed temperature evolution on each of six continents provides stronger evidence of human influence on climate than was available in the TAR. {3.2, 9.4} • Difficulties remain in reliably simulating and attributing observed temperature changes at smaller scales. On these scales, natural climate variability is relatively larger, making it harder to distinguish changes expected due to external forcings. Uncertainties in local forcings and feedbacks also make it difficult to estimate the contribution of greenhouse gas increases to observed small-scale temperature changes. {8.3, 9.4} • Anthropogenic forcing is likely to have contributed to changes in wind patterns,13 affecting extratropical storm tracks and temperature patterns in both hemispheres. However, the observed changes in the Northern Hemisphere circulation are larger than simulated in response to 20th-century forcing change. {3.5, 3.6, 9.5, 10.3} • Temperatures of the most extreme hot nights, cold nights and cold days are likely to have increased due to anthropogenic forcing. It is more likely than not that anthropogenic forcing has increased the risk of heat waves (see Table SPM.2). {9.4} Analysis of climate models together with constraints from observations enables an assessed likely range to be given for climate sensitivity for the fi rst time and provides increased confidence in the understanding of the climate system response to radiative forcing. {6.6, 8.6, 9.6, Box 10.2} • The equilibrium climate sensitivity is a measure of the climate system response to sustained radiative forcing. It is not a projection but is defined as the global average surface warming following a doubling of carbon dioxide concentrations. It is likely to be in the range 2°C to 4.5°C with a best estimate of about 3°C, and is very unlikely to be less than 1.5°C. Values substantially higher than 4.5°C cannot be excluded, but agreement of models with observations is not as good for those values. Water vapour changes represent the largest feedback affecting climate sensitivity and are now better understood than in the TAR. Cloud feedbacks remain the largest source of uncertainty. {8.6, 9.6, Box 10.2} • It is very unlikely that climate changes of at least the seven centuries prior to 1950 were due to variability generated within the climate system alone. A significant fraction of the reconstructed Northern Hemisphere interdecadal temperature variability over those centuries is very likely attributable to volcanic eruptions and changes in solar irradiance, and it is likely that anthropogenic forcing contributed to the early 20thcentury warming evident in these records. {2.7, 2.8, 6.6, 9.3} A major advance of this assessment of climate change projections compared with the TAR is the large number of simulations available from a broader range of models. Taken together with additional information from observations, these provide a quantitative basis for estimating likelihoods for many aspects of future climate change. Model simulations cover a range of possible futures including idealised emission or concentration assumptions. These include SRES14 illustrative marker scenarios for the 2000 to 2100 period and model experiments with greenhouse gases and aerosol concentrations held constant after year 2000 or 2100. For the next two decades, a warming of about 0.2°C per decade is projected for a range of SRES emission scenarios. Even if the concentrations of all greenhouse gases and aerosols had been kept constant at year 2000 levels, a further warming of about 0.1°C per decade would be expected. {10.3, 10.7} • Since IPCC’s first report in 1990, assessed projections have suggested global average temperature increases between about 0.15°C and 0.3°C per decade for 1990 to 2005. This can now be compared with observed values of about 0.2°C per decade, strengthening confidence in near-term projections. {1.2, 3.2}

# Warming Adv – Impact Warming extinction

**Global Warming causes extinction**

**Strickland Jr., founder and chairman for the Austin Space Frontier Society, 2010**

(John K. Strickland Jr., <http://spacejournal.ohio.edu/issue16/strickland1.html>, Winter 2010, as)

What would the worst effects of Global Warming be like, (assuming there is no quick polar collapse)? Assuming that no political or technical effort to stop CO2 emissions works, all the continental ice would gradually melt over many hundreds to thousands of years. This would make sea levels rise hundreds of feet, submerging coastlines globally, some for hundreds of miles inland. Temperate areas would become Tropical, and Arctic areas would become Temperate. Most equatorial areas would not get much hotter.[30] Most polar animal & plant species would slowly go extinct or adapt to temperate conditions.

How would this impact us? The cost of relocation of coastal cities would be in the many trillions, but it might take place over many centuries, giving time to adapt. Many historical places would be lost under the ocean, but many buildings and cities could be moved uphill. At the same time, vast areas in Canada, Siberia and eventually Antarctica and Greenland would become cropland to grow additional food. Major portions of some countries and low-lying river valley regions, such as the Amazon and the Mississippi basins, would become "inland seas" like those that existed during the Jurassic, with huge new fisheries.

# Warming Advantage—warming bad impacts

**Warming is real and causes extinction**

**Henderson 2006**

[Bill, environmental scientist, “Runaway Global Warming Denial.” Countercurrents.org August 19,. [http://www.countercurrents.org/cc-henderson190806.htm](https://webmail.whitman.edu/horde/services/go.php?url=http%3A%2F%2Fwww.countercurrents.org%2Fcc-henderson190806.htm)]

The scientific debate about human induced global warming is over but policy makers - let alone the happily shopping general public - still seem to not understand the scope of the impending tragedy. Global warming isn't just warmer temperatures, heat waves, melting ice and threatened polar bears. Scientific understanding increasingly points to runaway global warming leading to human extinction. If impossibly Draconian security measures are not immediately put in place to keep further emissions of greenhouse gases out of the atmosphere we are looking at the death of billions, the end of civilization as we know it and in all probability the end of man's several million year old existence, along with the extinction of most flora and fauna beloved to man in the world we share.

# Warming advantage---Impact droughts

**Climate change real and hurts water supplies**

**Tobiska, space environment Technologies, 10/29/10**

(W. Kent Tobiska, online journal of space communication, <http://spacejournal.ohio.edu/issue16/tobiska.html>, retrieved on 6/22/11, HLM/AS)

<Climate Change and Water Shortage Climate change is stressing the Earth's environment. It is occurring because of increasing accumulation of two trace-species “greenhouse” gases in the lower atmosphere, i.e., carbon dioxide (CO2) and methane (CH4). These long-lived stratospheric gases are very effective at trapping the re-radiated infrared radiation from the surface. Carbon dioxide and methane are not equal in their heat-retention capacity and methane is 20 times more effective at trapping heat than is carbon dioxide. The Intergovernmental Panel on Climate Change (IPCC) reports that the 1906-2005 trend in the global surface-to-stratosphere temperature is a warming of 0.74°C per century (IPCC, 2008). Measureable effects of this temperature rise include melting polar cap ices, rising sea levels, and more severe storms. The warming rate has escalated over the past 50 years and, in that period, the sea level has risen about 150 millimeters (6 inches) with a continuing rise of approximately 3 millimeters (1/8 inch) per year (NAP, 2008). One reason for the acceleration of global warming may be the increase in methane where, as the arctic permafrost thaws, more methane is released. The consequences of climate change on fresh water are severe. By 2050, climate change will likely decrease the annual average river runoff (less water available) in mid-latitude drier regions and the dry tropics. In addition, there will likely be increasing runoff (flooding) at high latitudes and in some wet tropical areas. The average person in semi-arid areas such as the Mediterranean Basin, western USA, southern Africa, Australia, and northeastern Brazil will likely see decreased water supply. In contrast, people in northern Europe, central and northern USA, northern China, and the wet tropical regions in Southeast Asia, Africa, and South America will see increased flooding events even during the winter. Climate change affects the global water infrastructure including hydropower, flood defense, drainage, and irrigation systems as well as water management practices (IPCC, 2008). The drought and flooding effects on freshwater systems adds to other stresses such as population growth, changing economic activity, land-use changes, and urbanization. These stresses occur because water demand will grow globally in the coming decades due to increased population and affluence. For the western U.S., the projected warming by 2050 will likely cause large decreases in snowpack, earlier snowmelt, more winter rains, increased peak winter flooding, and reduced summer water flow. Secondary consequences will be increased drought conditions, lower crop yields, greater agricultural unemployment, and more pervasive forest fires. Reduced water supplies, coupled with increased demand, are likely to exacerbate state-to-state and urban-rural competition for over-allocated water resources.>

# Warming Advantage – warming impacts

**Impact:** **Global warming leads to human extinction.**

**Hsu**, Systems Engineering & Risk Management, **10**

(Dr. Feng Hsu, “Harnessing the Sun”, Winter 2010, <http://spacejournal.ohio.edu/issue16/hsu.html>, KJ)

<The evidence of global warming is alarming. The potential for a catastrophic climate change scenario is dire. Until recently, I worked at Goddard Space Flight Center, a NASA research center in the forefront of space and earth science research. This Center is engaged in monitoring and analyzing climate changes on a global scale. I received first hand scientific information and data relating to global warming issues, including the latest dynamics of ice cap melting and changes that occurred on either pole of our planet. I had the chance to discuss this research with my Goddard colleagues, who are world leading experts on the subject.

I now have no doubt global temperatures are rising, and that global warming is a serious problem confronting all of humanity. No matter whether these trends are due to human interference or to the cosmic cycling of our solar system, there are two basic facts that are crystal clear: a) there is overwhelming scientific evidence showing positive correlations between the level of CO2 concentrations in the earth's atmosphere with respect to the historical fluctuations of global temperature changes; and b) the overwhelming majority of the world's scientific community is in agreement about the risks of a potential catastrophic global climate change. That is, if we humans continue to ignore this problem and do nothing, if we continue dumping huge quantities of greenhouse gases into earth's biosphere, humanity will be at dire risk.

As a technical and technology risk assessment expert, I could show with confidence that we face orders of magnitude more risk doing nothing to curb our fossil-based energy addictions than we will in making a fundamental shift in our energy supply. This is because the risks of a catastrophic anthropogenic climate change can be potentially the extinction of human species, a risk that is simply too high for us to take any chances. Of course, there will be economic consequences to all societies when we restrict the burning of fossil fuels in an effort to abate "global warming." What we are talking about are options and choices between risks. All human activities involve risk taking; we cannot avoid risks but only make trade-offs, hopefully choosing wisely. In this case, there has to be a risk-based probabilistic thought process when it comes to adopting national or international policies in dealing with global warming and energy issues.>

# Warming ADV – Science True

**Global warming science true**

**Strickland Jr., founder and chairman for the Austin Space Frontier Society, 2010**

(John K. Strickland Jr., [**http://spacejournal.ohio.edu/issue16/strickland1.html**](http://spacejournal.ohio.edu/issue16/strickland1.html), Winter 2010, as)

<Evidence for Global Warming What kinds of evidence exist for Global Warming? The evidence is very strong and from multiple sources and disciplines, but not perfect. The exact amount of human responsibility cannot be measured, since we cannot measure the natural effects accurately enough and cannot separate them from the anthropogenic effects. Humans probably cause 50% or more of the current climate changes, estimated between one-third and two-thirds. We may or may not be still emerging from the little Ice Age, which ended about a century ago but could still be hiding a major climate change factor. Some examples of independent global warming evidence include the facts that: Alpine Glaciers are melting globally as measured by retreat of glacier and volume of ice; air, sea, and ground temperatures are rising globally and Arctic Permafrost is melting; Arctic Sea Ice (floating pack) cover is being lost; changes are occurring in plant and animal annual cycles; a slow increase in sea level but not a rapid rise is occurring; the Greenland Continental glaciers are losing mass; loss of floating ice shelves in both the Arctic and the Antarctic continues; and the overall [Keeling](http://www.globalwarmingart.com/wiki/File%3AMauna_Loa_Carbon_Dioxide_png) annual CO2 concentration curve recorded on Mauna Loa is visibly an accelerating curve, not a straight line. How fast is the warming? The PETM event released excess CO2 at 230 million metric tons/yr for 15,000 years (above the normal amount of 130 m mt/y that is absorbable by the normal Geological Carbon Cycle. (The total natural release during the PETM was thus 360 million mt/y). We are now releasing excess CO2 more or less 100 times faster (22 billion mtons/yr) and could reach PETM conditions in only 150 years, with about a 1% increase in CO2 per year.>

# Warming Advantage--AT: Kyoto CP to solve warming

**Kyoto fails to curb climate change**

**Strickland Jr., founder and chairman for the Austin Space Frontier Society, 2010**

**(John K. Strickland Jr.,** [**http://spacejournal.ohio.edu/issue16/strickland1.html**](http://spacejournal.ohio.edu/issue16/strickland1.html)**, Winter 2010, as)**

<Kyoto-Like Solutions are worse than useless. Such "solutions" which would cost advanced countries hundreds of billions of dollars a year, but would produce no measurable results after 1 century, should not be used. If we decide that GW is a problem, we must realize the scale of the problem. It is such a big problem that we better be very careful before deciding on solutions, due to the huge scale of commitment required, so we need to make sure we have the right set of solutions before we start. Wrong solutions could divert resources from the right solutions and prevent their implementation. It also takes energy and cash to build new energy plants. Both of these resources might be in short supply after too much of them have been expended on the wrong solutions. You can't fool the Market and economics always finds the truth. If alternate energy were easy to harness, it would pay very well and would already have replaced fossil fuel. If we take rash and drastic action, spending money and resources on grossly uneconomic energy systems, we will use up the financial, energy and material resources needed to build the new, non-carbon energy system needed for the 21st Century. Drastically higher energy costs demanded by many national and local politicians could cause high inflation and wipe out many jobs and businesses, even impact costs of existing pollution control.>

# \*\*\*\*Energy Advantage\*\*\*\*

# Energy Advantage Solvency: SPS meets Energy demands 1ac

**SPS only effective solar power without need for storage**

**SolarHigh.org,** research group for solar power, **‘11**

(Solar high research group, NGO that studies SPS, <http://solarhigh.org/resources/16KwordBrief.pdf>, 2011, AJ)

If we want to make solar energy affordable, we must put the collectors in space, where the sun

shines 24/7 and the intensity of sunlight is 1,360 W/sq.m., 40% greater than on Earth. The

best location is geostationary orbit (GSO, 35,800 km above the equator), where a satellite

remains fixed relative to terrestrial sites. The principal components of a power satellite are a large solar array and a microwave transmitter that beams power to an Earth-based receiver called a rectenna (a contraction of ‘rectifying antenna’), where it is converted to standard AC. The continuous, intense sunlight in GSO means that that no energy storage is needed, and that the solar array is a factor of 8 smaller than a similar terrestrial array with the same average output. The benign operating environment, in vacuum and free fall, permits high solar concentration without complex suntracking mechanisms and avoids maintenance problems caused by wind, dust, rain, snow or hail. Each satellite will deliver 2 GW to the utility grid, an output similar to a large nuclear plant. There is room in GSO for thousands of them. The microwave flux in the power beam is insufficient to harm aircraft or birds. The rectenna area is a factor of 9 smaller than the terrestrial solar farm that it replaces; it can be located close to the intended load center; and the structure shields the ground underneath from microwaves but is largely transparent to sunlight, so that it can be used for agriculture or other purposes. The technical feasibility of space-based solar power (SBSP) is beyond dispute. PV cells have been used in space for decades, and wireless power transmission has been demonstrated repeatedly, on Earth and in space. NASA and the DOE sponsored an extensive study of the subject in the late 1970s that found no show-stoppers, and this result has been confirmed by several major studies since then. We have been waiting for advances in space technology to reduce costs to a competitive level. That time is now.

# Energy Advantage Solvency: fossil fuel

**SPS provides electricity to replace fossil fuel generated electricity**

**Xin et al**, Masters degree in aerospace management, **2009**

(Sun Xin , Evelyn Panier, Cornelius Zünd, and Raul Gutiérrez Gómez, Toulouse Business School, May 2009 <http://www.nss.org/settlement/ssp/library/2009-FinancialAndOrganizationalAnalysisForSSP.pdf>, *AJ*)

According to the International Energy Agency, the burning of fossil fuel currently accounts for

about 64% of world electricity production. Economically this is not a bad proposition, since the

technology to do so is very old and the fuel sources are still fairly cheap and easily accessible.

Conversely renewable energy sources make up only 2% of the world energy mix; partially due

to questions of capacity and base load energy deliveryxix.At first glance it might seem that such a small market for renewable energy is a hindrance.However the potential market for the SSPS is not limited to that of green energy, but insteadthe entire electricity market as a whole.Although it can be argued as a green energy source, the SSPS in fact differs from currentrenewables since it is possible for it to become a base load system. As a result it becomes adirect competitor to standard generation sources such as nuclear and coal and therefore a

credible contender for the future growing energy marketxx

# Energy Advantage solvency demand

**SPS increases access to cleanly generate electricity without the environmental costs of building more traditional capacity (also answers terrestrial tradeoff turn)**

**Xin et al**, Masters degree in aerospace management, **2009**

(Sun Xin , Evelyn Panier, Cornelius Zünd, and Raul Gutiérrez Gómez, Toulouse Business School, May 2009 <http://www.nss.org/settlement/ssp/library/2009-FinancialAndOrganizationalAnalysisForSSP.pdf>, *AJ*)

According to the International Energy Agency (IEA) 25% of the world population lives without electricity, in most cases there is no way to deliver the energy. clxiii Markets are changing and the demand for green energy is very high. The deployment of renewable technologies for smallscale applications has large possibilities for the future. Energy can be generated from different natural resources, such as sunlight, wind, water and geothermal heat. Stationary small-scale applications must be applicable for all kinds of geographical classifications. To come to the fore only wind and solar will be examined in this context. Airflows can be used to produce electricity with wind turbines. This technology is growing at an average annual growth rate of 25%. clxiv This requires large amounts of land; particularly in areas of high wind resources. The strength of the wind varies from zero to storm force. Wind turbines do not produce the same amount of electricity all the time. There will be times when they produce no electricity at all. Efficiency is depending on the region where it is running. Land limitations make it even more difficult to install more systems. Lots of people think the landscape should be left in its natural form for everyone to enjoy. Wind turbines are also very noisy and they can generate the same level of noise as a family car travelling at 100 km/h. Solar power is most available energy source on earth, capable of providing many times of the current energy consumption. Electricity can be generated by means of photovoltaic cells or heat engines. Photovoltaic cells were originally developed for the use in space, where repair is expensive, if not impossible. But it still powers nearly every satellite in orbit because it operates reliably for a long period of time with virtually no maintenance. Solar power on earth is however an unsteady energy source, with energy production relying on the sun and therefore depending on day/ night cycles and alternatively the weather conditions. Some days it may not produce power at all, which could lead to energy shortage. As seen in Figure 29 only about half of the incoming solar energy reaches the Earth's surface.

# Energy Advantage Solvency fossil fuels

**SPS replaces fossil fuel electricity efficiently and cheaply**

**Xin et al**, Masters degree in aerospace management, **2009**

(Sun Xin , Evelyn Panier, Cornelius Zünd, and Raul Gutiérrez Gómez, Toulouse Business School, May 2009 <http://www.nss.org/settlement/ssp/library/2009-FinancialAndOrganizationalAnalysisForSSP.pdf>, *AJ*)

The current level of electricity generation is nowhere near the amount of electricity expected to

be demanded in the future. As the per capita consumption of energy in the developing world is

expected to climb sharply, the current level of generation will not be able to cope. Add to this

also the fact that much of the current electrical infrastructure is old and soon in need of

replacementxxi. If the problem is not sufficiently handled, the cost of electricity could become

astronomical.

If we consider the amount of new energy sources that need to be added to compensate for

growing demand and ageing infrastructure, we can see that there is a significant market

potential. We are also presented with an interesting opportunity to phase out old polluting and

difficult to operate power stations with clean energy supplied by a SSPS.

# Energy Advantage— solves energy scarcity

**SPS electricity to high demand, difficult to reach locations**

**Xin et al**, Masters degree in aerospace management, **2009**

(Sun Xin , Evelyn Panier, Cornelius Zünd, and Raul Gutiérrez Gómez, Toulouse Business School, May 2009 <http://www.nss.org/settlement/ssp/library/2009-FinancialAndOrganizationalAnalysisForSSP.pdf>, *AJ*)

Remote Premium: Some people are willing (and often have no choice) to pay more for energy in remote places, since generation in place is either difficult or expensive and given population density and distance to the power grid setting up the infrastructure to get interconnected results in prohibitive costs. Therefore, the idea is offering SSPS in-situ power generation at comparatively lower costs because of the logistics implied (no required fossil fuel transportation and storing or wired power transmission infrastructure), as well as environmentally friendly (no fossil fuel burning, water dams flooding terrain, or highly spaced wind turbines affecting landscape and wild life, among others). Some examples of regions where the stated conditions exist and such a concept would work well are isolated towns or villages in Siberia, Africa, Alaska, China, India, the Amazon region, Antarctica and medium size islands and archipelagos. The concept of this premium is associated with small stationary applications which are explained in their corresponding section. According to the “space solar power program, final report” paper of the International Space University of Kitakyushu, Japan, written in 1992, a reasonable price per kW/h at remote locations can be set up between US$ 0.22 and US$ 0.55, depending upon factors such as transportation costs for fuel and power output of the generator. At this time Antarctica is the place with the highest price per kW/h. Such values are derived from direct operation costs; environmental costs due to the impact of burning fossil fuels (Diesel as the main one) haven’t been accounted for. Therefore any power provider that intends to be competitive in such market type must offer costs within this range. Green Premium: For research purposes two sets of surveys were developed, details and results are explained in the Market Research section of this report as well as in Appendix E. One of the surveys was designed for common consumers and among other results it was found that people are willing to pay a surcharge of 1-5% of their regular electricity bill for the option of buying pollution free energy, such as SSPS. A 2.5% addition to the total electricity bill of potentially hundreds of thousands of households would provide an important economic incentive to develop green energy sources. A portion of this can be devoted to payback the investments made to develop a commercially viable SSPS. This finding, along with the fact that “only about 12% of the daily energy production on earth comes from renewable sourcesshow that there is a huge potential for a successful business model based on the SSPS concept”.

# Energy Advantage—energy demand increasing

**\*\*Electricity demand increasing in SQ—SPS provides cheap way to fill need**

**Xin et al**, Masters degree in aerospace management, **2009**

(Sun Xin , Evelyn Panier, Cornelius Zünd, and Raul Gutiérrez Gómez, Toulouse Business School, May 2009 <http://www.nss.org/settlement/ssp/library/2009-FinancialAndOrganizationalAnalysisForSSP.pdf>, *AJ*)

The standard of living in developing countries is expected to grow at a very rapid pace in the coming decades. The consumption of energy is very much linked to the living standard of a population, and so as it starts to improve, the per capita consumption of energy per person will rise as wellxxiv. Simply multiplying currently used energy generation sources by what will be needed in the future is not good enough. Considering the harm currently caused by these methods, multiplying their effects could prove to be catastrophic. The SSPS is therefore a way of moving forward to meet the growing energy needs of the planet without causing any more harm to the environment. As an example, depending on the kind of technology used, a SSPS could at worst lose 11% of its energy to heat in the atmosphere during inclement weather. For a sample system which provides 100KW of energy, this amounts to 11KW of thermal energy which is diffusely added to the biosphere. By comparison, this SSPS system which operates (worst case) at 89% efficiency is bested only by a nuclear power station which can operate at 98% efficiency. Modern day coal fired plants produce electricity at only ~32% efficiency, meaning that 68% of the energy released during the combustion of fuel is lost to heat and other forms of energy which also end up in the biosphere.

# Energy Adv – SPS solves

**SPS solves energy concerns without health effects**

**Amos, Science reporter for BBC News, 2010**

(Jonathan Amos, <http://news.bbc.co.uk/2/hi/science/nature/8467472.stm>, January 2010, as)

Space solar power is an attractive concept because it would be clean, inexhaustible, and available 24 hours a day.

The amount of energy falling on photovoltaic cells placed in orbit is considerably greater than the same solar panels positioned on the Earth's surface. In space, the incidence of light is unaffected by clouds, dust or the filtering effects of atmospheric gases.

Critics, though, have always pointed to multiple hurdles - to the cost of launching and assembling large solar stations in orbit, to the losses in efficiency in conversion, and to the safety issues surrounding some wireless transmission methods, particularly those that use microwaves.

Astrium says the latter can be addressed by using infrared lasers which, if misdirected, would not risk "cooking" anyone in their path.

The company has already tested power transmission via laser in its labs, and is now working on improving the efficiencies of the end-to-end system

# Energy Advantage—replace fossil fuels

**Solvency—investment in SPS produces electricity to meet demand for electricity without increasing climate change**

**Gauger, PhD at UCLA in cosmic ray studies, professional life in the aerospace industry, 2010**

**(Joleroy,** Online Journal of Space Communication

[**http://spacejournal.ohio.edu/issue16/gauger.html**](http://spacejournal.ohio.edu/issue16/gauger.html)**, date accessed 6/20/11, as)**

<The sun delivers energy to earth at the rate of 1.37 kilowatts per square meter during daylight hours. This amounts to 174 petawatts (one petawatt is 10 to the fifteenth power). About 89 petawatts reach the earth's surface. A satellite positioned in geosynchronous orbit at approximately 22,300 miles above earth (with an area of solar cells of 10 kilometers squared) will be bombarded by 13.7 gigawatts with only brief blackouts twice a year. With cell conversion efficiencies of only 10%, the electricity potentially produced will be 10 gigawatts delivered to the space-based microwave transmitter; somewhat less will be delivered to the receiver and relayed into the modified power distribution networks located near the user on earth.

Not one but several gigawatt-satellites will be required to generate the power needed over the next twenty to twenty five years. The continuing degradation of the environment accelerated by population growth, our inadequate efforts to balance carbon-based fuels with those from "green" sources and the increasing worldwide gross national product is good reason to get started with a program of energy from space. >

# Energy Advantage--SPS meets demand

# Energy ADV – SPS produces lots of energy

**Empirically, sps programs solve for round the clock renewable energy**

**Woody, staff writer for Space Future, 9**

(Todd Woody, New York Times, 12/3/9, <http://green.blogs.nytimes.com/2009/12/03/solar-plant-in-space-gets-go-ahead/>, 6/23/11, KJ)

California regulators on Thursday went where no regulators have gone before — approving a utility contract for the nation’s first space-based solar power plant. The 200-megawatt orbiting solar farm would convert solar energy collected in space into radio frequency waves, which would be beamed to a ground station near Fresno, Calif. The radio waves would then be transformed back into electricity and fed into the power grid. “At the conceptual level, the advantages of space-based systems are significant,” said Michael Peevey, president of the [California Public Utilities Commission](http://www.cpuc.ca.gov/puc/), during a hearing on Thursday. “This technology would offer around-the-clock access to clean renewable energy, and while there’s no doubt this project has many hurdles to overcome, both regulatory and technological, it’s hard to argue with the audacity of the project. A Southern California start-up called Solaren will loft components for the solar power plant into orbit and sell the electricity it generates to Pacific Gas and Electric, the major utility in Northern California, under a 15-year contract. The project is supposed to be turned on in 2016.

**solvency- sps delivers more and cheaper electricity without environmental costs**

**Gauger, PhD at UCLA in cosmic ray studies, professional life in the aerospace industry, 2010**

**(Joleroy, Online Journal of Space Communication**

[**http://spacejournal.ohio.edu/issue16/gauger.html**](http://spacejournal.ohio.edu/issue16/gauger.html)**, date accessed 6/20/11, as)**

<In the preceding paragraphs, I have shown a few of the areas within the electric power system that might undergo drastic change with a new source of energy from the satellite power system. Upon implementation, the majority of the terrestrial cross-linking power transmission networks will never be used. Satellite power will be delivered to receiving antennas located close to the distribution network, eliminating the need for most of the high power transmission lines. This should reduce the cost per kilowatt hour by at least 10%, since at least 30-40 percent is due to the fuel burned. The present rates average about 10 cents per kilowatt hour; that rate will drop to 5 cents per kilowatt hour, or less. Society will see a reduction in some of the unaccounted costs due to reductions in green house gas emissions not showing up in the power costs today. Those costs will be further lowered by greater efficiencies and implementation of advance technologies and mass production in the designing, developing, deploying and operating satellite and rectenna systems. Such cost reductions can be estimated as part of an early solar satellite definition program. That program should be started as soon as possible -- Now.>

# Energy Advantage--SPS meets demand for electricity

**Solvency—investment in SPS produces electricity to meet demand for electricity without increasing climate change**

**Gauger, PhD at UCLA in cosmic ray studies, professional life in the aerospace industry, 2010**

(Joleroy, Online Journal of Space Communication

 [**http://spacejournal.ohio.edu/issue16/gauger.html**](http://spacejournal.ohio.edu/issue16/gauger.html), date accessed 6/20/11, as)

<The sun delivers energy to earth at the rate of 1.37 kilowatts per square meter during daylight hours. This amounts to 174 petawatts (one petawatt is 10 to the fifteenth power). About 89 petawatts reach the earth's surface. A satellite positioned in geosynchronous orbit at approximately 22,300 miles above earth (with an area of solar cells of 10 kilometers squared) will be bombarded by 13.7 gigawatts with only brief blackouts twice a year. With cell conversion efficiencies of only 10%, the electricity potentially produced will be 10 gigawatts delivered to the space-based microwave transmitter; somewhat less will be delivered to the receiver and relayed into the modified power distribution networks located near the user on earth.

Not one but several gigawatt-satellites will be required to generate the power needed over the next twenty to twenty five years. The continuing degradation of the environment accelerated by population growth, our inadequate efforts to balance carbon-based fuels with those from "green" sources and the increasing worldwide gross national product is good reason to get started with a program of energy from space. >

# Energy Adv – SPS solves resource wars

**Lack of terrestrial resources spark wars, SSP solves for resource security**

Collins and Autino 08

Patrick Collins and Andriano Autino, May 25 2008, <http://www.spacefuture.com/archive/what_the_growth_of_a_space_tourism_industry_could_contribute_to_employment_economic_growth_environmental_protection_education_culture_and_world_peace.shtml>, Accessed June 24, 2011, JP)

<As an alternative to the "resource wars" already devastating many countries today, opening access to the unlimited resources of near-Earth space could clearly facilitate world peace and security. The US National Security Space Office, at the start of its report on the potential of space-based solar power ( SSP) published in early 2007, stated: "Expanding human populations and declining natural resources are potential sources of local and strategic conﬂict in the 21st Century, and many see energy as the foremost threat to national security" [38]. The report ended by encouraging urgent research on the feasibility of SSP: "Considering the timescales that are involved, and the exponential growth of population and resource pressures within that same strategic period, it is imperative that this work for "drilling up" vs. drilling down for energy security begins immediately" [38].

Although the use of extra-terrestrial resources on a substantial scale may still be some decades away, it is important to recognise that simply acknowledging its feasibility using known technology is the surest way of ending the threat of resource wars. That is, if it is assumed that the resources available for human use are limited to those on Earth, then it can be argued that resource wars are inescapable [22,37]. If, by contrast, it is assumed that the resources of space are economically accessible, this not only eliminates the need for resource wars, it can also preserve the benefits of civilisation which are being eroded today by "resource war-mongers", most notably the governments of the "Anglo-Saxon" countries and their "neo-con" advisers. It is also worth noting that the $1 trillion that these have already committed to wars in the Middle-East in the 21st century is orders of magnitude more than the public investment needed to aid companies sufficiently to start the commercial use of space resources.>

# Energy Advantage-energy demand solvency

**Solvency: SSP is required to properly meet the energy demand of the world or the country - we must begin SSP work**

[**Schubert**](http://spacejournal.ohio.edu/about_ed.html#flournoy), Ph.D., P.E., Packer Engineering, Inc., Naperville, IL, 20**10**

(Peter J., Online Space Journal of Communication, December 2010. http://spacejournal.ohio.edu/issue16/schubert.html NP)

The Energy Information Agency (EIA) of the US predicts that in the time between 2004 and 2030 the world's energy demand will almost double. An extra 8,500 GW of installed capacity is needed to meet the growing energy needs of an increasingly affluent and industrialized world. This amounts to 328 GW per year of installed baseload power generation. A typical terrestrial "mega-nuclear" plant having multiple reactors produces from 5 to 8 GW, takes 8 years to build, and costs 25 billion USD, or about 3.85 USD/watt. Worldwide, the translates into 1.25 trillion USD each year on power generation facilities.

Renewable energy sources, such as hydroelectric, wind, biomass, geothermal, and solar (passive, concentrated, and photovoltaic) are limited, according to the EIA. Even if fully utilitized and cost-effective, these sources are barely capable of meeting energy needs in 2030, but inadequate to meet the projected needs in 2050. Therefore, SSP needs to become a large and growing segment of mankind's power needs by no later than 2030. The Manhattan Project took 6 years, and the first nuclear reactor came 9 years later. The Apollo project also took 6 years, and routine space travel via the STS began 12 years after that. Thus, the latest date at which SSP work must be started is 2012.

# Energy Advantage—solves energy demands

**Solvency – SPS solves energy demands**

**Globus, 10**

(Al, Globus, Online Journal of Space Communication, Winter 10, <http://spacejournal.ohio.edu/issue16/globus2.html>, KJ)

<Space solar power generation has the opposite problem. SSP produces power almost 24/7 365 days a year. At geosynchronous orbit, there are only few hours of eclipse per year when a solar power satellite will not produce power. Thus, when solar power satellites are dedicated to providing all the energy needed for a given area on earth, there will at times be too much power. To a certain extent, this can be handled by directing powersat beams to other antennas. Otherwise, the energy must be thrown away, stored, or used for non-time-critical tasks such as desalinating water.

All of the terrestrial options require power to be distributed by wire from the place produced to the point of use. Each power source can only insert power into the grid at a single point. SSP, however, can redirect the power of satellites to different antennas as demand fluctuates. As long as the antennas are placed fairly near the point of use, the total need to deliver power over landlines should be substantially reduced.>

# Energy Advantage—energy efficiency

**Solvency: SSP is more power efficient than terrestrial energy production sources.**

**Globus, 10**

(Al, Globus, Online Journal of Space Communication, Winter 10, <http://spacejournal.ohio.edu/issue16/globus2.html>, KJ)

<When we examine the environmental costs of long term energy production, it is fairly clear that SSP infrastructures built from lunar materials will be far superior to coal, oil, gas, and nuclear. While space has certain advantages, ground solar, wind, waves may well be the most competitive in the short term. The wisest energy policy from an environmental perspective may be to encourage wind and ground solar, particularly on rooftops where no land is consumed, combined with a vigorous SSP development effort. In the long term, a combination of distributed, intermittent energy production by wind, solar, waves and tides and the large scale and constant 24/7 potential of SSP could prove best. When the space segment can be substantially built from lunar materials, the benefits of an ample energy supply with low environmental cost will be possible for the indefinite future.>

# Energy Advantage--SPS Solves Sustainable Energy

**Solvency: Must utilize the sun for sustainable energy consumption.SPS solves sustainable energy consumption**

**Hsu, Systems Engineering & Risk Management, 10**

(Dr. Feng Hsu, “Harnessing the Sun”, Winter 2010, <http://spacejournal.ohio.edu/issue16/hsu.html>, KJ)

<In my view, [hu]mankind must now embark on the next era of sustainable energy consumption and re-supply. The most obvious source of which is the mighty energy resource of our sun. Adequately guide and using human creativity and innovation; the 21st century will become the next great leap forward in human civilization by taming solar energy, transforming our combustion world economy into a lasting solar-electric world economy. In solving humanity's energy problems we must learn from our ancestors. Taming the natural forces of the sun will be much like our ancestors' early efforts to harness the power of wild fire. We must use common sense, as they did, developing the tools and technologies that address the needs of our time. The Romans used flaming oil containers to destroy the Saracen fleet in 670. In the same century, the Japanese were digging wells to a depth approaching 900 feet with picks and shovels in search of oil. By 1100, the Chinese had reached depths of more than 3,000 feet in search of energy. This happened centuries before the West had sunk its first commercial well in 1859 in Titusville, Pennsylvania. With all such human creativities in the past, the searching for energy has been driven by our combustion world economy, which focused primarily on what's beneath the surface of our planet - the secondary energy resources which originated from the power of our sun. Now it's time for mankind to lift their heads and start focusing our profound creativity in harnessing the sun and making our way into the energy technology frontiers in the sky.>

# Energy Adv—solar power

**Solar power provides enough energy for demand**

**Smith, president of the Long Island Space Society, 04**

(Arthur P. Smith, November 1 2004, National Space Society, <http://www.nss.org/adastra/volume16/smith.html>, JP)

Use of energy, whether fuel for transportation, electrical energy running the Internet, or the destructive energy released in weapons, is central to our economy and security. It is with good reason that the technical term for energy use per unit time, "power," suggests control in the human world as well. Three actions taken now — working to reserve radio spectrum for power transmission, focusing on reductions in costs for space launch, and investing in space solar power system research — hold the promise of opening up vast new sources of power within the next 10 to 15 years. Space is big. There is an awful lot of energy out there, and the crumbs we fight about here on Earth are laughably tiny in comparison. Zettawatts from the sun pass just through the region between Earth and the moon — that's enough energy for each man, woman and child in the United States to power and sustain an entire U.S. economy all by themselves.

# Energy Advantage—demand

**Increased energy demand will not be met with existing approaches—must invest in SPS**

**Rajagopalan Senior Fellow at the Institute of Security Studies 11**

(Rajeswari Pillai Rajagopalan, April 2 2011, Observer Research Foundation, <http://www.orfonline.org/cms/sites/orfonline/modules/analysis/AnalysisDetail.html?cmaid=22177&mmacmaid=22178>, JP)

<Speaking in New Delhi in November last year, Dr. Kalam said that "by 2050, even if we use every available energy resource we have, clean and dirty, conventional and alternative, solar, wind, geothermal, nuclear, coal, oil, and gas, the world will fall short of the energy we need by 66%. There is an answer. An answer for both the developed and developing countries. This is a solar energy source that is close to infinite, an energy source that produces no carbon emissions, an energy source that can reach the most distant villages of the world, and an energy source that can turn countries into net energy exporter."3 According to the International Energy Agency (IEA), the worldwide demand for primary energy increases by 55 per cent between 2005 and 2030 - 1.8 per cent hike per year on average; and for India, the demand is expected to more than double by 2030, growing at 3.6 per cent rate per year.4

With energy demand growing rapidly, the SBSP option offers huge opportunities. Such an option will also be reportedly a cleaner energy option. This option would also significantly augment India’s capabilities in the space domain, which will have far-reaching positive spin-offs in the ever-changing security environment in Asia. This will bring the much-desired focus on the question of technology transfer between India and the US, Japan and Israel. >

# Energy Advantage – energy demand solvency

**SPS reliable and flexible energy source solves for energy demand**

**PowerSat**, a pioneer in generating safe, clean, reliable energy, 20**09** (PowerSat, “PowerSat Files Patent That Accelerates Viability Of Space Solar Power (SSP) Satellite Systems”, June 16 2009, http://www.businesswire.com/portal/site/google/ndmViewId=news\_view&newsId=20090616005687&newsLang=en, Accessed on June 22, 2011. NP)

“This patent filing is a watershed moment not only for PowerSat but for a renewables industry that, until now, could neither compete economically nor generate power at the base load scale of oil or coal,” said PowerSat CEO William Maness. “Today, the convergence of technology and energy demand, combined with the political will to wean us off of fossil fuels, enables space solar power (SSP) to fill a widening clean energy supply gap.”

SSP is a clean, viable solution to our world’s growing energy problems. Not limited by weather or geography, SSP solves the intermittency problems of earth-based renewables by providing a reliable and flexible energy source that is available 24/7. The underlying technology components are proven and systems will be deployable within a decade. Solar energy is captured via solar power satellites (known as powersats) and transmitted wirelessly to receiving stations at various points around the globe. Thousands of megawatts can be harnessed and shifted between receiving stations thousands of miles from each other—all in a matter of seconds.

# Energy Advantage—fossil fuel use in SQ

**U-SQ electricity relies on coal generators, oil and natural gas with huge costs**

**Gauger, PhD at UCLA in cosmic ray studies, professional life in the aerospace industry, 2010**

**(Joleroy, Online Journal of Space Communication**

 [**http://spacejournal.ohio.edu/issue16/gauger.html**](http://spacejournal.ohio.edu/issue16/gauger.html), date accessed 6/20/11, as)

<1. The majority of U.S. electricity comes from coal steaming generators. The coal fields are typically in the Midwest or West as much as 1500 miles away from the generation plants. The cost of the delivery of the coal is at 40-50 dollars per short ton and the many mile-long trains required to deliver the coal are clogging the rail systems. The disposition of the coal ash and debris is a major expense.

The 1,460 coal-fired boiler plants operating at 30.9% capacity consume 121.7 million short tons of coal to yield 171,683 megawatt hours of electricity. The average delivered price is $41.23 per short ton. Most of this coal is mined in Appalachia (389 million short tons), in the interior states (146.7 million short tons), and in the western states (633.6 million short tons). This fuel cost totals over 5 billion dollars. The average mileage of the rail transportation lies in the vicinity of 100 to 500 miles from the mines to the power generation sites.

While the coal derived electricity cost is at 3 to 4 cents per kilowatt hour, there are unaccounted costs:

* These plants are large producers of greenhouse gases, a principal driver of planetary warming;
* These plants are extremely wasteful of energy, converting only about a third of the available energy into electrical power;
* These plants leave significant residue in the ash (and airborne contaminants such as mercury) that further contaminate the soil;
* The mile-long trains required to deliver the coal are clogging the rail systems; and
* The disposition of the coal ashes and debris is a major expense.>

# Energy Advantage—increasing demand

**By 2100, 5 billion people will live without fuels or electricity**

**Snead, Professional Aerospace Engineer, 11/08**

(James Michael Snead, *The End of Easy Energy and What to do About It,* [*http://mikesnead.net/resources/spacefaring/white\_paper\_the\_end\_of\_easy\_energy\_and\_what\_to\_do\_about\_it.pdf*](http://mikesnead.net/resources/spacefaring/white_paper_the_end_of_easy_energy_and_what_to_do_about_it.pdf)AJ)

By 2100, the number of people actually using electricity and modern fuels will more than double. Of the world’s current 6.6 billion people, 2.4 billion do not have access to modern fuels and 1.6 billion do not have access to electricity. As a result, a substantial percentage of the world’s population lives in a state of energy deprivation that substantially impacts health, individual economic opportunity, social and political stability, and world security. By 2100, the world’s population is projected to climb another 3.4 billion to roughly 10 billion. This means that by 2100, an additional 5 -6 billion people, not using modern fuels and electricity today, must be provided with assured, affordable, and sufficient energy supplies if the world’s current energy insecurity is to be substantially eliminated.

# Energy Advantage—peak coming

**If no alternative energy source is found, oil, coal, and natural gas will be depleted by 2100**

**Snead, Professional Aerospace Engineer, 2008**

(James Michael Snead, *The End of Easy Energy and What to do About It,* [*http://mikesnead.net/resources/spacefaring/white\_paper\_the\_end\_of\_easy\_energy\_and\_what\_to\_do\_about\_it.pdf*](http://mikesnead.net/resources/spacefaring/white_paper_the_end_of_easy_energy_and_what_to_do_about_it.pdf)AJ)

If oil, coal, and natural gas remain the predominant source of energy, both known and expected newly discovered reserves will be exhausted by 2100, if not far earlier. Of the 81 billion BOE produced each year from all energy sources, 86 % or 70 billion BOE comes from non -renewable oil, coal, and natural gas. At this percentage, by 2100, the world would need about 240 billion BOE from oil, coal, and natural gas. With an annual average of about 155 billion BOE through the end of the century, the world would need about 14,1 00 billion BOE of oil, coal, and natural gas to reach the end of the century. Current proved recoverable reserves of oil, coal, and natural gas total only about 6,000 billion BOE. Expert estimates of additional recoverable reserves optimistically add another 6,000 billion BOE—for example, including nearly 3,000 billion BOE from all oil from oil shale—for a combined total of around 12,000 billion BOE.\* With increasing world energy consumption and if oil, coal and natural gas continue to provide most of the world’s energy, known and new reserves of oil, coal, and natural gas will be exhausted by the end of the century, if not much earlier.

# Energy Advantage—SQ solutions fail

**Squo alternative energy sources produce health and environmental effects**

**Weinstein, Sc. D, 09**

(Leonard Weinstein, April 19 2009, <http://noconsensus.wordpress.com/2009/09/02/the-solution-to-future-energy-needs-and-global-pollution/>, JP)

<Burning fossil fuels produces Carbon Monoxide, Nitrous Oxides, Sulfur Oxides, and particulates (including heavy metal contamination), which all negatively affect the atmosphere to some extent. Carbon Dioxide is also produced in large quantity, but this is not a negative factor as the others are. Burning coal also produces large amounts of waste ash which is difficult to dispose of safely. In addition, the present easily obtainable oil reserves are limited and might not last too much longer. Since oil is the main source of fuel for transportation, this is particularly significant. Alternatives such as synthetic oil based fuels made from coal or other sources are both more expensive, and also will eventually be limited.

The use of renewable fuels such as ethanol, methanol, and biologically produced oils appears to be an attractive solution, but many issues have arisen including the limited amount of land that can be dedicated to production without negatively impacting food production and costs. In addition, recent analysis indicates that converted land (converted from forest or multi-crop activity) may actually produce more pollutants due to the conversion than is reduced in the vehicle by use of the alternate fuel.

Nuclear fission power has its own problems. Licensing and building reactors take a very long time. If the fuel were used directly (non-breeder reactors), the finite Uranium sources would limit the available operation in a relative short time (several decades). Going to breeder reactors can greatly extend this time, but these reactors produce Plutonium, which is very toxic and dangerous. Getting rid of reactor waste products is a major problem. One final problem is due to the need for large quantities of cooling water, which can exacerbate the existing problem of stretched water supplies. If fusion energy were available, it would have some of the same problems as fission power plants, but it is not even available.

While hydroelectric, Geo-thermal, wind and Solar generated power do not have the polluting problems of the previous techniques (but may have other problems) and do not get used up, they are also limited in location, magnitude, and in the case of wind and Solar, are limited in production times. Hydroelectric and Geo-thermal power are very limited in generation capacity. Unless far more practical energy storage and long-range distribution systems are developed, wind and Solar will also remain limited to a small part of energy production.>

# Energy Adv –Resource Conflicts coming

**Resource conflicts coming soon – energy security key to prevent**

**Rogue, Director of National Security Space Office 07**

(Joseph D. Rogue, Phase O Architecture Feasibility Study, JP)

<Consistent with the US National Security Strategy, energy and environmental security are not just problems for America, they are critical challenges for the entire world. Expanding human populations and declining natural resources are potential sources of local and strategic conflict in the 21st Century, and many see energy scarcity as the foremost threat to national security. Conflict prevention is of particular interest to security‐providing institutions such as the U.S. Department of Defense which has elevated energy and environmental security as priority issues with a mandate to proactively find and create solutions that ensure U.S. and partner strategic security is preserved. >

# Energy Adv –energy security key to all good things

**Clean tech solves energy security, reduces poverty and pollution to increase economy**

**Rogue, Director of National Security Space Office 07**

(Joseph D. Rogue, Phase O Architecture Feasibility Study, JP)

The post‐9/11 situation has changed that calculus considerably. Oil prices have jumped from $15/barrel to now $80/barrel in less than a decade. In addition to the emergence of global concerns over climate change, American and allied energy source security is now under threat from actors that seek to destabilize or control global energy markets as well as increased energy demand competition by emerging global economies . Our National Security Strategy recognizes that many nations are too dependent on foreign oil, often imported from unstable portions of the world, and seeks to remedy the problem by accelerating the deployment of clean technologies to enhance energy security, reduce poverty, and reduce pollution in a way that will ignite an era of global growth through free markets and free trade. Senior U.S. leaders need solutions with strategic impact that can be delivered in a relevant period of time. >

# Energy Adv- Solve alt energy

**SPS key to energy security which deescalates conflicts**

**Rogue, Director of National Security Space Office 07**

(Joseph D. Rogue, Phase O Architecture Feasibility Study, JP)

<Consistent with the US National Security Strategy, energy and environmental security are not just problems for America, they are critical problems for the entire world. Expanding human populations and declining natural resources are potential sources of strategic and local conflict in the first half of the 21st Century. Conflict prevention is of particular interest to security‐providing institutions such as the U.S. Department of Defense. Equitable access to sufficient quantities of clean, reliable, and affordable energy fundamentally enables the technical and policy solutions that can prevent future resource conflicts while still providing opportunities for prosperous growth. Every energy resource opportunity, including those from space, must be fully explored to determine its ability to contribute toward solving mankind’s looming energy supply and security dilemma.

<A single kilometer‐wide band of geosynchronous earth orbit experiences enough solar flux in one year (approximately 212 terawatt‐years) to nearly equal the amount of energy contained within all known recoverable conventional oil reserves on Earth today (approximately 250 TW‐yrs). The enormous potential of this resource demands an examination of [hu]mankind’s ability to successfully capture and utilize this energy within the context of today’s technology, economic, and policy realities, as well as the expected environment within the next 25 years. Study of space‐based solar power (SBSP) indicates that there is enormous potential for energy security, economic development, advancement of general space faring, improved environmental stewardship, and overall national security for those nations who construct and possess such a capability. >

# Energy Adv – Solves alt energy

**SBSP creates inexhaustible renewable energy**

**Rogue, Director of National Security Space Office 07**

(Joseph D. Rogue, Phase O Architecture Feasibility Study, JP)

<FINDING:The SBSP Study Group found that by providing access to an inexhaustible strategic reservoir of renewable energy, SBSP offers an attractive route to increased energy security and assurance.

The reservoir of Space‐Based Solar Power is almost unimaginably vast, with room for growth far past the foreseeable needs of the entire human civilization for the next century and beyond. In the vicinity of Earth, each and every hour there are 1.366 gigawatts of solar energy continuously pouring through every square kilometer of space. If one were to stretch that around the circumference of geostationary orbit, that 1 km‐wide ring receives over 210 terawatt‐years of power annually. The amount of energy coursing through that one thin band of space in just one year is roughly equivalent to the energy contained in ALL known recoverable oil reserves on Earth (approximately 250 terawatt years), and far exceeds the projected 30TW of annual demand in mid century. The energy output of the fusion‐powered Sun is billions of times beyond that, and it will last for billions of years—orders of magnitude beyond all other known sources combined. Space‐Based Solar Power taps directly into the largest known energy resource in the solar system. This is not to minimize the difficulties and practicalities of economically developing and utilizing this resource or the tremendous time and effort it would take to do so. Nevertheless, it is important to realize that there is a tremendous reservoir of energy—clean, renewable energy—available to the human civilization if it can develop the means to effectively capture it. >

# Energy Advantage: Peak Oil coming

**Peak oil coming---disruptions mean should find alternative fuel now**

**Xin et al**, Masters degree in aerospace management, **2009**

(Sun Xin , Evelyn Panier, Cornelius Zünd, and Raul Gutiérrez Gómez, Toulouse Business School, May 2009 <http://www.nss.org/settlement/ssp/library/2009-FinancialAndOrganizationalAnalysisForSSP.pdf>, *AJ*)

One thing that needs to be considered is the long heralded arrival of “Peak Oil”. Peak Oil is the point when the production of oil worldwide reaches its maximum and thereafter begins a slow decline. Since not all of the world’s oil reserves have yet been identified, it remains unclear when Peak Oil may occur. Still, optimists and pessimists alike have placed it sometime between 2010 and 2030x. Considering the reliance of the world on oil, the eventual scarcity and then disappearance of this energy source will cause incredible worldwide problems if no replacement can be found. It is conceivable that there will be considerable strife and conflict over these remaining resources, and that it would certainly be in our best interest to find alternatives.

# Energy Adv - Uniqueness - Population Increasing

**Currently Population increasing will increase demand for energy**

**Snead, senior member of the American Institute of Aeronautics and Astronautics , 08**

(James Snead, , November 19 2008, <http://mikesnead.net/resources/spacefaring/white_paper_the_end_of_easy_energy_and_what_to_do_about_it.pdf> JP)

<1. By 2100, the number of people *actually using* electricity and modern fuels will more than double. Of the world’s current 6.6 billion people, 2.4 billion do not have access to modern fuels and 1.6 billion do not have access to electricity. As a result, a substantial percentage of the world’s population lives in a state of energy deprivation that substantially impacts health, individual economic opportunity, social and political stability, and world security. By 2100, the world’s population is projected to climb another 3.4 billion to roughly 10 billion. This means that by 2100, an additional 5-6 billion people, not using modern fuels and electricity today, must be provided with assured, affordable, and sufficient energy supplies if the world’s current energy insecurity is to be substantially eliminated.

2. By 2100, to meet reasonable energy needs, the total world’s energy production of electricity and modern fuels must increase by a factor of about 3.4X while that of the United States must increase by a factor of 1.6X. The annual per capita total energy consumption of Japan, South Korea, and Europe averages about 30 barrels of oil equivalent or BOE. Further energy conservation may reduce this to about 27 BOE per year. This value is used in this paper as a level of energy consumption needed for a modern standard of living and a stable political and economic environment outside the United States. By 2100, should the non-U.S. world population achieve this modern “middle class” standard of living, the world will require an annual energy supply of around 280 billion BOE. In 2006, the world’s electricity and modern fuels energy supply was about 81 billion BOE. Hence, by 2100, the world will need on the order of 3.4X more energy than was being produced in 2006. In the United States, a near doubling of the population by 2100, even with a 20% reduction in per capita energy use, will require a 1.6X increase in U.S. energy needs.>

# Energy Advantage--Increasing demand for electricity in SQ

**U-increasing demand for electricity**

**Gauger, PhD at UCLA in cosmic ray studies, professional life in the aerospace industry, 2010**

(Joleroy, Online Journal of Space Communication

<http://spacejournal.ohio.edu/issue16/gauger.html>, date accessed 6/20/11, as)

<I would add government to the category of bulk users of electrical power, in addition to those identified by the DOE Energy Information Administration: industrial, transportation, commercial and residential.

The electric power system is over 100 years old. As it stands today, it is a classic hierarchy that has grown out of the changing requirements of the public and the increasing capabilities of industry. Electricity uses have grown in scope, quantity, and location diversity. Meeting industry and public demands have resulted in the development of several types of generators. The diversity and variability of the categories of end users have required that the output of the power generators be distributed, creating the need for transmission networks of different sizes that could handle DC or AC power at varying voltages. This has resulted in the rise of the 500 or so commercial operators who design, monitor, control and manage the transmission networks. The distances over which the power must be delivered requires interconnection of U.S. and Canadian AC power supplies. Power is lost in transit. Efficiency in transfer of power is relevant to the amount of generated, and the voltages that can be used in the transmission must be taken into consideration.>

# Energy Adv- Resources shortages now

**Fossil fuels reach peak by 2100 – must act now**

**Snead, senior member of the American Institute of Aeronautics and Astronautics , 08**

(James Snead, , November 19 2008, <http://mikesnead.net/resources/spacefaring/white_paper_the_end_of_easy_energy_and_what_to_do_about_it.pdf> JP)

3. If oil, coal, and natural gas remain the predominant source of energy, both known and expected newly discovered reserves will be exhausted by 2100, if not far earlier. Of the 81 billion BOE produced each year from all energy sources, 86% or 70 billion BOE comes from non-renewable oil, coal, and natural gas. At this percentage, by 2100, the world would need about 240 billion BOE from oil, coal, and natural gas. With an annual average of about 155 billion BOE through the end of the century, the world would need about 14,100 billion BOE of oil, coal, and natural gas to reach the end of the century. Current proved recoverable reserves of oil, coal, and natural gas total only about 6,000 billion BOE. Expert estimates of additional recoverable reserves optimistically add another 6,000 billion BOE—for example, *The End of Easy Energy and What to Do About It* 7 10.00% 10.80% 20.60% 5.80% 52.80%Projected world conventional, terrestrial, sustainable, dispatchable electrical power generation capacity and deficiency in 2100 Nuclear Geothermal Hydroelectric Wind Deficiency World sustainable energy production today and what additional is needed by 2100 Today Must be added by 2100 including nearly 3,000 billion BOE from all oil from oil shale—for a combined total of around 12,000 billion BOE.\* With increasing world energy consumption and if oil, coal, and natural gas continue to provide most of the world’s energy, known and new reserves of oil, coal, and natural gas will be exhausted by the end of the century, *if not much earlier*.>

# Energy Advantage—oil shocks coming

**The United States remains addicted to oil as its primary source of energy. As a result, oil shocks coming in 2012 – that tanks the economy**

**Kopits, Writer of the Energy Bulletin,** 20**11** (Steven R. Kopits heads the New York office of Douglas-Westwood, energy business consultants, “Commentary: An oil shock in 2012?” Post Carbon Institute, accessed 6/27/11 <http://www.energybulletin.net/stories/2011-02-14/commentary-oil-shock-2012> aes)

Thus, effective spare capacity in the global system should be considered 1.4 - 2.4 million b/d less than the 4.65 million b/d currently reported by the EIA. Consequently, it may not be more than 2.25 – 3.25 million b/d, in essence as much as global growth in demand last year. This is not much. Further, if we pair reduced spare capacity with increased demand, then effective surplus capacity is consumed at a brisk pace. By the middle of 2012, spare capacity could be as low as 1 million b/d, or even less, if the Saudis decide to limit production at 10 million b/d. To a certain extent, these developments could be forestalled by inventory drawdowns, and indeed, the EIA forecasts inventory draws averaging a quarter million barrels a day in 2012 to sustain spare production capacity. Such draws are not unprecedented or unusual in themselves, but they are another factor suggesting tight markets. In any event, when surplus capacity falls below one million b/d, an oil shock cannot be precluded. Thus, in the better case, the world is facing tight oil markets in 2012; in the worst case, the country may be heading into another oil shock and recession. For policy makers, this has a number of implications. For starters, it suggests that Saudi Arabia will have a material influence on the 2012 US elections. The Kingdom will be able to create constricting oil prices not only by withholding production, but by releasing it too slowly. Therefore, the nature and quality of US relations with the Kingdom will matter. It also suggests that an oil shock is likely by 2013, even if the US is lucky enough to escape one in 2012. Such shocks are typically associated with recessions, which would imply increased unemployment, surging budget deficits and possibly more pressure on housing prices and the financial sector. Policy analysts need to run the numbers, to anticipate potential fallout and look to mitigate adverse effects to the extent possible.

**Prices rising because of increased demand – shocks coming soon that exacerbate the recession**

**Kopits, Writer of the Energy Bulletin,** 20**11** (Steven R. Kopits heads the New York office of Douglas-Westwood, energy business consultants, “Commentary: An oil shock in 2012?” Post Carbon Institute, accessed 6/27/11 <http://www.energybulletin.net/stories/2011-02-14/commentary-oil-shock-2012> aes)

The price of oil is once again daily in the news. The Western Europe benchmark Brent crude has hovered near $100 / barrel for much of the last month, and the IEA is again warning of the burden of oil consumption. Is this a harbinger of things to come, or a mere statistical blip in a market that is "well supplied"? How will events play out in oil markets in the coming year or two? Certainly, oil prices have surged on the back on strong demand, of which some is structural, and some transient. The northern hemisphere has seen a strikingly cold winter, leading to increased heating oil usage. And the global economy is recovering from a deep recession, with demand bouncing off the recessionary trough. These are, to an extent, passing events. But in many respects, increased prices fundamentally reflect an oil demand that is increasing faster than supply. Indeed, the recent growth of demand has been described as "astonishing". While it is not unexpected from our perspective, demand growth is still impressive. According to the EIA, world petroleum liquids consumption was up 2.8 million b/d, that is 3.2 percent, in the three months through January 2011, compared to the same three months a year earlier. While this is a high number, it is not unprecedented. In the twelve years to 1972, world oil consumption increased by 30 million b/d, representing 150% demand growth over the period and 2.7 million b/d average annual demand growth. And demand increased by 7-8 million b/d in the three years of recovery following the oil shock of 1973 and the 2001 recession. (These recessions were arguably the most comparable to the recent one. After 1973, the western world was still continuing the process of motorization, and thus demand recovered quickly. This was also true after 2001, when China first made its impact on global oil markets.) Today, as after 1973 and 2001, the pace of motorization continues—indeed, has accelerated—in the developing world, and thus demand growth at a pace of 2.5 million b/d / year through 2012 should not be surprising. Nor should oil demand growth compared to other energy sources be a surprise. Natural gas and coal consumption increased by 3.2 percent and 5.1 percent per annum, respectively, from 2002 through 2008, the start of the recession. It is hard to imagine that oil consumption would forever lag other fuel sources if the oil were available. And available it was in 2010. According to the EIA, the oil supply increased by 2.1 million b/d in the three months through Jan. 2011, compared to the same period a year earlier. Non-OPEC liquids contributed 1 million b/d to this, consisting primarily of the US (+0.4 million b/d), China (+0.3), FSU (+0.3), Brazil (+0.2), and India (+0.1), offsetting production declines, notably in the North Sea (-0.4) and Mexico (-0.2). The balance of the increase came from OPEC, with natural gas liquids (NGL‘s) contributing nearly 1 million b/d and crude a lowly 0.2 million b/d.

# Energy Advantage—oil shocks coming

**Saudi Arabia will cause shocks – limited supply**

**Kopits, Writer of the Energy Bulletin,** 20**11** (Steven R. Kopits heads the New York office of Douglas-Westwood, energy business consultants, “Commentary: An oil shock in 2012?” Post Carbon Institute, accessed 6/27/11 <http://www.energybulletin.net/stories/2011-02-14/commentary-oil-shock-2012> aes)

None of these is suggestive of a country in which one could stick a straw in ground and draw light sweet crude without effort. However, when the Saudis were pushed prior to the recession, they were able to add nearly two million barrels of capacity is relatively short order and at comparatively modest cost. Saudi Arabia is no longer an Iraq—an under-developed resource—but with 260 billion barrels of proved reserves, the Kingdom still a formidable producer capable of lifting production if its national interests so dictate. However, the Saudis, having produced aggressively for more than half a century, can envision the future, perhaps seventy years from now, when Saudi Arabia‘s resources will be largely depleted. If Saudi is not yet half way through its oil resources, it is close enough to appreciate that they are finite. This perspective may have led King Abdullah to command in 2008 to "leave it in the ground, by Allah, our children will need it." As a result, the Kingdom may be reluctant to increase production. It is certainly fair to posit that the Saudis would prefer higher prices to higher volumes, and the current environment looks likely to provide them. Both these factors would encourage the Kingdom to limit production.

# Energy Adv – Oil Shocks – Economy

**Oil Shocks coming now – threatens the global economy – inflation and imports**

**Washington Post** 20**11 (**By CHRISTOPHER S. RUGABER and MARTIN CRUTSINGER The Associated Press Thursday, March 10, 2011, “ Higher oil prices threaten global economy” accessed 6/27/11 <http://www.washingtonpost.com/wp-dyn/content/article/2011/03/10/AR2011031004708.html> aes)

Higher oil prices are slowing global economic growth, and the impact is likely to spread in coming months. Oil prices helped raise the U.S. trade deficit to a seven-month high in January, when crude prices were $87.50 a barrel. Oil is now trading at more than $100 a barrel, suggesting the gap will widen in coming months. Even fast-growing China isn't immune -- higher oil prices contributed to a rare trade deficit there in February. "It's a bad start, because we all know the oil shock is still coming," said Paul Ashworth, an economist at Capital Economics. Pricier oil dampens consumer spending and that cuts into economic growth. Surging oil prices can also stir up inflation fears, triggering higher interest rates that cut into household and business spending. In January, America's foreign oil bill rose 9.5 percent, or $3.04 billion, to $34.9 billion. That's the highest monthly total since October 2008. Since then, political turmoil in Libya, Egypt and Tunisia have sent oil prices surging. At the same time, accelerating economic growth in Asia and Latin America has also boosted demand. The impact is visible in bold numbers each morning on gas station marquees across the United States. Pump prices have risen 13 percent in the past month to a national average of $3.53 a gallon, according to AAA, Wright Express and Oil Price Information Service. Airlines have also been rapidly raising their fares to offset higher fuel costs. American Airlines said Thursday it is increasing its base fares by $10, the seventh price hike this year by U.S. airlines. Jay Bryson, global economist at Wells Fargo Securities, said he has cut his U.S. growth estimate for the January-March period to 2.9 percent, down from about 3.3 percent last month. Much of that reduction is due to the impact of higher oil and gas prices. The $46.3 billion trade deficit in January also will subtract from economic growth. Higher prices for oil helped drive imports up at the fastest rate in 18 years, as did rising demand for foreign cars, auto parts and machinery. Imports rose at nearly twice the pace of exports, to $214.1 billion, the Commerce Department said. Exports rose to an all-time high of $167.7 billion. That isn't all bad news. A wider deficit is partly a sign of greater spending by businesses and consumers. But it also means that more of that spending is going overseas, reducing U.S. economic growth. Imports of foreign-made autos and auto parts increased 14 percent, or $2.67 billion, as auto production rose in the U.S. and Canada. Demand for big-ticket capital goods such as industrial machinery and computers increased 5.2 percent. Imports of consumer goods, such as clothing, shoes, electronic appliance and toys and games, were up 2.2 percent. "To the extent that this surge reflects the strength of domestic demand ... it isn't necessarily a disaster," Ashworth said. Rising oil prices can slow the economy in another way: by spurring central banks to raise interest rates. Few economists expect the U.S. Federal Reserve to take such a step. But that's a potential problem in Europe. Both the European Central Bank and the Bank of England appear to be preparing interest rate hikes in the next couple of months, in an effort to keep inflation in check. Many analysts fear that could bring a faltering economic recovery in Europe to a halt. Though Germany, Europe's economic powerhouse, is growing strongly, a number of countries, notably the highly indebted nations such as Greece and Portugal, are expected to contract further this year. Europe is a major source of U.S. exports and a slowdown there could weigh on the U.S. recovery.

# Energy Adv – Oil Competition – China Ext

**China and US will go to war over oil – competition**

**Hatemi,** professor at the University of Nebraska-Lincoln **and Wedeman,** associate professor and chair of Asian Studies at the University of Nebraska-Lincoln, **2007** ( Peter Hatemi is a professor at the University of Nebraska-Lincoln. Andrew Wedeman is associate professor and chair of Asian Studies at the University of Nebraska-Lincoln., China Security, Vol. 3 No. 3 Summer 2007, pp. 95 - 118 2007 World Security Institute, “Oil and Conflict in Sino-American Relations” accessed 6/27/11 <http://www.wsichina.org/cs7_5.pdf> aes)

Although China is likely to reach regional military parity with the United States around the mid-2040s, this does not mean that China will necessarily challenge the status quo. The latter is only likely if China either opportunistically challenges the United States or if China believes that it is at such a disadvantage that it feels compelled to challenge the status quo. For conflict to become likely, not only must two states be in relative power parity, but there must also be some tangible antagonism in the relationship capable of triggering serious conflict. Lateral pressure theory and its focus on resource scarcity as a source of interstate conflict provides one possible motivation for two states to collide. 27 Because the economies of both the United States and China depend heavily on imported energy - primarily oil - the advent of a zero-sum situation where global demand exceeds supply could create a potential casus belli. Rising Chinese demand for oil imports will at some point create pressure on the global supply, and continued expansion of its imports will likely impinge on the U.S. ability to sustain its own import demand. 28 If a situation occurs where China thinks its national interests depend on its ability to increase its share of total imports and where the United States concludes that its national interests demand that it pre vent China from making further inroads into its share of total imports, conflict is likely. In some cases, the search for new resources will manifest itself in the form of imperial expansion with the state conquering neighboring territories and establishing overseas colonies. 29 In other cases the search may take a less overtly military form and manifest itself in efforts to open up new markets, dominate current markets, obtain critical supply concessions or establish new trade networks. So long as resources are finite, both efforts to seize control of new supplies or to obtain them through the market are likely to generate conflict. Lateral pressure increases the potential for major powers to come into conflict, especially when competing states’ spheres of influence in resource-rich peripheral regions begin to overlap. An important consequence of lateral pressure is the action-reaction process wherein one antagonistic activity (perceived or real) leads to a counteraction by the competing state. Activities that may be generated by one state due to considerations other than resource security, but that affect the resource security of another state, could also be perceived as a threat even though no threat was intended. The most important of these interactions is when the expanding activities and interests of two high-capability, high-lateral pressure states, such as the United States and China, collide. If the activities of either nation are perceived as threatening, the two may be caught in a security dilemma, wherein reciprocation of antagonistic actions may lead to war. 30

# Energy Advantage Internal Link-resource peak

**World supply of certain resources will peak and demand for clean energy increasing to combat climate change**

**Wallach,** General Counsel of the NewSpace Alliance, **2010**

(Mark I. Wallach, Online Journal of space communication [**http://spacejournal.ohio.edu/issue16/wallach.html**](http://spacejournal.ohio.edu/issue16/wallach.html), winter 2010, as)

The increasing shortage in world energy supplies expected during the coming decades, the result of increasing world population, increased energy usage and the "peaking" of existing energy sources like oil, has led to a search for new sources of energy. At the same time, concern about human-induced climate change has led many state governments to set target dates for utilities to achieve mandated levels of energy produced from renewable sources as part of their energy portfolios, commonly referred to as renewable portfolio standards (RPS).

# Energy Advantage-peak oil internal link

**Peak oil inevitable, SPS key to solve the impacts**

**Mankins, 2008**

(John, National Space Security Office; Ad Astra; Spring 2008; <http://www.nss.org/adastra/AdAstra-SBSP-2008.pdf>;tr)

**<5.** SBSP is an anti-war capability. America can use the existing technical expertise in its military to catalyze an energy transformation that lessens the likelihood of conflict between great powers over energy scarcity, lessens the need to intervene in failed states which cannot afford required energy, helps the world climb from poverty to prevent the spawn of terrorism, and averts the potential costs and disaster responses from climate change. Solving the long-term energy scarcity problem is too vital to the world’s future to have it derailed by a misconception that space solar power might somehow be used as a weapon. That is why it is so important to educate people about this technology and to continue to conduct the research in an open environment. –The NSSO SBSP Study Group, a.k.a. The Caballerosern weapon systems spend two decades in pre-production and another five in operation— a 70-year life cycle that clearly places any new platforms (and our entire war-fighting doctrine) squarely on the backside of peak oil, and permanently in a hangar unless DoD can reinvent itself to remain relevant in an energyscarce world. Therefore, DoD is in a position of greatest need for examining all alternate energy options. On a more tactical level, the very real high cost in dollars and lives lost to deliver large quantities of fuel and energy supporting operations in Iraq and Afghanistan has informed the military that energy logistics From Left: Col. Mike “Green Hornet” Hornitschek; Lt. Col. Paul “Plato” Damphousse; Lt. Col. Pete “Lips” Garretson; John “The Evil Dr” Mankins; Lt. Col. Mike Sires; Lt. Col. M.V. “Coyote” Smith; Mita Desai is a reality that begs for a paradigm change. After concluding that most superficial observers of SSP casually and wrongly dismiss it either as science fiction or a complete economic infeasibility, a small group of motivated action officers from the Pentagon with science and technology, space, philosophy, operational, and strategy development backgrounds banded together (the self-anointed “Caballeros”) with several long-time SSP experts on a voluntary mission to educate the un-informed about the amazing potential of this almost-forgotten energy idea.Spring 2008 ad Astra 29 had previously failed to close the SSP business case by examining energy as the only delivered revenue stream, DoD has a voracious demand for many different capabilities beyond just energy. These capabilities include command and control, persistent surveillance, operationally-responsive space access, space control, orbital debris removal, and in-space construction and maintenance of large structures. Recognizing that technical advances are occurring exponentially around the globe, and that history has shown time and again that deliberate and sustained innovation is the engine that drives true economic and political power, the “Eureka!” moment came with the realization that all of the previous business case analyses failed to include the economic and national security benefits of sure spin-off technologies and ancillary capabilities associated with deployment of a major SSP system. This list included not only the capabilities previously described, but also space infrastructure, low-cost reusable space access, orbital maneuver capabilities, broad-area space radar surveillance and telecommunication, and space-to-space and ground-to-ground power beaming. The ancillary benefit list was so remarkably large that it became nearly as important as the actual energy SSP could provide— no one in the DoD had ever viewed SSP through this lens before.>

# Energy Adv – Oil Depletion War impact

**Sudden loss of key oil supplies independently kills 5 billion people**Richard **Heinberg**, Senior Fellow at the Post Carbon Institute, **2005**
(The Party's Over : Oil, War and the Fate of Industrial Societies, p. 33)
The third danger of the drawdown strategy is one that is discussed less frequently than either pollution or global warming, though its ultimate implications for humankind may be even more dire. This is our increasing dependency on energy resources that are depleting within historically narrow time frames. There are now somewhere between two and five billion humans alive who probably would not exist but for fossil fuels. Thus if the availability of these fuels were to decline significantly without our having found effective replacements to maintain all their life-sustaining benefits, then the global human carrying capacity would plummet - perhaps even below its pre-industrial levels. When the flow of fuels begins to diminish, everyone might actually be worse off than they would have been had those fuels never been discovered because our pre-industrial survival skills will have been lost and there will be an intense competition for food and water among members of the now-unsupportable population (Chapter 5 provides a closer look at the likely consequences of the anticipated petroleum depletion. ).

# Energy Adv – Adventurism Mod ½

**\*please don’t read with leadership advantage**

**A. Oil Shocks cause military adventurism – alternative energy key**

**Quinn**, Staff writer for Newsweek, **2006** (Jane Bryant Quinn, 4/24/06, “The Price of Our Addiction” accessed 6/27/11 <http://www.newsweek.com/2006/04/23/the-price-of-our-addiction.html> aes)

This throws our Iraq wars into a different light. To an extent that most Americans don't yet understand, the U.S. military has become a "global oil-protection force," says Michael Klare, an expert on natural-resource wars and author of the book "Blood and Oil." President Jimmy Carter declared the free flow of oil from the Persian Gulf to be a vital U.S. interest, enforced at the point of a gun, if necessary. Today, we patrol tanker routes not only in the gulf, but in the Indian Ocean and South China Sea. Troops and advisers help protect pipelines in chaotic countries such as Colombia and the Republic of Georgia. We're planting military bases near oil supplies in Asia and Africa. Gulf War I was billed as a war to save Saudi oilfields from Saddam Hussein. Gulf War II was elevated to a "war against terror." But it's arguably still about oil--the Carter Doctrine reigns. One of the prizes in Iraq was to have been British and American access to its huge and unexploited oil reserves, Klare says. What does all this add up to? A future oil market drastically rationed by price. Farmers, truckers and people on lower incomes who have to drive to work will be squeezed, especially if they also need oil to heat their homes. But heating with natural gas won't save you either, says oil investment banker Matthew Simmons; natural-gas supplies may grow even tighter and even higher priced. On paper, we have alternatives, such as liquefied coal, oil sands from Canada and ethanol. But they're not anywhere close to production on a massive scale. For a smooth transition, mega-energy projects need to get started at least 20 years before oil supplies decline, writes Robert Hirsch of the consulting firm SAIC in a study prepared for the U.S. Department of Energy. If we don't get a running start on the problem, he says, "the economic consequences will be dire." We're probably already behind. It takes leadership to address a potential crisis in advance. Unfortunately, we're investing in war, not in crash projects to develop new energy sources. Maybe there's time to spare. But some events, like true civil war and collapse in Iraq, could change everything in a day. We're running a faith-based energy policy--still addicted to oil. If something goes wrong, it will go wrong big.

# Energy Adv – Adventurism Mod 2/2

**\*please don’t read with leadership advantage**

**b. Adventurism causes war and extinction**

**Kellner,** Social Sciences at UCLA, **2003** (Douglas Kellner is a professor of social sciences at UCLA, “An Orwellian Nightmare: Critical Reflections on the Bush Administration” accessed 6/27/11 <http://gseis.ucla.edu/faculty/kellner/papers/orwelliannightmare.htm> aes)

After the collapse of the Baath regime in April 2003, the Bush administration began threatening Syria and there have been reports that the neo-conservatives in the administration have planned five more wars (see Clark 2003). The Bush administration policy of Terror War raises the possibility that Orwell's 1984 might provide the template for the new millennium, as the world is plunged into endless wars, as freedom and democracy are being snuffed out in the name of freedom, as language loses meaning, and as history is constantly revised (just as Bush and his scribes constantly rewrote his own personal history). There is thus the danger that Orwell's dark grim dystopia may replace the (ideological) utopia of the "information society," the "new economy," and a prosperous and democratic globalization that had been the dominant ideology and vision of the past decade. Questions arise: Will the Bush administration Terror War lead the world to apocalypse and ruin through constant war and the erection of totalitarian police states over the faÁade of fragile democracy? Or can more multilateral and global solutions be found to the dangers of terrorism that will strengthen democracy and increase the chances for peace and security? There is indeed a danger that Terror War will be a force of historical regression, and the motor of destruction of the global economy, liberal polity, and democracy itself, all to be replaced by an aggressive militarism and totalitarian police state. It could well be that Orwell will be the prophet of a coming New Barbarism with endless war, state repression, and enforced control of thought and discourse, and that George W. Bush and his minions are the architects of an Orwellian future. It could also be the case, however, that the Taliban, bin Laden, Al Qaeda, Saddam Hussein, and the Bush administration represent obsolete and reactionary forces that will be swept away by the inexorable forces of globalization and liberal democracy. The opposing sides in the current Terror War of the Bush administration reactionaries and Al Qaeda could be perceived as representing complementary poles of an atavistic and premodern version of Islam and nihilistic terrorism confronted by reactionary rightwing conservatism and militarism.[12] In this scenario, both poles can be perceived as disruptive and regressive forces in a global world that need to be overcome to create genuine historical progress. If this is the case, Terror War would be a momentary interlude in which two obsolete historical forces battle it out, ultimately to be replaced by more sane and democratic globalizing forces. This is, of course, an optimistic scenario and probably, for the foreseeable future, progressive forces will be forced to confront intense battles between the opposing forces of Islamic terrorism and rightwing militarism. Yet if democracy and the human species are to survive, global movements against militarism and for social justice, ecology, and peace must emerge to combat and replace the atavistic forces of the present. As a new millennium unfolds, the human race has regressed into a New Barbarism unforeseeable prior to September 11. If civilization is to survive, individuals must perceive their enemies and organize to fight for a better future. And now is the time for liberals, conservatives and those who believe in truth in politics to demand straight talk from the Bush administration and other politicians, and for the media and critics of the politics of lying to take the Bush administration to task for its Big Lies. As the history of recent totalitarian regimes demonstrates, systematic deception and lying rots the very fabric of a political society, and if U.S. democracy is to find new life and a vigorous future there must be public commitments to truth and public rejection of the politics of lying. To conclude: as a response to the September 11 terror attacks, the Bush administration has answered with an intensified militarism that threatens to generate an era of Terror War, a new arms race, accelerated military violence, U.S. support of authoritarian regimes, an assault on human rights, constant threats to democracy, and destabilizing of the world economy. The Bush regime also provides political favors to its largest corporate and other supporters, unleashing unrestrained Wild West capitalism, exemplified in the Enron scandals, and a form of capitalist cronyism whereby Bush administration family and friends are provided with government favors, while social welfare programs, environmental legislation, and protection of rights and freedoms are curtailed. Consequently, I would argue that Bush administration unilateralist militarism is not the way to fight international terrorism, but is rather the road to an Orwellian nightmare in which democracy and freedom will be in dire peril and the future of the human species will be in question. These are frightening times and it is essential that all citizens become informed about the fateful conflicts of the present, gain clear understanding of what is at stake, and realize that they must oppose at once international terrorism, Bushian militarism, and an Orwellian police-state in order to preserve democracy and a life worthy of a human being.

# \*\*\*Leadership Advantage\*\*\*

# Leadership ADV – Crisis coming Uniqueness

**Energy Crisis will lead to a loss of US HEG**

**Mahan, author for Citizens for Space Based Solar Power, No Date Given**

(Rob Mahan, <http://c-sbsp.org/sbsp-faq/#01>, Last Modified 06/24/2011, as)

I can remember when gasoline was about 25 cents a gallon in the 1960′s. Today it is often over $3.00 a gallon and crude oil is $100 a barrel. In 1960, the U.S. population was about 180 million and today it is nearly 310 million. There have been several energy crises (increased price or decreased supply) in the U.S. since the 1960′s. The 1973 oil crisis was caused by an OPEC oil export embargo and the 1979 energy crisis was caused by an Iranian revolution. Again in 1990, a spike in the price of oil was caused by the Gulf War. During 2000-2001, a California electricity crisis was caused by failed government deregulation coupled with several instances of business corruption. The most recent oil price increases of 2004-2007 have been caused by increasing demand from the U.S and China, the falling state of the U.S. dollar and stagnation of production due to the war in Iraq.

Energy crises of the future will likely be more severe. Energy scarcity will give rise to even more international conflicts in the future. As world population grows, the laws of supply and demand will eventually break when the demand for natural resources exceeds the total capacity of the planet to sustainably supply them. World population is projected to rise from today’s 6.6 billion to 9.2 billion by 2050. (United Nations Population Division, 2007). Abundant, affordable energy is required to sustain our most basic needs for clean air, clean water and a safe food supply.

President Bush, in the 2006 State of the Union Address said, “America is addicted to oil.” The U.S. currently imports between 50% – 60% of the crude oil we use and we pay between $400 and $500 billion per year for that imported crude oil. This makes us dependent on many who are not necessarily our friends. Threats of price increases or limitations of supply and come from energy cartels (OPEC) or energy superpowers (Iran, Venezuala, etc.). Carbon emission price increases, penalties and pressure to reduce emissions can come from international bodie like the United Nations and its Intergovermental Panel on Climate Change (IPCC). The Kyoto Protocol (reduction of greenhouse gas emissions) would put significant financial penalties on the U.S. for failing to meet the requirements of the treaty. Our reliance on foreign energy gives others a lever (or a stick) to use against us. Energy independence will give us many more political options when dealing with these external forces.

Space-based solar power addresses many of the issues related to energy independence. Nearly every source of energy we use today can be traced back to the Sun, which is a huge nuclear (hydrogen fusion) furnace. Space-based solar power is a potentially unlimited source of clean energy and it could eventually supply all of our country’s needs. Instead of importing vast amounts of fossil fuels, the U.S. could become a major exporter of energy & technology.

America can use the platform of energy to once again set an example of what being a good citizen-nation of the world is all about. Bill Richardson, governor of New Mexico and former Secretary of Energy (1997-2001), has published his vision for our energy future in a book titled “Leading by Example”. He offers the warning “America is just one crisis away from an energy emergency that will completely disrupt daily life, sharply increase energy prices, and perhaps even lead to military intervention in the world energy markets.” And he also offers hope for our energy future when he states “The American people are full of optimism and ingenuity. The people of the world want to believe that we are responsible and compassionate, that we are committed to freedom and basic fights, and that we want to participate constructively in world affairs. Visionary leadership, and visonary action to implement a new role for the United States, will turn the situation around quickly, and America will find itself surrounded by friends and allies once again.”>

# Leadership Adv – Aerospace UQ

**US leads in aerospace competitiveness now, but space development is key to stay ahead of China**

**Wharton 2011** (Wharton Aerospace and Defense Report, 6/17/11, “Boeing Executive Worried about U.S. Aerospace Industry’s Future” accessed 6/27/11 http://executiveeducation.wharton.upenn.edu/wharton-aerospace-defense-report/Boeing-Executive-Worried-about-US-Aerospace-Industrys-Future-0611.cfm)

Jim Albaugh, the top executive of Boeing's commercial aircraft division, warned that the U.S. aerospace industry faces an uncertain future as new competitive challenges and worker shortages loom. In an interview with The Seattle Times, Albaugh said he worries about what he calls "the intellectual disarmament" of the United States. He said the country took a lead in aerospace driven by Cold War military and space-race competition. But that might all change now because of a lack of government funding of new challenges, according to the interview. "We still are the leader in aerospace," said Albaugh, who is serving as the 2011 chairman of the Aerospace Industries Association, a trade group that represents defense and commercial aviation, and space companies. "Are we going to be the leader in aerospace in another 20 years?" Albaugh cited the following during his Seattle Times interview for his growing concern for the industry: The Defense Department has no industrial base policy other than market forces. Companies are only planning for what the Pentagon needs now. "Right now, the Boeing Company is the only company in the United States that has a design team working on a new airplane. There are no [all-new] airplanes being developed for the Department of Defense probably for the first time in 100 years." The best and brightest immigrants used to come to the U.S. to study and then stayed on to build their careers and lives in this country. "Now, the best and brightest come to the United States, get trained and leave, and go back and compete against us." New competition from abroad will erode the U.S. market-share. He pointed to China's test flight of its new J-20 Stealth fighter, which he saw less as a military threat than an economic threat. "They will sell that airplane around the world and will take away a lot of the market that's been enjoyed by U.S. defense contractors." **The U.S. government withdrawal from space exploration will lead China to walking on the moon sooner than the U.S. can even launch an American into orbit again now that the Shuttle program winds down.**

**Recent defunding puts the aerospace industry at risk**

**Ferster,** staff writer for space news, **2011** (Warren Ferster is a staff writer for space news, 6/13/11, “Frank Slazer, Vice President, Space, Aerospace Industries Association (AIA)” accessed 6/27/11 <http://spacenews.com/profiles/110613-frank-slazer.html> aes)

The U.S. aerospace industry has been through government spending declines before, and while there is a sense in Washington that this one’s different, Frank Slazer isn’t so sure. The industry veteran recalls during the 1990s — he was working in the Washington office of the former McDonnell Douglas Corp. at the time — when the emphasis on deficit reduction was one of the main arguments for canceling what is now the international space station. Not only did the space station survive multiple cancellation attempts, the nation managed to get its fiscal house in order, to the point of running a surplus, though that turned out to be short lived. Slazer maintains there’s no telling what the fiscal environment will be like five years from now. What is different today, Slazer says, is that industry is not united the way it was back when the space station was in the crosshairs of budget hawks. These days the industrial stakeholders in NASA’s human spaceflight program are divided into two camps: those who support the White House decision to scrap the Moon-bound Constellation program and nurture commercially operated space station logistics and astronaut transportation services; and those invested in the remnants of Constellation, including the congressionally mandated heavy-lift Space Launch System (SLS) and Orion deep space crew capsule. Slazer, whose consensus-based organization does not take sides in such matters, says it is both possible and logical to pursue both paths, a position that appears to buck the sentiments of some of his member companies. One of his main goals, he says, is to unite the industry behind that point of view. Slazer, who came to the AIA in March, spoke recently with Space News editor Warren Ferster.

# Leadership Adv – Aerospace UQ

**Space funding key to aerospace competitiveness – budget cuts have put the US at a disadvantage**

**Nakano**, consultant for Aviation Week and Space Technology, **2011** (Thomas Aki Nakano, 4/25/11, “Don't Erode U.S. Edge In China” Aviation Week and Space Technology, accessed 6/24/11, Lexis, aes)

China's emergence as a dynamic aviation marketplace and its aspiration to become a leader in **aerospace** have altered the **competitive** dynamic in this fast-growing economy. For U.S. companies, success will mean more than simply competing against other Western suppliers for a share of the market. As in many parts of the world, Pratt & Whitney has embraced «co-opetition»--cooperation and competition--with key Chinese aviation entities. Often, leveraging collective resources to achieve common interests proves more effective than going it alone. A key player in helping promote common interests among U.S. aviation companies in China is the Aviation Cooperation Program (ACP), a strategic multi-program, public-private partnership that is supported by the U.S. Trade and Development Agency, FAA and Civil Aviation Administration of China (CAAC), the organization responsible for the nation's affairs in aviation. The seven-year-old ACP consists of 36 companies, including Pratt & Whitney and its parent company, United Technologies Corp. (UTC), Boeing, Rockwell Collins, General Electric, Honeywell, Goodrich, UPS, Parker Aerospace, Textron, United Airlines, Delta Air Lines and American Airlines. The ACP has engaged with relevant Chinese counterparts to offer assistance through programs that train aviation managers and air traffic management executives and provide expertise in areas such as air traffic flow management, general aviation and regional aviation. ACP also is embarking on an Airport Sustainable Best Practices Consultancy, a ground delay program and an International Play Book to facilitate aviation safety and development in China. This type of cooperation has served many U.S. companies well in the eyes of relevant Chinese authorities and airline operators. So it is especially regrettable that funding for many of these efforts will be reduced or terminated due to budgetary challenges in the U.S. To date, the United States Trade & Development Agency (USTDA) has invested about $5.5 million in the ACP with supplemental funding provided by the member companies, the FAA and CAAC. With the U.S. budget forecast at about $3.75 trillion, the comparably small investment in ACP reaps big returns. The funding cuts now under consideration could bring an end to the USTDA and ACP. The ACP offers win-win initiatives that provide strategic and competitive advantages for U.S. companies while supporting our friends in China as they continue to develop what already is the world's second-largest air traffic market. Many ACP-developed projects aid the safety of Chinese commercial and general aviation--no small task for a nation that has built 45 new airports since 2006, with 52 more expected by 2020. Enhanced management know-how has enabled free exchanges from both sides of the Pacific. ACP bolsters mutual cultural understanding, potentially avoiding conflicts and promoting grass-root-level exchanges in a more relaxed business atmosphere. The rapid rise of Asia in the aviation sector is not a surprise to Pratt & Whitney, which joined other UTC business units in China almost a century ago. In 1929, only four years after the birth of Pratt & Whitney, our engine powered China Postal's flight between Hankow and Shanghai, serving what was then the Republic of China. During World War II, our motors propelled the famous Flying Tigers. In 1972, the company returned to the People's Republic of China on the wings of the JT3D-powered Air Force One, which carried President Richard M. Nixon on his quest to normalize the U.S.-China relationship. Ever since, we have powered many Chinese civil aircraft; no small accomplishment as three of the top five passenger airlines (ranked by market capital) now are Asian, including Air China and China Southern. With more than 1,200 employees, a customer training center, one engine overhaul facility, three aero-engine component manufacturing facilities and many field offices, Pratt & Whitney is committed to the continued development of Chinese aviation. Aviation growth is said to follow the growth of the national GDP. With only 200 airports (compared with 10,000 in the U.S.) and a population of 1.3 billion, China remains a strategic and key aviation market for many U.S. companies. ACP has proven its effectiveness. We hope to extend such cooperation to additional fields in Chinese aviation, such as blue sky and general aviation and to include government regulators and ministries, further strengthening bilateral cooperation. Cutting funding for ACP, however, would be a step in the wrong direction. The organization should be supported in its role as a bridge for Sino-American aviation--and as a booster of U.S. competitiveness in one of the world's most important markets.

**China’s aerospace competitiveness rising now – puts US at risk**

**Mecham,** consultant for Aviation Week and Space Technology, **2010** (Michael mecham, 9/6/11, Aviation week and space technology, “An Emerging Conundrum” accessed 6/27/11, Lexis, aes)

China's emergence as the world's second largest economy plays out in many ways, including the possibility it will lead a fragmentation of the traditional Airbus and Boeing duopoly that provides airlines on all continents with most of their jets. Boeing's own forecast for the Asia-Pacific region underscores that potential. In the aggregate, China leads a region that is expected to buy $1.1 trillion worth of large new jets during the next 20 years--more than North America, Russia, the Middle East, Latin America and Africa combined. At 7.9%, China's air travel growth is top-of-the-world. Some analysts even expect it to lead the world's private aircraft orders within a decade. This is not news to aviation suppliers; they've been pouring into China since the 1990s. The talisman for the Chinese government's drive to become world-ranked in aircraft manufacturing is the 156-seat C919, powered by CFM International LEAP-1C engines (see p. 48). The narrowbody jet is being developed by Commercial Aircraft Corp. of China (Comac) as a competitor to the industry's best-sellers, the Airbus A320 and Boeing 737 families. Bombardier is challening Boeing and Airbus at the bottom of their product lines with the CSeries, and Russia's Irkut is going directly after the A320 and 737 with the MS-21. But China's ambitions have prompted the most attention from Western manufacturers in terms of joint ventures, advice and technology transfer. The Chinese know the incumbents will defend their territory fiercely. Acquiring the necessary manufacturing skills to attract top foreign airlines' attention is only the first step, and perhaps the easiest. Learning the fine art of integrating fuselage assemblies, engines, avionics and other components efficiently and cost-effectively is a far bigger one. Even the experts can stumble in assembly--witness Boeing's 787 and Airbus's A380 woes. But surmounting the third barrier--establishing a service culture in which airlines have confidence--takes time and attention to detail. There is as much continuing innovation in services as in design and materials.

# Leadership Advantage Solves Aerospace industry

**Correctly funded SSPS would spillover into aerospace industry—and decrease launch costs**

**Xin et al**, Masters degree in aerospace management, **2009**

(Sun Xin , Evelyn Panier, Cornelius Zünd, and Raul Gutiérrez Gómez, Toulouse Business School, May 2009 <http://www.nss.org/settlement/ssp/library/2009-FinancialAndOrganizationalAnalysisForSSP.pdf>, *AJ*)

A correctly funded SSPS would have many knock on effects to the aerospace industry by

supplying investment in and encouraging development of both new and existing technologies.

Some areas which could receive direct benefits from such a project would be satellite

integrators, OEM’s, defence companies, robotics research, and launcher companies.

For instance as has been mentioned before, one of the limiting factors in the SSPS model is the

cost of launching materials into orbit. It is argued that for the SSPS to be built there needs to be

a significant reduction in the cost per kilogram. However on the other hand the only way to

stimulate such a large drop in prices for launchers is to fund a project which will require

launchers in bulk and therefore drive down the costs; a project like the SSPS. This conundrum

has been likened to the story of the chicken and the egg.

# Leadership Advantage Solves Military readiness

**SPS increase military readiness**

**Xin et al**, Masters degree in aerospace management, **2009**

(Sun Xin , Evelyn Panier, Cornelius Zünd, and Raul Gutiérrez Gómez, Toulouse Business School, May 2009 <http://www.nss.org/settlement/ssp/library/2009-FinancialAndOrganizationalAnalysisForSSP.pdf>, *AJ*)

Military Premium: The military is highly interested in this concept, since it would allow

operation without being hindered by logistical and security constraints. The so called Fuel

Tether, as was labelled by Lieutenant General James N. Mattis..

Such dependency on fuel represents one of the greatest weaknesses and threats not only

for the US military but for any Armed Force in the world since it implies a heavy and long

logistics chain that can be attacked much more easily than any other military objective. This

has been the case during the Iraq war for the coalition led by US Forces or in Afghanistan for

NATO Forces.

# Leadership Advantage Solvency military readiness

**SPS boosts military readiness**

**Globus, NASA Ames Research Center Scientist, 10/10**

(Al Globus, Towards an Early Profitable PowerSat, October 2010, http://space.alglobus.net/papers/SSI2010SSPpaper.pdf, June 21, 2011, AJ)

<Clearly, improvement in infra-red power beaming would greatly benefit the proposed system. [The U.S. military is working vigorously to increase the power (Northrop-Grumman recently demonstrated a 100kw solid state laser) and generation efficiency (65% achieved, 80% is a near term goal) of lasers, as mentioned in the IR Power Beaming section. DOD has substantial resources and it would be difficult for a small organization such as the Space Studies Institute (SSI) to make a contribution. However, there are areas where relatively small efforts may bear fruit.

First of all, it may be possible to substantially increase the efficiency of converting laser light to electricity. LaserMotive used custom cells provided by Spectrolab of Sylmar CA, a subsidiary of the Boeing Company. The light impinging on the receiver will be nearly a single frequency, so energy conversion should be much easier than for sunlight which is relatively wide-band.

Perhaps the easiest and most profitable research area is system design; which has received very little effort so far. There are a wide variety of issues to be addressed, from efficiency, scalability and reliability to environmental effects and safety that must be considered. The thermal design is particularly important since even at 80% efficiency the lasers will generate a great deal of heat. However, a single brilliant insight can make large improvements and have a substantial impact on the potential profitability of the system.>

# Leadership Adv- Readiness internal link

**Military use of sps increases readiness and improves force structure**

**Rogue, Director of National Security Space Office 07**

(Joseph D. Rogue, Phase O Architecture Feasibility Study, JP)

<For the DoD specifically, beamed energy from space in quantities greater than 5 MWe has the potential to be a disruptive game changer on the battlefield. SBSP and its enabling wireless power transmission technology could facilitate extremely flexible “energy on demand” for combat units and installations across an entire theater, while significantly reducing dependence on vulnerable over‐land fuel deliveries. SBSP could also enable entirely new force structures and capabilities such as ultra long‐endurance airborne or terrestrial surveillance or combat systems to include the individual soldier himself. More routinely, SBSP could provide the ability to deliver rapid and sustainable humanitarian energy to a disaster area or to a local population undergoing nation‐building activities. SBSP could also facilitate base “islanding” such that each installation has the ability to operate independent of vulnerable ground‐based energy delivery infrastructures. In addition to helping American and allied defense establishments remain relevant over the entire 21st Century through more secure supply lines, perhaps the greatest military benefit of SBSP is to lessen the chances of conflict due to energy scarcity by providing access to a strategically secure energy supply. >

# Leadership Advantage –military access to energy

**Solvency: SPS solves energy prob on battlefield**

Pop, 2000

(Virgiliu Pop, Space Future, <http://www.spacefuture.com/archive/security_implications_of_non_terrestrial_resource_exploitation.shtml>, 6/23/11, KJ)

<As the OTA considers, "[m]ilitary satellites for communications and remote sensing are currently used by several countries, and presumably use of the SPS platform for such purposes would not constitute a change in accepted practice"[33].

The SPS potential of jamming of enemy radio communications is considered to be "significant"[34] and one of "the most logical offensive uses of SPS"[35]. Orbital solar mirrors could be used to intimidate the enemy and to illuminate the battlefields during an attack. Given their dimensions, SPS can serve as a "space launching pad"[36] and repair facilities[37]. The SPS "would be able to transmit power to remote military operations anywhere needed on earth"[38]. >

# Leadership Adv – SpS save military resources

**Advantage: Solar powered systems save resources and funding for the military (in 1ac)**

**Goel, 11**

(Tarun Goel, brighthub, 5/17/11, <http://www.brighthub.com/environment/renewable-energy/articles/89238.aspx>

, 6/23/11, KJ)

In the US, a huge amount is spent every year on military operations. Security and military spending sometimes exceeds public spending, which creates an unnecessary burden on the public and tax payers. However, recently the Department of Defense has announced that it is going to use solar devices for military applications, which is a welcome step as it is going to reduce defense spending and save resources. Major research, security, and defense outfits like NASA and the American Army are going green by installing solar grids for general lighting and heating purposes. This is not only cutting down electricity consumption, but also giving free time to the army personnel as the solar panels and devices do not require any maintenance, unlike conventional devices which have to be monitored (and refueled) every now and then. However, the use of solar power is not restricted to solar panels and grids only. The military and defense services are using solar charged devices like mini-solar-computers, GPS devices, night vision goggles, solar torches, other portable devices, and even solar-recharging tents. Thin film solar modules are specially designed for lightweight portable gadgets with rugged features that ideally suit military and defense applications. Since the cost of traditional energy sources used by the military is already high, solar modules can be produced at substantially lower costs for special purpose military uses. Components of Solar Devices for Military Applications The solar powered devices make use of latest inventions that make these devices portable and lightweight. Reliability is the most important factor because if a device is to be used in military operations, it ought to be perfect because failing in the time of need could be fatal. Mention below mentioned are the major elements used in these portable devices. 1 Chlorophyll-F pigment - Chlorophyll-F pigment is a new discovery that has the special property of capturing sunlight beyond the red end of the wavelength band. Harnessing the pigment can enhance bio-fuel generating algae which are very efficient. It has a larger spread of sunlight absorption than any anticipated organism. The new pigment is capable of absorbing sunlight efficiently at wavelengths around 706 nanometers, which is beyond the red end of the visible spectrum and human perception. 2 Graphene - Researchers are finding graphene an incredible material suitable for high speed electronics, microchips, and touch screen technology. Nanotechnology graphene is successfully produced in small size having high quality electrical characteristics. It is a new form of carbon made of a single layer of atoms configured in a honeycomb shaped lattice. It is highly conductive and extremely strong despite being one atom thick. A major breakthrough of the graphene project for intensifying solar energy was measuring electrical characteristics with ultra-high precision to accurate standards. The Quantum Hall Effect phenomenon is an international standard for accurately measuring electrical properties in 2D materials. 3 Nano Composite Capacitors - Films are created from barium titanate (BaTiO3) nano-particles. These nano-particles are held in a polymer matrix. In this new technique, the nanocomposite materials are tested at high frequencies to the extent of one megahertz. This fabrication of improved versions of these capacitors has twice the energy of existing capacitors.

# Leadership ADV – SPS Solves deterrence

**SPS laser energy could be used for military applications**

\*be careful this is a link to space mil

**Pop, staff writer for Space Future, 2000**

(Virgiliu Pop, Space Future, <http://www.spacefuture.com/archive/security_implications_of_non_terrestrial_resource_exploitation.shtml>, 6/23/11, KJ)

Another "mass destruction-like" effect may be presented by the SPS that would use lasers instead of microwaves as means of transmission of energy and that may also have the capacity to cause catastrophic fires on enemy territory. Gerrard and Barber note that " there is some debate as to whether nuclear-powered lasers are [weapons of mass destruction]"[14]. The same may be true in the case of use of orbiting solar mirrors: it may "become technically feasible to concentrate solar energy in certain areas of the earth and thereby cause fires, scorch the earth, or cause floods"[15]. Precedents of the use of solar rays as a weapon exist as far back as the 3rd Century BC, when Archimedes is said to have put fire to the Roman fleet invading Syracuse by using solar rays concentrated by mirrors.

# Leadership ADv – SPS solves readiness

**SPS solves energy problems on battlefield**

**Pop, staff writer for Space Future, 2000**

(Virgiliu Pop, Space Future, <http://www.spacefuture.com/archive/security_implications_of_non_terrestrial_resource_exploitation.shtml>, 6/23/11, KJ)

<As the OTA considers, "[m]ilitary satellites for communications and remote sensing are currently used by several countries, and presumably use of the SPS platform for such purposes would not constitute a change in accepted practice"[33]. The SPS potential of jamming of enemy radio communications is considered to be "significant"[34] and one of "the most logical offensive uses of SPS"[35]. Orbital solar mirrors could be used to intimidate the enemy and to illuminate the battlefields during an attack. Given their dimensions, SPS can serve as a "space launching pad"[36] and repair facilities[37]. The SPS "would be able to transmit power to remote military operations anywhere needed on earth"[38]. >

# Leadership Adv – green tech

**US development key to energy leadership**

**Mahan, author for Citizens for Space Based Solar Power, No Date Given**

(Rob Mahan, <http://c-sbsp.org/sbsp-faq/#01>, Last Modified 06/24/2011, as)

The development of space-based solar power will help other renewable energy technologies with spin-off technologies in the areas of photovoltaics, exotic materials, manufacturing techniques and many more.

Space-based solar power is a long-term solution with huge social and economic potential. It could actually be the game-changing energy technology, the elusive “silver bullet”, that is needed to address many of the energy and environment related problems we face today. Some estimates put space-based solar power at potentially a one trillion dollar a year industry.

Here’s a quote from the GA Tech Space Solar Power Workshop:

“Escalating tension between our environment and energy choices drove us to search for the best energy choice. That choice is Space Solar Power – the cleanest electricity generation process known. Gathered by satellites in geosynchronous orbit for use on Earth, pure clean energy would be beamed gently to earth. Space Solar Power should become the major source of the world’s energy and electric power to minimize our environmental footprint.”
I believe space-based solar power should be the cornerstone technology in our energy future. The United States must take the lead role in it’s development, deployment and management. There is great value in being first to market with any new product, let alone a breakthrough application of technology.

# Leadership ADV – SPS Solves leadership

**US must lead SBSP development or lose leadership**

**Mahan, author for Citizens for Space Based Solar Power, No Date Given**

(Rob Mahan, <http://c-sbsp.org/sbsp-faq/#01>, Last Modified 06/24/2011, as)

The U.S. Government must take a lead role in creating an environment that will enable the development of space-based solar power. Congress must organize a public – private effort because existing agencies, such as the U.S. House Committee on Science & Technology, the Department of Energy, the Advanced Research Projects Agency – Energy, the Pentagon’s National Security Space Office and NASA, are not set up for the large scale manufacturing that will be required.

The U.S. private sector will be key in the development of space-based solar power, and there is much precedent for Congress to foster just that kind of private sector development. The 1984 Commerical Space Launch Act was signed by President Reagan and the 1990 Launch Services Purchase Act was signed by President Bush. These Acts resulted in the private partnership, the United Launch Alliance (ULA), which places most U.S. payloads in orbit today. Arianespace, another private company, is similarly responsible for most European payloads. Commercial Orbital Transportation Services (COTS), such as Space Exploration Technologies (SpaceX) and Rocketplane Kistler (RpK) are already competing for U.S. orbital services contracts. Virgin Galactic, owned and operated by Sir Richard Branson and Burt Rutan, are already making inroads in space tourism.

# Leadership ADV – SPS solves competitiveness

**S-SBSP solves US economy economic competitiveness and hegemony**

**Mahan, author for Citizens for Space Based Solar Power, No Date Given**

(Rob Mahan, <http://c-sbsp.org/sbsp-faq/#01>, Last Modified 06/24/2011, as)

Yes, several very important ones. U.S. manufacturing and technology companies are concerned about being able to hire enough capable employees to replace the experienced workforce, a large percentage of which will be elgible to retire within the next ten years. Our domestic “intellectual feedstock” is very low, which is one of many reasons we haven’t built any new nuclear facilities in the last twenty-five years. Like the Apollo and other U.S. space programs did so many years ago, space-based solar power will inspire new generations of U.S. science and technology graduates.

The U.S. domestic manufacturing base is badly eroded, and while some economists say that we are moving towards a service-based economy, common sense tells me that we should regain our independence and self-sufficiency in many areas necessary to support our society. Now that what seems like the majority of our clothing, computers, cars, oil, toys and electronics are imported, space-based solar power will support the development of new domestic manufacturing industries.

We will also benefit from spin-offs similar to the original space program (microelectronics, internet, velcro, Tang, etc.) Better earth-based solar power efficiences will be gained. Low cost and reliable access to space will support many new industries. Perhaps a space tourism industry will be the forerunner of space colonization. Manufacturing in zero gravity and the hard vacuum of space will yield new materials and new products. Moon and asteroid based operations, such as the mining of natural resources from the Moon and asteroids will provide a platform for planetary protection from NEO (meteor / asteroid) strikes. The U.S. could become a major exporter of affordable energy and of energy and conservation technologies. But most importantly, the development of space-based solar power would demonstrate our nation’s belief in democracy and freedom for the entire human race. Space-based solar power gives the United States a great opportunity to regain a respected leadership role, not by force, but by example.>

# Leadership Adv – SPS solves Aero Competitiveness

**SPS solves aerospace competitiveness and USFG action key**

**Rogue, Director of National Security Space Office 07**

(Joseph D. Rogue, Phase O Architecture Feasibility Study, JP)

**<FINDING:** The SBSP Study Group found that SBSP directly addresses the concerns of the Presidential *Aerospace Commission* which called on the US to become a true spacefaring civilization and to pay closer attention to our aerospace technical and industrial base, our “national jewel” which has enhanced our security, wealth, travel, and lifestyle.

An SBSP program as outlined in this report is remarkably consonant with the findings of this commission, which stated:

The United States must maintain its preeminence in aerospace research and innovation to be the global aerospace leader in the 21st century. This can only be achieved through proactive government policies and sustained public investments in long‐term research and RDT&E infrastructure that will result in new breakthrough aerospace capabilities. Over the last several decades, the U.S. aerospace sector has been living off the research investments made primarily for defense during the Cold War…Government policies and investments in long‐term research have not kept pace with the changing world. Our nation does not have bold national aerospace technology goals to focus and sustain federal research and related infrastructure investments. The nation needs to capitalize on these opportunities, and the federal government needs to lead the effort. Specifically, it needs to invest in long‐term enabling research and related RDT&E infrastructure, establish national aerospace technology demonstration goals, and create an environment that fosters innovation and provide the incentives necessary to encourage risk taking and rapid introduction of new products and services. >

# Leadership Advantage—sps solves competitiveness

**SPS spurs private leadership**

**Medin**, Chief Industrial Designer, **10**

(Kristin Medin, “Disruptive Technology: A Space-Based Solar Power Industry Forecast”, Winter 10, <http://spacejournal.ohio.edu/issue16/medin.html>, 6/22/11, KJ)

<Development of a private spaceflight industry will parallel development of solar power satellites, since the cargo-to-space innovations needed to carry out frequent and affordable launches from earth will parallel innovations in human space transport. For example, recreational travel to space can only be developed out of accessible power sources native to space as opposed to today's method of lifting the energy needed to sustain space missions from the launch pad.

Comparatively, today's model is as efficient as the days when pulling loaded wagons on the Oregon Trail during the times of the "American frontier" was necessary because there were no proven sources of food, warmth or shelter along the way. Suborbital power stations coupled with water resources recently found on the moon, with water being the key to propulsion in space, may give rise to virtual intergalactic "gas stops" for future space traffic.[7] More efficient payloads could mean more industries accepting the possibilities of space to develop new technologies, manufacturing techniques and products that improve the quality of life here on earth.>

# Leadership Adv Solv- SBSP solves competitiveness

**SBSP averts economic decline and involves great powers**

**Rogue, Director of National Security Space Office 07**

(Joseph D. Rogue, Phase O Architecture Feasibility Study, JP)

<FINDING:The SBSP Study Group found that SBSP offers a long‐term route to alleviate the security challenges of energy scarcity, and a hopeful path to avert possible wars and conflicts.

If traditional fossil fuel production of peaks sometime this century as the Department of Energy’s own Energy Information Agency has predicted, a first order effect would be some type of energy scarcity. If alternatives do not come on‐line fast enough, then prices and resource tensions will increase with a negative effect on the global economy, possibly even pricing some nations out of the competition for minimum requirements. This could increase the potential for failed states, particularly among the less developed and poor nations. It could also increase the chances for great power conflict. To the extent SBSP is successful in tapping an energy source with tremendous growth potential, it offers an “alternative in the third dimension” to lessen the chance of such conflicts. >

# Leadership Advantage—energy and competitiveness

**Advantage: SPS solves energy and competitiveness**

[**Flournoy**](http://spacejournal.ohio.edu/about_ed.html#flournoy), Professor of Telecommunications Ohio University, Athens Ohio, **2010**

(Don, Online Space Journal of Communication http://spacejournal.ohio.edu/issue16/flournoy.html)

Figuring out how to generate energy in space and make it available on-demand anywhere on earth will be an undertaking unparalleled in human history. Its significance, in the long run, will be far greater than placing a man on the moon or building a human habitat on mars, because ready access to energy on earth (and elsewhere) is key to all exploration of the universe. Because SunSats can tap the one energy supply that cannot be depleted, any corporation or country that is in the space energy business will have a perpetual competitive advantage.

In practical terms, building international businesses around solar energy from space may be the only way we can keep alive our individual and collective dreams for a better life. Having abundant, safe, non-polluting energy could represent a tipping point for human productivity and creativity, that one essential ingredient enabling us to not just to survive but to live up to our potential as a human race. If indeed solar energy could make that difference, let us hope that it will happen, as there are no other sustainable solutions currently up for consideration that have the potential to meet our expectations.

# Leadership Adv—competiveness key to leadership

**And, Competitiveness is key to benign leadership – Solves your impact turns**

Richard **Armitage** (Former Deputy Secretary of State) **and** Joseph **Nye** (Professor of Political Science at Harvard) December 12 **2007** “Why So Angry, America?” http://www.atimes.com/atimes/South\_Asia/IL12Df01.html

The world is dissatisfied with American leadership. Shocked and frightened after September 11, 2001, we put forward an angry face to the globe, not one that reflected the more traditional American values of hope and optimism, tolerance and opportunity. This fearful approach has hurt the United States' ability to bring allies to its cause, but it is not too late to change. The nation should embrace a smarter strategy that blends our "hard" and "soft" power - our ability to attract and persuade, as well as our ability to use economic and military might. Whether it is ending the crisis in Pakistan, winning the wars in Iraq and Afghanistan, deterring Iran's and North Korea's nuclear ambitions, managing China's rise or improving the lives of those left behind by globalization, the US needs a broader, more balanced approach. Lest anyone think that this approach is weak or naive, remember that Defense Secretary Robert Gates used a major speech on November 26 "to make the case for strengthening our capacity to use 'soft' power and for better integrating it with 'hard' power". We - one Republican, one Democrat - have devoted our lives to promoting American pre-eminence as a force for good in the world. But the US cannot stay on top without strong and willing allies and partners. Over the past six years, too many people have confused sharing the burden with relinquishing power. In fact, when we let others help, we are extending US influence, not diminishing it. Since September 11, the war on terrorism has shaped this isolating outlook, becoming the central focus of US engagement with the world. The threat from terrorists with global reach is likely to be with us for decades. But unless they have weapons of mass destruction, groups such as al-Qaeda pose no existential threat to the US - unlike our old foes Nazi Germany and the Soviet Union. In fact, al-Qaeda and its ilk hope to defeat us by using our own strength against us. They hope that we will blunder, overreact and turn world opinion against us. This is a deliberately set trap, and one whose grave strategic consequences extend far beyond the costs this nation would suffer from any small-scale terrorist attack, no matter how individually tragic and collectively painful. We cannot return to a nearsighted pre-September 11 mindset that underestimated the al-Qaeda threat, but neither can we remain stuck in a narrow post-September 11 mindset that alienates much of the world. More broadly, when our words do not match our actions, we demean our character and moral standing. We cannot lecture others about democracy while we back dictators. We cannot denounce torture and waterboarding in other countries and condone it at home. We cannot allow Cuba's Guantanamo Bay or Iraq's Abu Ghraib to become the symbols of American power. The United States has long been the big kid on the block, and it will probably remain so for years to come. But its staying power has a great deal to do with whether it is perceived as a bully or a friend. States and non-state actors can better address today's challenges when they can draw in allies; those who alienate potential friends stand at greater risk. The past six years have demonstrated that hard power alone cannot secure the nation's long-term goals. The US military remains the best in the world, even after having been worn down from years of war. We will have to invest in people and materiel to maintain current levels of readiness; as a percentage of gross domestic product, US defense spending is actually well below Cold War levels. But an extra dollar spent on hard power will not necessarily bring an extra dollar's worth of security. After all, security threats are no longer simply military threats. China is building two coal-fired power plants each week. US hard power will do little to curb this trend, but US-developed technology can make Chinese coal cleaner, which helps the environment and opens new markets for American industry. In a changing world, the US should become a smarter power by once again investing in the global good - by providing things that people and governments want but cannot attain without US leadership. By complementing US military and economic strength with greater investments in soft power, Washington can build the framework to tackle tough global challenges. We call this smart power. Smart power is not about getting the world to like us. It is about developing a strategy that balances our hard (coercive) power with our soft (attractive) power. During the Cold War, the US deterred Soviet aggression through investments in hard power. But as Gates noted late last month, US leaders also realized that "the nature of the conflict required us to develop key capabilities and institutions - many of them non-military". So the US used its soft power to rebuild Europe and Japan and to establish the norms and institutions that became the core of the international order for the past half-century. The Cold War ended under a barrage of hammers on the Berlin Wall rather than a barrage of artillery across the Fulda Gap precisely because of this integrated approach.

# Leadership Advantage Impact—Economy Add-on

Heg is key to the economy

Mandelbaum, Director & Professor of American Foreign Policy Program @ Johns Hopkins University, 2005

(Michael The Case for Goliath, its an actual book)

It is satisfying because if the strings that manipulate events the world over lead back to Washington and New York, then the world may be seen as intelligible, coherent, and rational, if not benign. It is plausible because, as by far the most powerful member of the system of sovereign states, the United States surely does exercise considerable influence. Globalization—the spread around the world of cross-border economic transactions—is not an American invention, nor does the United States control the trade and investment that enriches some, harms others, and alters the daily routines of tens of millions; but American-based firms certainly do conduct a large part of the world's trade and investment, American economic policies do affect conditions in the rest of the world and the system of global market relations within which these often disruptive transactions take places does rest on the military might and the economic strength of the international system's most powerful member.

Economic decline causes global nuclear war.

Mead, Henry A. Kissinger senior fellow for U.S. foreign policy at the Council on Foreign Relations, **2009**

[ Walter Russell ,” 2/4/2009 The New Republic, “Only Makes You Stronger,” <http://www.tnr.com/politics/story.html?id=571cbbb9-2887-4d81-8542-92e83915f5f8&p=2>, ]

So far, such half-hearted experiments not only have failed to work; they have left the societies that have tried them in a progressively worse position, farther behind the front-runners as time goes by. Argentina has lost ground to Chile; Russian development has fallen farther behind that of the Baltic states and Central Europe. Frequently, the crisis has weakened the power of the merchants, industrialists, financiers, and professionals who want to develop a liberal capitalist society integrated into the world. Crisis can also strengthen the hand of religious extremists, populist radicals, or authoritarian traditionalists who are determined to resist liberal capitalist society for a variety of reasons. Meanwhile, the companies and banks based in these societies are often less established and more vulnerable to the consequences of a financial crisis than more established firms in wealthier societies. As a result, developing countries and countries where capitalism has relatively recent and shallow roots tend to suffer greater economic and political damage when crisis strikes--as, inevitably, it does. And, consequently, financial crises often reinforce rather than challenge the global distribution of power and wealth. This may be happening yet again. None of which means that we can just sit back and enjoy the recession. History may suggest that financial crises actually help capitalist great powers maintain their leads--but it has other, less reassuring messages as well. If financial crises have been a normal part of life during the 300-year rise of the liberal capitalist system under the Anglophone powers, so has war. The wars of the League of Augsburg and the Spanish Succession; the Seven Years War; the American Revolution; the Napoleonic Wars; the two World Wars; the cold war: The list of wars is almost as long as the list of financial crises. Bad economic times can breed wars. Europe was a pretty peaceful place in 1928, but the Depression poisoned German public opinion and helped bring Adolf Hitler to power. If the current crisis turns into a depression, what rough beasts might start slouching toward Moscow, Karachi, Beijing, or New Delhi to be born? The United States may not, yet, decline, but, if we can't get the world economy back on track, we may still have to fight.

# Leadership Advantage Impact —Proliferation add-on

Heg deters proliferation

Mandelbaum, Director & Professor of American Foreign Policy Program @ Johns Hopkins University, 2005

(Michael The Case for Goliath, its an actual book)

The greatest threat to their security that the members of the international system did face in the new century, one that the United States had devoted considerable resources and political capital to containing and that a serious reduction in the American global rule would certainly aggravate, was the spread of nuclear weapons. Nuclear proliferation poses three related dangers. The first is that, in the absence of an American nuclear guarantee, major countries in Europe and Asia will feel the need to acquire their own nuclear armaments. If the United States withdrew from Europe and East Asia, Germany might come to consider it imprudent to deal with a nuclear-armed Russia, and Japan with a nuclear-armed China, without nuclear arms of their own. They would seek these weapons in order to avoid an imbalance in power that might work to their disadvantage. The acquisition of nuclear weapons by such affluent, democratic, peaceful countries would not, by itself, trigger a war. It could, however, trigger arms races similar to the one between the United States and the Soviet Union during the Cold War. It would surely make Europe and East Asia less comfortable places, and relations among the countries of these regions more suspicious, than was the case at the outset of the twenty-first century. The spread of nuclear weapons poses a second danger, which the United States exerted itself to thwart to the extent of threatening a war in North Korea and actually waging one in Iraq and that the recession of American power would increase: the possession of nuclear armaments by "rogue" states, countries governed by regimes at odds with their neighbors and hostile to prevailing international norms. A nuclear-armed Iraq, an unlikely development after the over-throw of Saddam Hussein's regime, or a nuclear-armed Iran, a far more plausible prospect, would make the international relations of the Persian Gulf far more dangerous. That in turn would threaten virtually every country in the world because so much of the oil on which they all depend comes from that region.' A nuclear-armed North Korea would similarly change the international relations of East Asia for the worse. Especially if the United States withdrew from the region, South Korea and Japan, and perhaps ultimately Tai-wan, might well decide to equip themselves with nuclear weapons of their own. A North Korean nuclear arsenal would pose yet a third threat: nuclear weapons in the hands of a terrorist group such as al Qaeda. Lacking the infrastructure of a sovereign state, a terrorist organization probably could not construct a nuclear weapon itself. But it could purchase either a full-fledged nuclear explosive or nuclear material that could form the basis for a device that, while not actually exploding, could spew poisonous radiation over populated areas, killing or infecting many thousands of people.' Nuclear materials are potentially available for purchase not only in North Korea but elsewhere as well.

Proliferation causes extinction

Utgoff, Deputy Director of Strategy, Forces, & Resources Division of Institute for Defense Analysis, 2002, [ Victor A. *Survival*, Summer, ProQuest]

In sum, widespread proliferation is likely to lead to an occasional shoot-out with nuclear weapons, and that such shoot-outs will have a substantial probability of escalating to the maximum destruction possible with the weapons at hand. Unless nuclear proliferation is stopped, we are headed toward a world that will mirror the American Wild West of the late 1800s. With most, if not all, nations wearing nuclear ‘six-shooters’ on their hips, the world may even be a more polite place than it is today, but every once in a while we will all gather on a hill to bury the bodies of dead cities or even whole nations. This kind of world is in no nation’s interest.

# Leadership Advantage Impact —China Add-on

Primacy is key to contain Chinese expansion

Thayer, Prof. Poli. Sci. @ Mo State U, 2006 [ Bradley A. In Defense of Primacy, The National Interest, November]

China is clearly the most important of these states because it is a rising great power. But even Beijing is intimidated by the United States and refrains from openly challenging U.S. power. China proclaims that it will, if necessary, resort to other mechanisms of challenging the United States, including asymmetric strategies such as targeting communication and intelligence satellites upon which the United States depends. But China may not be confident those strategies would work, and so it is likely to refrain from testing the United States directly for the foreseeable future because China's power benefits, as we shall see, from the international order U.S. primacy creates.

And, confrontation with China causes extinction

Straits Times, 00 (6/25, “Regional Fallout: No one gains in war over Taiwan,” lexis)

THE high-intensity scenario postulates a cross-strait war escalating into a full-scale war between the US and China. If Washington were to conclude that splitting China would better serve its national interests, then a full-scale war becomes unavoidable. Conflict on such a scale would embroil other countries far and near and -- horror of horrors -- raise the possibility of a nuclear war. Beijing has already told the US and Japan privately that it considers any country providing bases and logistics support to any US forces attacking China as belligerent parties open to its retaliation. In the region, this means South Korea, Japan, the Philippines and, to a lesser extent, Singapore. If China were to retaliate, east Asia will be set on fire. And the conflagration may not end there as opportunistic powers elsewhere may try to overturn the existing world order. With the US distracted, Russia may seek to redefine Europe's political landscape. The balance of power in the Middle East may be similarly upset by the likes of Iraq. In south Asia, hostilities between India and Pakistan, each armed with its own nuclear arsenal, could enter a new and dangerous phase. Will a full-scale Sino-US war lead to a nuclear war? According to General Matthew Ridgeway, commander of the US Eighth Army which fought against the Chinese in the Korean War, the US had at the time thought of using nuclear weapons against China to save the US from military defeat. In his book The Korean War, a personal account of the military and political aspects of the conflict and its implications on future US foreign policy, Gen Ridgeway said that US was confronted with two choices in Korea -- truce or a broadened war, which could have led to the use of nuclear weapons. If the US had to resort to nuclear weaponry to defeat China long before the latter acquired a similar capability, there is little hope of winning a war against China 50 years later, short of using nuclear weapons. The US estimates that China possesses about 20 nuclear warheads that can destroy major American cities. Beijing also seems prepared to go for the nuclear option. A Chinese military officer disclosed recently that Beijing was considering a review of its "non first use" principle regarding nuclear weapons. Major-General Pan Zhangqiang, president of the military-funded Institute for Strategic Studies, told a gathering at the Woodrow Wilson International Centre for Scholars in Washington that although the government still abided by that principle, there were strong pressures from the military to drop it. He said military leaders considered the use of nuclear weapons mandatory if the country risked dismemberment as a result of foreign intervention. Gen Ridgeway said that should that come to pass, we would see the destruction of civilisation. There would be no victors in such a war. While the prospect of a nuclear Armageddon over Taiwan might seem inconceivable, it cannot be ruled out entirely, for China puts sovereignty above everything else.

# Leadership Advantage-- Laser/Microwaves capabilities

**SPS provides powerful laser and microwave capabilities.**

**The Economist, 11**

(The Economist, 6/24/11, <http://www.economist.com/node/18864324?story_id=18864324&fsrc=rss>, 6/24/11 KJ)

This summer, Stephen Sweeney and his colleagues will test a laser that would do the job which Asimov assigned to microwaves. Certainly, microwaves would work: a test carried out in 2008 transmitted useful amounts of microwave energy between two Hawaiian islands 148km (92 miles) apart, so penetrating the 100km of the atmosphere would be a doddle. But microwaves spread out as they propagate. A collector on Earth that was picking up power from a geostationary satellite orbiting at an altitude of 35,800km would need to be spread over hundreds of square metres. Using a laser means the collector need be only tens of square metres in area.

Dr Sweeney’s team, working in collaboration with Astrium, a satellite-and-space company that is part of EADS, a European aerospace group, will test the system in a large aircraft hangar in Germany. The beam itself will be produced by a device called a fibre laser. This generates the coherent light of a laser beam in the core of a long, thin optical fibre. That means the beam produced is of higher quality than other lasers, is extremely straight (even by the exacting standards of a normal laser beam) and can thus be focused onto a small area. Another bonus is that such lasers are becoming more efficient and ever more powerful.

**SPS provides energy for high power microwaves that could be used to disrupt electronic systems**

**Pop, staff writer for Space Future, 2000**

(Virgiliu Pop, Space Future, <http://www.spacefuture.com/archive/security_implications_of_non_terrestrial_resource_exploitation.shtml>, 6/23/11, KJ)

High power microwaves (HPM) are a new means of warfare. The use of microwaves as the means of transmission of energy between the SPS and the ground based collecting rectenna may qualify them as electromagnetic weapons. The most widely acknowledged effect of HPM is "disruption of electronic systems", able to "reset computers, cause complete loss of stored data and/or cause microprocessors to switch operating modes"[7]. This would "produce substantial paralysis in any target system, thus providing a decisive advantage in the conduct of Electronic Combat, Offensive Counter Air and Strategic Air Attack"[8]. In the same time, a HPM attack directed at an aircraft "could corrupt the plane's control and navigation systems enough to cause a crash"[9].

# Leadership Advantage – military effectiveness

**SPS solves military effectiveness—demonstration project proves**

**Iannotta**, a Space News Staff Writer, 20**09** (Becky, “Space Solar Power Crowd Bets on Obama”, February 25 2009, <http://www.space.com/3317-space-solar-power-crowd-bets-obama.html>, Accessed on June 25, 2011. NP)

Alternative energy advocates are not the only ones interested in space solar power beaming; the U.S. military is also eying the technology as a possible means of delivering power to remote areas of the globe. The Air Force Academy, for example, has begun building two small satellites to test the concept of transmitting solar power from space via laser technology. That demonstration is expected to produce enough power to illuminate a single one-tenth-of-a-watt light emitting diode, or LED. Meanwhile, the space station power beaming experiment has won support from Gary Payton, undersecretary of the Air Force for space. Following a briefing on the proposed demonstration, Payton wrote Bill Gerstenmaier, NASA?s space operations chief, to say the space agency and Pentagon should begin exploring ways to collaborate on solar power beaming experiments. ?I believe it is time for NASA and [the Defense Department] to collaborate on a project to demonstrate safe space-to-earth transmission of solar energy is possible, and scalable to a magnitude that can enhance national security interests,? Payton said in the Sept. 30 letter.

# Leadership Advantage—I/L Economic competitiveness and Military

**SPS inevitable but US involvement key to signal investment and solves the US economy and military readinesss**

**Dinerman, author and journalist, 2007**

(Taylor Dinerman, The Space Review, 7/16/7, <http://www.thespacereview.com/article/910/1> 6/24/11, KJ)

<The first steps in such a program would be to begin work on an experiment to prove that power transmission in space via laser is possible. Already lasers are being used for communications in civil and military applications; taking this one step beyond to encompass power should be within the state of the art. At the same time the US Defense Department and NASA could begin joint work on a new generation of high-capacity power systems for future spacecraft. The power management and thermal control needs of a spacecraft that will carry a human crew to Mars may not be all that different from those of an SPS or an SR satellite. The bulk of the development work on the radars themselves can be left until later in the program. Meanwhile, the US could profitably study less ambitious space radar programs such as Canada’s Radarsat. Launching one or two modest technology development satellites over the next five or ten years would be a helpful way to set the stage for a new SR program. In the long term, say, by around 2010, the GMTI radar could be replaced and supplemented by an Air Moving Target Indicator (AMTI), which would need even more power. Instead of using a single large antenna or multiple smaller ones on the same spacecraft, a future stealthy SR could use radars on multiple satellites. Formation flying is now commonplace and coordinating multiple beams from two or three satellites in different orbits should not be that hard. The biggest problem will be to prove to Congress that the technology is ready for prime time. Almost all of America’s major military space programs are too far along to effectively incorporate the lessons of China’s ASAT test. SR, due to repeated budget cuts, is the great exception. Other satellite programs that could be modified to incorporate the needs of the new space warfare requirements include the T-SAT Transformational Communications project and the possibly the NRO’s problem-plagued Future Imagery Architecture (FIA).If the US were to develop space solar power for military applications it would give the US civilian industry a big head start. As long as the military requirements are legitimate, there is no reason why this cannot be made into a win-win outcome. The stealthiness and robustness of all these programs, or their successors, would benefit from being able to draw electricity from a set of SPSs in GEO. The solar power satellites themselves would not necessarily have to be owned by the US government. They could be built privately based on a contract that promises that the Defense Department would buy a given amount of power at a predetermined price. This would be similar to the “power by the hour” contracts that are sometimes signed with jet engine manufacturers or the privately-financed initiative that the British RAF has established with a consortium for a new squadron of Airbus refueling tanker aircraft. In GEO an SPS is a large and conspicuous target. A realistic new space architecture would have to find ways to give both active and passive protection to such valuable assets. At the same time, these measures must not detract from the commercial profitability of the operation. The Civil Reserve Air Fleet system is a possible model; airlines buy some planes that are modified for possible military use in an emergency and the government compensates them for the extra weight they carry while in normal commercial use. Space solar power is, in the long run, inevitable. The Earth’s economy is going to need so much extra power over the next few decades that every new system that can be shown to be viable will be developed. If the US were to develop space solar power for military applications it would give the US civilian industry a big head start. As long as the military requirements are legitimate, there is no reason why this cannot be made into a win-win outcome.>

# \*\*\*Add-ons\*\*\*

**These are prime areas for new Advantages---with some impact work. They can also serve as internal links into the advantages we have done here**

# Tourism Advantage – SPS solves space tourism

 **S:SPS leads to space tourism**

**Allan, Breakthrough Energy Examiner, 2009**

Sterling Allan, <http://www.examiner.com/breakthrough-energy-in-national/first-space-to-earth-solar-power-station-targeted-for-oct-2010>, 2010, as)

Because of his work with what apparently will be the first functioning space-based solar array for transmitting power to earth, Sir Charles was invited to be part of the recent groundbreaking for [Spaceport America](http://www.spaceportamerica.com/) on June 19 in New Mexico, near Truth or Consequences -- yes, that's the name of a town.  Shults is relocating Xenotech Research there so they'll be conveniently located for their work in conjunction with the deployment of what apparently will be the world's first space-based solar collector and transmission project, to be carried out by the [Space Island Group](http://www.spaceislandgroup.com/home.html).  Space Island Group (SIG) is the leader in the commercialization of space and plans to design, build and operate commercial space transportation systems and destinations that are dedicated to commerce, research, space solar power, satellite repair, manufacturing and tourism. ([Ref](http://www.spaceislandgroup.com/home.html).)

The solar collector components will be piggy-backed to space along with the space tourism that will be carried out.  Sir Charles told me he has recently been negotiating with Gene Meyers and Terry Martin of SIG.  They are looking to him to supply some technologies for their orbital solar power project, having received permission to orbit a solar power satellite demonstrator and will soon be building receiving stations on the ground for the proof of principle.  Sir Charles' involvement includes advising on methods for moving craft from lower to higher orbits using less rocket fuel; energy generation technology; and technology for power-receiving antennas on the ground.

# Space Tourism Adv—lowers launch costs

**Tourism will lead to decreased space launch costs, allowing for SPS**

Collins and Autino 08

Patrick Collins and Andriano Autino, May 25 2008, <http://www.spacefuture.com/archive/what_the_growth_of_a_space_tourism_industry_could_contribute_to_employment_economic_growth_environmental_protection_education_culture_and_world_peace.shtml>, Accessed June 24, 2011, JP)

<Another potentially major space-based industry, which has been held back for 40 years by high launch costs, is the supply of solar power from space to Earth. Although the potential of this system was recognised in studies by the US Department of Energy in the late 1970s, and confirmed in the 1990s [13], total funding has remained minimal. However, progress could be rapid once launch costs fall to a few percent of ELV costs [14]. Hence, as passenger space travel activities expand to large scale, a growing range of manufacturing activities in Earth orbit, on the lunar surface and elsewhere could develop spontaneously, driven by entrepreneurial effort to exploit new business opportunities opened up by the growth of new commercial markets in Earth orbit. These will in turn open the door to the large-scale space activities described in [11].>

# Space Tourism Advantage - Increase Employment

**Space tourism creates new jobs avoiding unemployment, poverty, and social damage**

Collins and Autino 08

Patrick Collins and Andriano Autino, May 25 2008, <http://www.spacefuture.com/archive/what_the_growth_of_a_space_tourism_industry_could_contribute_to_employment_economic_growth_environmental_protection_education_culture_and_world_peace.shtml>, Accessed June 24, 2011, JP)

<In most countries, most of the population do not have economically significant land holdings, and so employment is the economic basis of social life, providing income and enabling people to have stable family lives. The high level of unemployment in most countries today is therefore not only wasteful, it also causes widespread poverty and unhappiness, and is socially damaging, creating further problems for the future. One reason for investing in the development of passenger space travel, therefore, is that it could create major new fields of employment, capable of growing as far into the future as we can see.>

# Space Tourism Advantage cost efficiency

**Increasing tourism via SPS decreases launch costs, allowing SSP to be economical**

Collins and Autino 08

Patrick Collins and Andriano Autino, May 25 2008, <http://www.spacefuture.com/archive/what_the_growth_of_a_space_tourism_industry_could_contribute_to_employment_economic_growth_environmental_protection_education_culture_and_world_peace.shtml>, Accessed June 24, 2011, JP)

<A second possibility, which has been researched for several decades but has not yet received funding to enable testing in orbit, is the delivery of continuous solargenerated power from space to Earth. Researchers believe that such space-based solar power ( SSP) could supply clean, low-cost energy on a large scale, which is a prerequisite for economic development of poorer countries, while avoiding damaging pollution. However, realisation of SSP requires much lower launch costs, which apparently only the development of a passenger space travel industry could achieve. Hence the development of orbital tourism could provide the key to realising SSP economically [14].

Clean energy produced by SSP could eliminate the environmental impact of space travel, and even make it "carbon neutral" if this is considered desirable [25]. Moreover, SSP has a much shorter energy pay-back time than terrestrial solar energy, due to the almost continuous supply of power which it can generate, rather than only in day-time during clear weather. Some critics claim that space travel will become a significant environmental burden [26]. However, while superficially correct in the short term, this is the opposite of the truth over the longer term. It would be a dangerous error to prevent the growth of space tourism in order to avoid its initial, minor environmental impact, since this would prevent a range of major benefits in the future, including the supply of lowcost, carbon-neutral SSP, and other space-based industry.>

**Tourism enable large scale SSP that enables economic growth while protecting the environment**

Collins and Autino 08

Patrick Collins and Andriano Autino, May 25 2008, <http://www.spacefuture.com/archive/what_the_growth_of_a_space_tourism_industry_could_contribute_to_employment_economic_growth_environmental_protection_education_culture_and_world_peace.shtml>, Accessed June 24, 2011, JP)

<If orbital travel grows to a scale of millions of passengers/year -- as it could by the 2030s, with vigorous investment -- it will stimulate the spontaneous growth of numerous businesses in space. These will grow progressively from simple activities such as maintenance of orbiting hotels, to in-space manufacturing using asteroidal minerals. For example, the development of SSP would enable a range of industrial processes using the advantages of space, including high vacuum, weightlessness, low-cost electricity and sources of both minerals and volatile chemicals in shallow gravitational wells.

If SSP grows to supply a significant share of the terrestrial energy market, more and more industry would operate outside the Earth's ecological system. While most industries cause growing damage to the Earth's environment as they grow in scale, industrial activities which are outside the Earth's ecosystem need not cause any such damage. Hence the growth of space-based industry to large scale offers the longer-term possibility of decoupling economic growth from the limits of the terrestrial environment. Indeed, it has been convincingly argued that only the use of space resources, including especially SSP, offers the possibility of protecting the Earth's environment while enabling sufficient economic growth to preserve civilised society [22,27].>

# Desalination add-on – SPS solves

**SPS solves seawater desalination**

**Tobiska, space environment Technologies, 10/29/10**

(W. Kent Tobiska, online journal of space communication, <http://spacejournal.ohio.edu/issue16/tobiska.html>, retrieved on 6/22/11, HLM/AS)

< The use of solar arrays for powering seawater desalination is not new nor is the idea of using heat flow tubes in the distillation process. Solar arrays are coupled with seawater desalination in the eastern Mediterranean and Persian Gulf. The prime disadvantages of using solar arrays are that solar energy is limited to approximately half a day (no solar power at night), seasonal Sun angles reduce solar array efficiency, and clouds reduce power from solar arrays. If fresh water production were implemented using an offshore platform, solar arrays are one feasible method for generating electrical power for either RO or distillation processes. However, for efficient fresh water production, a facility must be operated 24 hours a day. The use of solar power from orbiting satellites (Solar Power Satellites - SPS) is a method that can substantially increment the solar array power generated from natural sunlight. SPS systems (figure 3) have been conceived and designed for nearly 4 decades but not yet demonstrated. The design concept is straightforward - use a large solar array structure in space, collect the electrical power needed to power a microwave or laser transmitter on the spacecraft, direct the transmitted energy to a solar array receiving antenna at the Earth's surface that is sensitive to the transmitted microwave or laser frequency, and convert the received power at the Earth solar array into electricity. The advantage of a SPS in geosynchronous orbit (GEO) is that it is able to produce power 24 hours a day and, thus, power can be transmitted at night to the surface of the Earth. Minor outages of up to 1½-hours per day over a 2-week period occur during the spring and fall equinoxes.>

# Exploration Add-on- Increase Space Access

**SBSP increases space access**

**Rogue, Director of National Security Space Office 07**

(Joseph D. Rogue, Phase O Architecture Feasibility Study, JP)

<FINDING:The SBSP Study Group found that the SBSP development would have a transformational, even revolutionary, effect on space access for the nation(s) that develop(s) it.

• \_SBSP cannot be constructed without safe, frequent (daily/weekly), cheap, and reliable access to space and ubiquitous in‐space operations. The sheer volume and number of flights into space, and the efficiencies reached by those high volumes is game‐changing. By lowering the cost to orbit so substantially, and by providing safe and routine access, entirely new industries and possibilities open up.

- 12 - • \_SBSP and low‐cost, reliable space access are co‐dependent, and advances in either will catalyze development in the other. >

# Exploration ADV- SBSP causes Commercial Exploration

**Adv: SBSP causes increased international commercial exploration**

**Rogue, Director of National Security Space Office 07**

(Joseph D. Rogue, Phase O Architecture Feasibility Study, JP)

<FINDING:The SBSP Study Group found that SBSP directly supports the articulated goals of the U.S. National Space Policy and Vision for Space Exploration which seeks to promote international and commercial participation in exploration that furthers U.S. scientific, security, and economic interests, and extends human presence across the solar system.

No other opportunity so clearly offers a path to realize the Vision as articulated by Dr. Marburger, Science Advisor to the President: “As I see it, questions about the vision boil down to whether we want to incorporate the Solar System in our economic sphere, or not. Our national policy, declared by President Bush and endorsed by Congress last December in the NASA authorization act, affirms that, ‘The fundamental goal of this vision is to advance U.S. scientific, security, and economic interests through a robust space exploration program.’ So at least for now the question has been decided in the affirmative.” No other opportunity is likely to tap a multi‐trillion dollar market that could provide an engine to emplace infrastructure that could truly extend human presence across the solar system and enable the use of lunar and other space resources as called for in the Vision.>

# Exploration Adv - Increased New Technology

**L/: SBSP increased space options – disruptive technology**

**Rogue, Director of National Security Space Office 07**

(Joseph D. Rogue, Phase O Architecture Feasibility Study, JP)

<• \_At present, the United States has very limited capabilities to build large structures, very large apertures or very high power systems in orbit. It has very limited in‐space maneuver and operational capability, and very limited access to space. It cannot at present move large amounts of mass into Earth orbit. The United States correspondingly has extremely limited capabilities for in‐space manufacturing and construction or in‐situ space resource utilization. It has no capability for beamed power or propulsion. SBSP development would advance the state of the art in all of the above competencies.

• \_The expertise gained in developing large structures for space based solar power could allow entirely new technologies for applications such as image and real‐time surface and airborne object tracking services, as well as high bandwidth telecommunications, high‐definition television and radio, and mobile, broadcast services. It would enable entirely new architectures, such as power platforms that provide services to multiple payloads, autonomous self‐constructing structures, or wireless cooperative formations. The Solar Electric Transfer Vehicles (SETV) needed to lift the Space Solar Power Satellites out of low‐earth orbit, and perhaps even form its components, would completely revolutionize our ability to move large payloads within the Earth‐Moon system.• \_The technology to beam power over long distances could lower application satellite weights and expand the envelope for Earth‐ \_and space‐based power beaming applications. A truly developed Space‐Based Solar Power infrastructure would open up entirely new exploration and commercial possibilities, not only because of the access which will be discussed in the section on infrastructure, but because of the power available on orbit, which would enable concepts as diverse as comet / asteroid protection systems, de‐orbit of space debris, space‐to‐space power utilities, and beamed propulsion possibilities including far‐term concepts as a true interstellar probe such as Dr. Robert Forward’s StarWisp Concept. >

# India Coop Adv – SPS solves and warming

**SBSP cause increased U.S.-India co-op that solves carbon mititagon concerns**

**The Hindustan Times 10**

(The Hindustan Times, Sep. 13, 2010, Proquest Sirs Jesuit, Accessed June 21, 2011, JP)

<Noting that SBSP can be "the next major step in the Indo-US strategic partnership", the 174-page report says the launch of such a potentially revolutionary programme can begin with a joint statement by Prime Minister Manmohan Singh and US President Barak Obama during the latter's visit to New Delhi in November.

Besides helping to 'solve the linked problems of energy security, development and climate change', the SBSP will provide an opportunity for India to use its successful space programme while shaping a future peaceful space regime, Garretson said.

He has proposed a three-tiered programme, moving from basic technology and capacity building to a multi-lateral demonstrator and ultimately to an international commercial public-private-partnership entity to supply commercial power in the 2025 timeframe.

The report concludes that SBSP 'does appear to be a good fit for the US domestic, Indian domestic and bilateral agendas, and there are adequate political space and precursor agreements to begin a bilateral program".

Expanding on the three-stage plan, Garretson says an initial five-year $10-30 million programme will develop contributing technologies and build a competent work force culminating in a roadmap for a demonstration prototype.

A second, $10 billion, 10-year phase will see the formation of an international consortium to construct a sub-scale space solar power system that can directly be scaled up by industry. The final stage will entail India-US leadership to set up an international for-profit consortium along the lines of the INTELSAT model to address energy security and carbon mitigation concerns.

The overall program goal must be to enable, by 2025, space-based solar power as a viable economic replacement for fossil fuel energy, and second, to position the US and Indian technical and industrial bases to enjoy a competitive edge in what is expected to be a significant and profitable market,' the report says.

Garretson says that the US and India have demonstrated via a number of recent steps that they are ready for a deeper partnership, inclusive of sensitive and strategic technology in space and energy.

An international SBSP demo project is within reach of present engineering and mega science budgets, and can be done with existing launch vehicles,' he says.

From the US side, the programme can be managed out of the Department of State's Office of Ocean Environment and Science with funds coming from the Department of Energy's Advanced Research Projects Agency for Energy. On the Indian side, the report says, the high-level oversight can be provided by the Prime Minister's Council on Climate Change.

According to the report, such a programme linking the technical bases of the world's largest democracies might be a way out of India's (and the world's) climate-energy dilemma.>

# Pollution add on

**SPS presents a better alternative for energy that solves for Global Pollution**

[**Flournoy**](http://spacejournal.ohio.edu/about_ed.html#flournoy), Professor of Telecommunications Ohio University, Athens Ohio, **2010**

(Don, Online Space Journal of Communication http://spacejournal.ohio.edu/issue16/flournoy.html)

The world is facing a perfect storm in which an energy crisis and an environmental crisis are occurring simultaneously. Earth's population continues to grow. Oil, gas and coal, the principal energy basis for the steadily improving standards of living among the more developed societies - and coveted by lesser developed societies - are contaminating earth's atmosphere as they are mined, processed and consumed. Those non-renewable fossil fuels are rapidly being used up. Within the next human generation, fossil fuels - plus all known alternative energy sources on earth - are predicted to fall far short of what will be needed.

Several government commissions, think tanks, energy companies and utilities in more than one country investigating space-based solar power have concluded that SunSats are the world's most promising long-term solution. The argument is that the solar energy available in space is several billion times greater than any amount we could ever use on earth. The sun's energy is always available and it is inexhaustible. Unlike the fossil fuels of earth, space solar power does not emit greenhouse gases. Moving to solar can reduce competition for the limited supplies of earth-based energy, which is predicted to be the basis for future wars.

# \*\*\*\*Counterplan Answers\*\*\*\*

# Counterplan Answers--International Actor CP

**US Key and perm solvency**

**Hsu, Systems Engineering & Risk Management, 10**

(Dr. Feng Hsu, “Harnessing the Sun”, Winter 2010, <http://spacejournal.ohio.edu/issue16/hsu.html>, KJ)

<It is imperative that a multi-governmental organization or entity be put in place. For the U.S. - or any single nation - to implement a full-scale SPS project alone will be extremely difficult, if not inconceivable, due to the many political, regulatory and technological reasons stated. However, it is equally important that there be a lead nation providing the necessary leadership in such a complex and interdependent international effort. The various project elements involving multiple government and industry partnerships must be clearly defined. The United States is a logical leader in this area because of the breadth of its technology infrastructure and capability, as well as the magnitude of financial resources available in its industry and financial community. Building, launching and operating a system of Solar Power Satellites in space orbit is going to be a technology and engineering endeavor requiring great human effort and ingenuity. If we can go to the Moon and achieve the splitting of atoms, we can also overcome the inefficiency problems of solar-electric conversion, and we can achieve affordable access to space. We can make Solar Power Satellites a cost competitive source of energy for all of humanity.>

# Counterplan Answers --US Key

**US key to lower cost of SPS—launch and assembly processes**

**Iannotta**, a Space News Staff Writer, 20**09** (Becky, “Space Solar Power Crowd Bets on Obama”, February 25 2009, <http://www.space.com/3317-space-solar-power-crowd-bets-obama.html>, Accessed on June 25, 2011. NP)

The concept faces a major barrier, however, in the high cost of launching satellites large enough to transmit meaningful amounts of power to Earth, according to a white paper submitted by space solar advocate Charles Miller, president of Space Policy Consulting Inc. in Dayton, Ohio, to Obama’s transition team in November. The white paper recommends establishing a national space solar power policy, assigning a lead federal agency and an incremental research program. The white paper said the cost of space solar power could be reduced if the United States develops more-affordable access to space and applies high-volume assembly line techniques to satellite construction.

 **The US will not lead in SSP unless there is any research and development**

\*also answer private investment

[**Shea**](http://spacejournal.ohio.edu/about_ed.html#flournoy), Master of Arts in Science Technology and Space Policy at George Washington University, 20**10** (Karen Cramer, Online Space Journal of Communication, December 2010. http://spacejournal.ohio.edu/issue16/shea.html NP)

The time is now for the development of space solar power. If the U.S. government commits to it as a matter of public policy, a new SPS industry will emerge, repaying the public investment many times over. If the U.S. does not do so, Japan, China, India or Russia will take the lead in space solar power development and the U.S. will continue to send billions of dollars a year abroad to insure that our energy needs are met.

# Counterplan Answers Other Agent CP generic

**Perm solvency – all actors act**

**Amos, Science reporter for BBC News, 2010**

(Jonathan Amos, <http://news.bbc.co.uk/2/hi/science/nature/8467472.stm>, January 2010, as)

EADS Astrium says the satellite system would collect the Sun's energy and transmit it to Earth via an infrared laser, to provide electricity.

Space solar power has been talked about for more than 30 years. However, there have always been question marks over its cost, efficiency and safety.

But Astrium believes the technology is close to proving its maturity.

"Today we are not at an operational stage; it's just a test," said chief executive officer Francois Auque. "In order to implement a solution, of course, we would need to find partnerships and to invest, to develop operational systems," he told BBC News.

Those partnerships could comprise space agencies, the EU or national governments and even power companies, he said.

# Counterplan Answers Other Renewable Energy CPs-general

**All other renewable energies not comparable to SPS**

**Mahan, author for Citizens for Space Based Solar Power, No Date Given**

(Rob Mahan, <http://c-sbsp.org/sbsp-faq/#01>, Last Modified 06/24/2011, as)

Comparing space-based solar power to nuclear power, both provide baseload power but current nuclear fission creates radioactive waste, of which we have already already accumulated thousands of tons which must be safely tracked and stored long into the future, perhaps as long as 10,000 years. Space-based solar power radiates heat generated during the conversion of light to electricity back into deep space. Comparing space-based solar power to wind power, both are clean sources of energy but wind power is intermittent, so it can’t reliably provide baseload power. Wind power is well suited to certain geographical areas whereas space-based solar power can be delivered anywhere on the Earth. Comparing space-based solar power to ground solar power, both are clean sources of energy but ground solar power is intermittent, so it can’t reliably provide baseload power. Ground solar power is well suited to certain geographical areas. Solar energy in space is eight times more intense than after passing through the atmosphere and again, space-based solar power can be delivered anywhere on the Earth. Comparing space-based solar power to biofuels, biofuels (such as corn or sugar ethanol) require tremendous amounts of agricultural production. So far, biofuels have less energy per unit than fossil fuels. Space-based solar power does not compete with food production.

# Counterplan Answers Other Renewable Energy CPs-wind, land solar

**Wind and terrestrial solar power subject to weather issues---need to move beyond small scale projects**

**Coopersmith, Historian of Technology at Texas A&M University 2009**

(Jonathan Coopersmith, thespacereview.com, 9/28/09, <http://www.thespacereview.com/article/1475/1>, retrieved 6/22/11, HLM/AS)

<Fossil fuels such as coal increase global warming, nuclear power is very capital-intensive and still lacks a safe way to dispose of waste, and renewable fuels have not demonstrated the necessary scale, capability, or economics. There is no NIMBY (not in my backyard) opposition to SBSP because the backyard is 36,000 kilometers away in geosynchronous orbit (although placing the receiving rectennas may be a point of contention). Compared with terrestrial solar and wind power, SBSP is independent of local weather conditions and can produce power 24 hours a day. Indeed, space solar power complements, not compete with terrestrial solar power.

Attractive as SBSP is theoretically, becoming reality will not be easy. Indicative of the low visibility of SBSP and lack of research funding, most of the participants were over 50. Many had worked on SBSP for decades. Almost completely missing was the generation of postgraduates and young researchers who came of age in the 1990s and 2000s. SBSP needs to attract new people who will find this professionally rewarding as well as technically challenging. Missing also were potential allies, like environmentalists, as well as potential critics. That is, SBSP is still too small to attract much interest beyond its advocates.>

# Counterplan Answers Other Renewable energy CPs-general

**Solvency: much more efficient than any other renewable energy source including terrestrial solar power**

**Strickland, Senior Analyst/programmer, 10/29/2010**

(John K. Strickland, online journal of space communication, <http://spacejournal.ohio.edu/issue16/strickland2.html>, retrieved on 6/22/11, HLM/AS)

The massive advantage Space Solar has over ground solar and wind is the almost constant availability of 30% stronger sunlight in Geostationary or Geosynchronous Earth Orbit, which totally removes the requirement for storage of any kind. Thus, Space Solar is ideal for use as a base load power source. Power beams from a small number of spare satellites can be very rapidly switched from one receiving antenna to another during the very brief eclipses of satellites during the Equinox periods to cover scheduled or emergency power needs.

SSP has one characteristic advantage over nuclear: it is very dispatchable and is also a much faster form of "spinning reserve." The original concept of "spinning reserve" was of an extra generator running with water turning it at full speed, but where no power was being generated or transmitted. Such a generator can be switched to generating and transmitting mode very quickly. It would be too expensive to continuously power a generator like this with fossil fuels, and as a result, the delay in starting gas fired combustion, for example, is much greater than with a real "spinning reserve." (Batteries can cover part of this startup-lag requirement without using up too much energy). Reactors take much longer to bring on line, and cannot be used to cover wind and solar. Normally, reactors are not operated in start and stop mode, thus they are not dispatchable.

Space solar is much more efficient in land use and materials use than ground solar, which will of necessity need to cover huge areas (100,000 square miles or more) of land with the hot black surfaces of solar panels. Space solar energy receivers will cover much smaller areas with relatively sparse arrays of what are effectively like wire TV antennas, since the solar panels themselves are in space (where they belong!). This lets about 80% of the sunlight reach the ground and the area under the array can either be left as wild or used for farmland.>

# Counterplan Answers other renewable energy CPs—general

**Other renewable sources and energy efficiency won’t solve---ssp better**

**Strickland, Senior Analyst/programmer, 10/29/2010**

**(John K. Strickland, online journal of space communication,** [**http://spacejournal.ohio.edu/issue16/strickland2.html**](http://spacejournal.ohio.edu/issue16/strickland2.html), retrieved on 6/22/11, HLM/AS)

<University of Utah physicist Tim Garrett published a 2009 paper[13] that gives strong indirect support to SSP. In an article based more on physics than economics, Garrett suggests that energy conservation will have little effect in the long run, and that the globe currently needs to replace and/or add about 300 Gigawatt-equivalents of new non-carbon energy sources each year in order to stabilize current greenhouse gas levels. This rate of construction would not, however, reduce the current rate of greenhouse gas production. With current global demand at 16.4 Terawatts, and about 14 Terawatts of this energy coming from carbon fuel, he estimates it would take 46 years to eliminate all the existing carbon energy production, that is, if we could build an additional 300 equivalent Gigawatts (0.3 Terawatts per year) of carbon-free energy plants to cover new energy demands for both fuel and power.

Nuclear power can only cover part of the 300 Gigawatts per year needed, since there is not an unlimited amount of uranium. If we had cheap access to space, SSP would be the way to provide an unlimited amount of energy, since there is no fuel to deplete. Trying to generate that much energy using ground solar and wind means the globe would have to add 1200 Gigawatts per year of solar and wind capacity (assuming a capacity factor of 25%, yielding an average of 300 Gigawatts) along with either the power storage needed to make it available as electricity when needed, or the equipment to create non-carbon fuels out of the majority of it. Assuming that the capital cost of building the ground wind and solar equipment is about $10 Billion per Gigawatt, and that the storage and conversion equipment would be about the same, the annual global cost to meet this "red queen's race" would be about 24 Trillion dollars a year, of which the annual US share would be at least $5 Trillion/yr.?

# Counterplan Answers Other Renewable Energy CPs-land solar

**SBSP better than Land Based Solar Power – constant light, no atmosphere**

**Goldenberg, US environment correspondent, 09**

(Suzanne Goldenberg, April 16, 2009, <http://www.guardian.co.uk/environment/2009/apr/16/solar-energy-farms-space>, JP)

<Unlike on earth, with its cycle of nights and days and where there can be clouds, sunshine in space is practically constant – aside from a few days around the spring and autumn equinoxes. That means the space-based solar panels could potentially produce a steady supply of electricity. The sunlight hitting solar panels 200 miles in space would be 10 times as powerful as the light filtering down to Earth through the atmosphere. The satellite would then convert the energy into radio waves and beam them down to a receiving station on Earth. Spirnak did not give details of how this would work but said the technology was based on that now used by communications satellites, describing it as "very mature". He added that power losses via the radio-wave route are lower than transmission cables used on Earth. Another advantage of the plan is that it does not require large amounts of real estate. Ground-based solar installations require huge tracts of land.>

# Counterplan Answers Other Renewable Energ CP-nuke power

**Turn SPS solves CO2 emissions and prolif from nuke power**

**Rogue, Director of National Security Space Office 07**

(Joseph D. Rogue, Phase O Architecture Feasibility Study, JP)

<FINDING:The SBSP Study Group found that in the long run, SBSP offers a viable and attractive route to decrease mankind’s reliance on fossil fuels, as well as provides a potential global alternative to wider proliferation of nuclear materials that will almost certainly unfold if many more countries in the world transition to nuclear power with enrichment in an effort to meet their energy needs with carbon neutral sources.

To the extent mankind’s electricity is produced by fossil fuel sources, SBSP offers a capability over time to reduce the rate at which humanity consumes the planet’s finite fossil hydrocarbon resources. While presently hard to store, electricity is easy to transport, and is highly efficient in conversion to both mechanical and thermal energy. Except for the aviation transportation infrastructure, virtually all of America’s energy could eventually be delivered and consumed as electricity. Even in ground transportation, a movement toward plug‐in hybrids would allow a substantial amount of traditional ground transportation to be powered by SBSP electricity.

For those applications that favor or rely upon liquid hydrocarbon fuels, America’s national labs are pursuing several promising avenues of research to manufacture carbon‐neutral synthetic fuels (synfuels) from direct solar thermal energy or radiated/electrical SBSP. The lab initiatives are developing technologies to efficiently split energy‐neutral feedstocks or upgrade lower‐grade fuels (such as biofuels) into higher energy density liquid hydrocarbons. Put plainly, SBSP could be utilized to split hydrogen from water and the carbon monoxide (syngas) from carbon dioxide which can then be combined to manufacture any desired hydrocarbon fuel, including gasoline, diesel, kerosene and jet fuel. This technology is still in its infancy, and significant investment will be required to bring this technology to a high level of technical readiness and meet economic and efficiency goals.

This technology enables a carbon‐neutral (closed carbon‐cycle) hydrocarbon economy driven by clean renewable sources of power, which can utilize the existing global fuel infrastructure without modification. This opportunity is of particular interest to traditional oil companies. The ability to use renewable energy to serve as the energy feedstock for existing fuels, in a carbon neutral cycle, is a “total game changer” that deserves significant attention.

Both fossil and fissile sources offer significant capabilities to our energy mix, but dependence on the exact mix must be carefully managed. Likewise, the mix abroad may affect domestic security. While increased use of nuclear power is not of particular concern in nations that enjoy the rule of law and have functioning internal security mechanisms, it may be of greater concern in unstable areas of rouge states. The United States might consider the security challenges of wide proliferation of enrichment‐based nuclear power abroad undesirable. If so, having a viable alternative that fills a comparable niche might be attractive. Overall, SBSP offers a hopeful path toward reduced fossil and fissile fuel dependence. >

# Counterplan Answers Other Renewable Energy CP—no solve warming

**Other alternative energies fail – not enough output**

**Snead, senior member of the American Institute of Aeronautics and Astronautics , 08**

(James Snead, , November 19 2008, <http://mikesnead.net/resources/spacefaring/white_paper_the_end_of_easy_energy_and_what_to_do_about_it.pdf> JP)

 <6.Expanded conventional renewable sources of sustainable fuels—hydrogen, alcohol, bio-methane, and bio-solids—will not be able to meet the U.S.’s or the world’s 2100 needs for sustainable fuels. To assess the potential for conventional renewable sources of sustainable fuel for the entire world in 2100, hydrogen production from the electricity generated by nearly 600,000 sq. mi. of ground \* Stable electrical power grid operations require sufficient dispatchable power generation capacity to meet, at any time, peak consumer demand plus a modest reserve margin. Only generation systems that have a high assurance of being available to deliver power on demand (e.g., nuclear, hydroelectric, geothermal, and carbon-fired generators) are considered dispatchable. † The addition of 1,400 conventional nuclear fission reactors is consistent with projections of available land resources of uranium fuel, without using breeder reactors, lasting upwards of 150 years. The significant use of uranium extracted from seawater is not assumed. ‡ As discussed later in this paper, the variability of wind-generated electrical power is assumed to severely limit its ability to provide dispatchable electrical power. Most wind-generated electrical power is assumed to be used to produce hydrogen fuel. *The End of Easy Energy and What to Do About It* 9 solar photovoltaic systems, hydrogen production from over 80% of the electrical power generated by 11 million wind turbines, and biofuels produced from 13,000 million tons of land biomass from the world’s croplands and accessible forestlands would only be able to supply about 37% of the world’s 2100 need for sustainable fuels. For the United States, by 2100, the situation is about the same with only about 39% of the 2100 needed fuels production capable of being provided from these conventional sustainable energy sources. As with sustainable electrical power generation, conventional sustainable U.S. fuels production at projected 2100 levels would fall well short of meeting *current* U.S. needs for fuel. >

# Counterplan Answers--Nuke Power CP

**AT: Nuke Power CP: Nuclear power bad – terrorism and waste**

**Globus, 10**

(Al, Globus, Online Journal of Space Communication, Winter 10, <http://spacejournal.ohio.edu/issue16/globus2.html>, KJ)

<Fission also requires fuel, uranium in this case rather than carbon compounds. In addition to the environmental impact of uranium mining, processing and use, this fuel can be processed to provide material for nuclear weapons that can demolish whole cities and ecosystems, if used. The waste from fission power production is extremely toxic and long lasting, requiring long term, expensive and unpopular storage; at least in the case with currently operational plants. A successful terrorist attack on a fission plant could easily make its region unfit for human habitation for centuries, as has happened in areas near major nuclear accidents. Fusion power may reduce these problems, but after 60 years of research no credible design for a commercial plant exists, so the environmental effects are yet unknown.>

# Counterplan Answers: Terrestrial Solar CP

**Terrestrial Solar power Hurts the environment and is inefficient**

**Globus, 10**

(Al, Globus, Online Journal of Space Communication, Winter 10, <http://spacejournal.ohio.edu/issue16/globus2.html>, KJ)

<Ground solar in large quantities uses a great deal of land. Covering roof-tops with solar collectors avoids this problem but is limited in the total power produced. Centralized solar plants carry a larger environmental cost since the ecosystems beneath solar collectors become completely devoid of solar inputs. Assuming 80 kw continuous power per hectare, producing 10 TW of energy would require over 12 million hectares of solar power plant, or a square 350 km on a side. Of course, the actual area removed from biological production would be less since rooftops already shade the ground completely. By way of contrast, the total area needed for solar power satellite antennas depends heavily on the desired power density, which is a variable design parameter at present. Assuming a power beam transmitting energy 50% of strong sunlight (400w/m2) and 80% conversion efficiency, 10 TW of power on the downlink would require roughly 31,250 km2 or a square 175 km on a side for safe reception on earth. Thus, the area required is significantly less and the environmental impact per m2 is less as well.

Biomass is extremely inefficient as a way to harness solar energy. All the energy from biomass is derived from the sunlight falling on plants. The efficiency of plants converting sunlight into energy is typically a few percent (sugarcane is higher). There are also inefficiencies when converting biomass into usable energy so net efficiency is usually less than 1%. Solar cells, by contrast, are generally 10-20% efficient, or better. Of course, inedible biomass left over from food production and waste from timber production need not be as concerned about overall efficiency as it is produced anyway, but there is not nearly enough of this by-product to meet our energy needs. The production of energy from biomass has it's own environmental costs.>

# Counterplan Answers: Terrestrial Solar CP

**SSP is much more efficient than terrestrial energy sources.**

**Boyle, staff writer for MSN, 9**

**(Alan Boyle, MSN,** [**http://www.msnbc.msn.com/id/30198977/**](http://www.msnbc.msn.com/id/30198977/)**, 6/22/11, KJ)**

He said the space-power agreement was part of PG&E's effort to forge long-term deals for renewable energy, including deals for terrestrial-based solar power. Marshall pointed out that space-based and terrestrial-based solar power generation were "really very different animals." Unlike ground-based solar arrays, space satellites could generate power 24 hours a day, unaffected by cloudy weather or Earth's day-night cycle. The capacity factor for a ground-based solar is typically less than 25 percent. In contrast, the capacity factor for a power-generating satellite is expected to be 97 percent, Marshall said. "The potential for generating much larger amounts of power in space for any given area of solar cells makes this a very promising opportunity," Marshall said. He said the agreement called for 800 gigawatt-hours of electricity to be provided during the first year of operation, and 1,700 gigawatt-hours for subsequent years. The larger figure is roughly equal to the annual consumption of 250,000 average homes.

# Counterplan Answers--Terrestrial Solar CP

**2ac perm do both—solves warming**

**Hsu**, Systems Engineering & Risk Management, **10**

(Dr. Feng Hsu, “Harnessing the Sun”, Winter 2010, <http://spacejournal.ohio.edu/issue16/hsu.html>, KJ)

<We must advocate solar energy as a sustainability strategy for the future of humanity. That is the way to pursue Solar Power Satellites. We should not, nor do we need to, restrict our vision by choosing between terrestrial and space-based solar. The dream of SPS can be realized much sooner by getting behind the use of terrestrial solar energy and the development of pertinent solar technology on a global scale. Development of nanoparticle ultra high efficiency, low weight, low cost PV cells, along with higher capacity and lower cost energy storage systems, will also benefit SPS development. Our ultimate goal is to tame the "very wheelworks of nature" and harness the energy of the sun. It's not important whether we achieve this goal via SPS or through terrestrial solar approaches, or whatever technological approaches may be created for large scale and affordable use of solar energy.

Nanotech based PV solar cell materials are now being produced more cheaply and are reaching over 50% efficiency. Revolutionary developments are occurring in battery technologies. It is possible that one day we will not need to launch huge PV satellite structures into space to satisfy base-load electricity consumption for the entire planet, except of course for power supply in space environments. It is instructive to observe the 30% annual growth of the solar energy industry even without government policy support in such nations as the U.S. and Russia. Imagine the day when we are no longer dependent on gas and oil when our houses are built with cheap and highly efficient solar cell material installed in the roof and in siding, and parking lots in shopping malls and office buildings are equipped with solar powered charging plug-ins for electric cars.>

# Counterplan answers--Terrestrial Solar CP

**SPS is much more efficient than terrestrial energy sources.**

**The Yomiuri Shimbum, 11**

(The Yomiuri Shimbun, 1/23/11, dailyyomiurionline, 6/22/11, KJ

A successful test would likely accelerate the goal of putting a space-based power generation system into practical use by 2025. Space-based solar power generation, which is 10 times more efficient than earthbound generation, would be a major step forward in terms of fulfilling energy needs, as the strength of sunlight in space is about twice that on Earth, and there are four or five times the hours of sunlight due to the absence of clouds. Mitsubishi Electric has proposed what it calls the Solarbird project, in which 40 relatively small 200-meter solar power generating satellites would be launched. This could produce 1 million kilowatts of electricity, equivalent to a nuclear power plant. The Solarbird system would collect sunlight using reflecting mirrors fitted onto satellites in geostationary orbit 36,000 kilometers above the equator. After the electricity is generated, it would be converted into microwaves and transmitted to Earth. The microwaves--to be sent as harmless radio waves--would be received at ground stations 3 kilometers in diameter and placed on the sea or in sunny desert areas, and then converted back into electricity. The key to making the system practical hinges on the efficient conversion of electricity into microwaves. The experiment will be conducted in a room that does not reflect electromagnetic waves to mimic the conditions of space. If the team succeeds in converting a strong electrical current into microwaves and transmitting them about 10 meters, it will then start work on reducing the weight of the power generation equipment and improving the transmission technology. The team hopes to launch a trial satellite sometime after 2016. It is estimated that implementing a workable space-based solar power generation system will cost about 2 trillion yen.

# Counterplan Answers--Wind CP

**Wind power inefficient compared to SPS**

**Globus, 10**

(Al, Globus, Online Journal of Space Communication, Winter 10, <http://spacejournal.ohio.edu/issue16/globus2.html>, KJ)

<A typical 1MW wind generator in a good location can produce the equivalent of about 0.35 MW continuously. Thus, to produce 10 TW of energy would require roughly 28 million such windmills. Once built, assuming a 50-year life, these installations must be replaced at a rate of about 571 thousand per year. Like SSP antennas, most of the mass of a wind turbine is metal and can be fairly easily recycled into new turbines. The necessity of moving parts, however, means that lifetimes will be shorter.>

# AT: Wind power can replace fossil and nuclear fuels

**Wind Energy Alone cannot replace fossil and nuclear fuels**

**Bell, Researcher of foreign and domestic policy, 2009**

(Chris W Bell, American Thinking, December 5, 2009, <http://www.americanthinker.com/2009/12/save_the_planet_by_banning_ice.html>, June 27, 2011, AJ)

The idea of wind generated electric energy is being sold by environmentalists as an overlooked opportunity to reduce greenhouse gasses. Global warming advocates claim that this discounted treasure could be a major part of an effort to reduce the burning of fossil fuels and eliminate the need for some of our nuclear power plants. Is it true that we are passing up on a gold mine of renewable energy in favor of unnecessary and harmful fossil and nuclear fuels? Let's start by looking at what we use to generate the power we use today. Renewables, such as wind, solar, biomass, etc, provide 2.4% of our electricity.  The bulk of our power, 51%, comes from coal, followed by natural gas at 20% and nuclear at 19%. Included below in the category "other renewables", wind energy is currently supplying about 1% of our electricity Can we replace coal and natural gas with renewable energy sources? Let's examine the facts. Wind energy is harnessed by windmills that are similar to the types that have been around for centuries. The windmills that produce electricity are called wind turbines; they employ fan blades that turn when the wind is blowing. These blades are connected to electric generators. Keep in mind that sometimes the wind blows slowly or not at all, and windmills don't produce any power until the wind reaches about 8 MPH. A location for a windmill is not considered [viable](http://www.eia.doe.gov/oiaf/archive/aeo06/assumption/renewable.html) unless wind speeds average 14 MPH. The percentage of its rated power that a windmill can actually produce, given the variation of wind speeds at the installation site, is called its [capacity factor.](http://www.awea.org/faq/basicen.html) A [realistic](http://www.wind-watch.org/faq-output-p.php) capacity factor is 25%. That means that over time, the windmill actually delivers 25% of its rated power. (Electrical energy is measured in units called watts.  A kilowatt (KW) is 1,000 watts, a megawatt (MW) is a million watts. ) A [typical](http://www.vestas.com/en/wind-power-solutions/wind-turbines/1.65-mw.aspx) large wind-driven turbine is rated at about 1,500 kilowatts. It's 350 feet tall and has a fan blade of about 240 feet in diameter.  It will [actually](http://www.eia.doe.gov/cneaf/nuclear/page/analysis/nuclearpower.html) deliver about 375 kilowatts. It can power about 375 microwave ovens, or 6250 60-watt light bulbs simultaneously (only when the wind is blowing at about 25 miles per hour, which is a very strong wind). An [average](http://www.eia.doe.gov/cneaf/nuclear/page/analysis/nuclearpower.html) (1 gigawatt) power plant can power nearly a million microwaves, or 16 million light bulbs at the same time. A power plant near me produces 1,100,000 kilowatts (1.1 gigawatts) of power. At a 25% capacity factor it would take nearly [2600](http://www.vestas.com/en/wind-power-solutions/wind-turbines/1.65-mw.aspx) large wind turbines to produce the same power as this nuclear power plant. And this is not a particularly large plant. If you placed these 2600 wind turbines the [recommended](http://www.nrel.gov/analysis/power_databook/calc_wind.php) 5 rotor-blade diameters apart, they would stretch for 600 miles. That's as far as the distance from Michigan to Georgia. In practice wind turbines are not placed single file, they are placed in several rows, like crops, in what are called wind farms, but you get the idea. The amount of electricity generated by a wind turbine is proportional to the wind speed to the 3rd power (a 20 MPH wind will produce 8 times as much energy as a 10 MPH wind). Therefore wind turbines often produce energy in bursts; when the wind gusts, the energy output spikes, when the wind dies down, energy output dips. Unfortunately, there is no easy way to store these bursts of energy for later use. There are no batteries large enough that are also practical, and pumped-storage systems, which use unwanted energy to pump water into an aboveground reservoir for later use in turning a water-driven generator, require a large body of water. And when there is no wind, windmills produce no power, so a traditional power plant must be operational at all times to provide power during those in-between times. Also, most areas of the country have so little wind that wind turbines are not practical. As indicated in the wind resource map below, most of best energy-producing wind power areas are located far from population centers. The white areas are those that don't have fast enough winds to make wind power viable. Wind power does work. It is a clean and renewable source of energy. But it does have its limitations; we would have to have wind turbines stretching from sea to sea to equal the energy output we can get from traditional power plants, and they would only be a match for conventional power plants when the winds were strong.  On calm days they would produce no energy. And since most of the power would be generated in unpopulated areas, because that's where the strong winds are, (see map above) we would have to incur huge losses to transport this energy to where it is needed. And after all that, we would still need to maintain our current system of traditional power plants because we would have to have a backup source for when the wind is calm. And since the traditional power plants can't be turned on and off like a light bulb, it will be necessary to use the traditional power plants to provide the bulk of our power and use the wind generated power to supplement the power plants. All things considered, wind power has limitations that will relegate it to a role as a supplementary, not a primary, source of our electrical energy.  So the next time you hear a pundit say that we should throw over fossil and nuclear fuel in exchange for wind, know that it is not possible. And any proposals that are predicated on the replacement of natural fossil fuels, such as the replacement of real jobs with "green jobs" is as fallacious as an equation that is predicated on 2 plus 2 equaling 5.

# Counterplan Answers--Hydropower CP

**Tech not ready and hurts the environment**

**Globus, 10**

(Al, Globus, Online Journal of Space Communication, Winter 10, <http://spacejournal.ohio.edu/issue16/globus2.html>, KJ)

<Waves and tides are a promising source of energy, but the technology is currently underdeveloped and the environmental cost of operations is not well understood. For example, how disruptive will these applications be to sea life? Long lifetimes may be difficult to achieve for these types of technologies due to the corrosive nature of seawater and interference by sea life, a major problem for undersea cables today. In brief, sensible comparisons cannot be made at this time.>

Ground solar, wind, tides and waves are all intermittent power producers and the energy they produce is not always available when and where needed. Since these sources are somewhat unpredictable, with the exception of tides, there must be mechanisms for storing some portion of the energy generated, and there must be ways to transmit it to off-site locations where demand exists. Calculating even a very gross measure of the environmental cost of storage is difficult, but storage will certainly not be free.

**Hydro power is an ineffective energy production method.**

**Hsu, Systems Engineering & Risk Management, 10**

(Dr. Feng Hsu, “Harnessing the Sun”, Winter 2010, <http://spacejournal.ohio.edu/issue16/hsu.html>, KJ)

<Hydro power is renewable but such an energy source is limited and unstable. Liquid biomass competes for land with food production. Hydrogen (fuel cell), a form of energy storage rather than a source of energy, carries certain risks in storage and transport. Wind, geothermal and tidal solutions tend to also be unstable, intermittent and costly. Solar energy, on the other hand, basically doesn't matter whether it is surface or space-based; it has some limitations, but one of them is not harm to human beings.>

# Counterplan Answers Japan-US Cooperation

**Japan empirical collaboration with the US**

**Mohammed and Ramasamy,** Politicians and former Members of the Legislative Assembly**, ‘09**

(S. Sheik Mohammed and K.Ramasamy, proceedings of international conference on energy and environment, [Ebsco](http://web.ebscohost.com/ehost/detail?vid=10&hid=112&sid=5ac440de-7fdb-4dec-93a0-4edc0039db57%40sessionmgr13&bdata=JnNpdGU9ZWhvc3QtbGl2ZSZzY29wZT1zaXRl#db=a9h&AN=40086283), AJ)

As world-wide activities, the SPS research groups have initiated international collaboration such as Japan-US SPS workshop, International Conference on SPS and WPT, International Astronautical Congress Space Power Committee and URSI inter-commission working group. The contribution on SPS concept, studies and research activities of United States, Japan and Europe are discussed in this chapter

# Counterplan Answers private counterplan-perm solvency

**Perm do both—solves the implementation and research for sps**

**Space Enterprise Council**, US Chamber of Commerce, **2008**

(Space Enterprise Council, July 2008 *Recommendation on Space-Based Solar Power,* [*http://www.nss.org/settlement/ssp/library/2008-SECSpaceBasedSolarPowerWhitePaper.pdf*](http://www.nss.org/settlement/ssp/library/2008-SECSpaceBasedSolarPowerWhitePaper.pdf)*, AJ)*

Incremental Research Approach: SBSP should be addressed through an incremental roadmap approach, involving both Government and private sector investment. This roadmap should be constructed to address at the outset key questions about SBSP, including technical viability and cost-effectiveness. The roadmap should consist of a series of milestones, each built on the availability of information generated by prior research. If research results are positive, each milestone should lead to increased government and private sector effort and investment. If justified by research findings, a move from research to demonstration projects should be initiated. Beyond this, milestones should be designed to maximize opportunities for multiple applications of research results, so that improvements in existing technologies and development of new ones could have near-term applications in addition to SBSP (e.g., communications satellite power supplies, terrestrial solar power generation).

# Counterplan answers—Private companies CP

**Perm solvency Demonstration project would entice private companies into investing to create disruptive technology and reduced costs**

[**Shea**](http://spacejournal.ohio.edu/about_ed.html#flournoy), Master of Arts in Science Technology and Space Policy at George Washington University, 20**10** (Karen Cramer, Online Space Journal of Communication, December 2010. http://spacejournal.ohio.edu/issue16/shea.html NP)

To meet the demands of launching the components of four solar power satellites into geosynchronous orbit, the launch industry would have to rapidly up-size. Putting the power of the government behind this effort would assure development of improved facilities and technologies. Four satellites would allow the SSP technology to go through several generations of improvement while the market was being established. Once their capabilities are proven, with four electricity generating satellites in orbit, the industry will have a track record on which to secure investment capital for additional launches. It is hoped that because of the investment and new technologies applied launch costs will have been lowered.

# Counterplan Asnwers—Private Sector CP

**Perm answer to Privatization CP: US government funding and commercial involvement key**

[**Flournoy**](http://spacejournal.ohio.edu/about_ed.html#flournoy), Professor of Telecommunications Ohio University, Athens Ohio, **2010**

(Don, Online Space Journal of Communication http://spacejournal.ohio.edu/issue16/flournoy.html)

It is now clear that the more significant barriers to realizing a new satellite business based on energy from space are not technological barriers. Technical features of solar power satellite systems do require further development, including improvements in easier/cheaper access to space, efficiencies and capacities of solar cells, wireless power transmission and receiver networks, energy conversion, storage and distribution. Space visionaries have always looked to governments to get their ambitious projects off the ground. In the case of building SunSat infrastructures, governments can help with R&D funding, assist with demonstration projects and agree to be the anchor tenant purchasing the first products produced, but the commercial sector must be involved, and involved early, for long run implementation and management.

Progress made in raising capital for SunSat businesses will inevitably be tied to progress made in commercialization of space overall, and the development of plausible business plans related to alternative energy markets in particular. The fact that the U.S. demand for electricity is expected to increase by as much as 40 percent in the next two decades, and assumptions that lesser developed nations will wish to grow even faster, should be enough to get private enterprise paying attention.

# Counterplan Answers private counterplan perm solvency multi actors

**SPS uses multiple actors to function---proves CP not competitive**

**Xin et al**, Masters degree in aerospace management, **2009**

(Sun Xin , Evelyn Panier, Cornelius Zünd, and Raul Gutiérrez Gómez, Toulouse Business School, May 2009 <http://www.nss.org/settlement/ssp/library/2009-FinancialAndOrganizationalAnalysisForSSP.pdf>, *AJ*)

The aerospace industry is large in terms of turnover, but small in terms of community and the number of people that work in it. As a result there is often a lot of “cross pollination” between companies when large projects are in the works. If we can consider the European space industry as an example, there are many layers of companies who are at once cooperating on some levels and competing on others. What this means is that no single industry or government will be able to pursue the SSPS concept on its own. It can be expected that there will be significant internal and cross industry cooperation for such a project including academic institutions, government agencies, and other aerospace companies. Furthermore it will be interesting to integrate power delivering companies such as EDF or OPA into this mix, since the SSPS is a project which will involve them as well.

# Counterplan Answers China Do It CP—perm solvency

**Perm—do the plan and CP provides for a consortium to develop SBSP**

**Cox, retired prosecutor and public interest lawyer, 2011**

(William John, March 23, 2011, <http://www.consortiumnews.com/Print/2011/032311b.html>, 6-27-11)

<President Kennedy once said, “We choose to go to the moon in this decade, not because it is easy, but because it is hard.” The United States readily achieved that objective and, effectively, won the Cold War.

A similar challenge is now presented in the race for space-solar energy.  What, if anything, will President Obama say or do?

Rather than a competition, however, the United States, China, Japan, and perhaps Russia, should organize a public service consortium to cooperatively produce energy from outer space.

Such a consortium could take advantage of the unique abilities of each nation to collectively produce space-solar energy, and it would avoid private corporate domination over the distribution of a product that is essential to human civilization.

A Space-Solar Energy Consortium would be a giant step toward world peace and a small leap into the universe of unlimited and unimaginable futures that surround and await us.>

# Counterplan Answers Laser Only CP Microwave Net Benefit

**Non unique and no impact---other everyday tools increase expsosure to microwaves**

**Xin et al**, Masters degree in aerospace management, **2009**

(Sun Xin , Evelyn Panier, Cornelius Zünd, and Raul Gutiérrez Gómez, Toulouse Business School, <http://www.nss.org/settlement/ssp/library/2009-FinancialAndOrganizationalAnalysisForSSP.pdf>, *AJ*)

When the idea of wireless energy transfer via microwaves or lasers is presented, the question that comes first is whether or not such a technology is safe. There is a perception, though not entirely unfounded, that there are many possible negative side effects of this proposition such as space to space weapons, space to Earth weapons, and also of cooking people and animals that get too close to the transmission zone. What seems less obvious to many people is that wireless energy transfer is used all the time with significant regularity. Cell phones, wireless internet, and even radio are forms of wireless energy transfer. In fact if you consider the range of microwaves in the electromagnetic spectrum, each of these applications are already using microwave energy and have been determined to be very safe for human use. In essence then the natural fear that accompanies such a proposition will certainly prove to be a hindrance. Perhaps the best way to overcome this is with education. For instance if people are made more aware that the technologies that they use on a day to day basis are the same that would enable a wireless energy transfer, then familiarity and acceptance of the project will be much easier to accomplish.

# Counterplan Answers Laser only CP Microwaves net Benefit

**Microwaves good—and more efficient transmission**

**Wallach, General Counsel of the NewSpace Alliance, 2010**

**(Mark I. Wallach, Online Journal of space communication** [**http://spacejournal.ohio.edu/issue16/wallach.html**](http://spacejournal.ohio.edu/issue16/wallach.html)**, winter 2010, as)**

In space based solar power systems, a very large array of solar collectors - as large as multiple square miles of collection surface - is placed into a geosynchronous orbit to collect massive amounts of solar energy. Modern solar power technology has produced new thin films, no more than a few millimeters thick, capable of serving as efficient and reliable solar collectors in space. Because of their flexibility and low weight per kilowatt (kW) of electricity produced, such films are thought to be ideal for SBSP applications. A number of designs for the solar collection portion of an SBSP system have been proposed, some involving multiple interconnected collector units, some involving concentrator lenses to intensify the solar energy received by each collector cell. Once the solar energy has been collected, it is converted by the collector cells to electrical energy and transmitted wirelessly to an earth-based receiving antenna, called a rectenna.

While most SBSP system designs contemplate use of microwave beams to convey solar energy to earth, some propose to utilize laser beams instead. The advantage of a microwave frequency beam is the near transparency of earth's atmosphere to electromagnetic radiation, thereby reducing energy loss as the beam passes through the atmosphere. Microwave beams also create no measurable health threats, and are virtually impossible to use as weapons. In contrast to microwave beams, laser beams are better suited to smaller power production systems, but their high intensity introduces the possibility of property damage or even personal injury from diverted beams.

# Counterplan Answers Laser only CP PIC Microwave Radiation Net Benefit

**AT: microwaves not harmful even with claimed “athermal” effects**

**Osepchuk, Full Spectrum Consulting in Concord, 02**

(John M. Osepchuk, December 2002, IEEE Microwave Magazine, JP)

<The judgment of safety for public exposure from proposed SPS systems is strongly supported by reference to safety standards throughout the world. Critics, however, bring up the question of “athermal” effects. It is a fact that such effects—more accurately described as low-level chronic-exposure effects—have never been proved to exist in a meaningful form. Many papers suggesting such effects were marred by various artifacts, which explains why all responsible bodies have discounted such literature. It may be pointed out that most of such speculations have linked allegations of “athermal” effect to the presence of certain types of modulation or pulse characteristics that are absent in proposed SPS systems. One might add that real effects, like the auditory effect associated with transient heating, result from low duty cycle pulses or very complex modulations, both of which are absent in the SPS systems under consideration. Despite continuing speculation, the only confirmed mechanism for bioeffects at microwave frequencies is heating. (One can note that basic EM theory shows that absorbed EM energy is thermalized in biological tissue in a period of picoseconds to nanoseconds.) All international safety standards recognize this, and we also note that all practical applications [10] of microwave power are based on heating. Safe exposure limits are based on average measures of power or field (squared) parameters through time averaging.>

# Counterplan Answers AT SPS hurts humans and animals

**No link---empirical studies prove no harms to humans or animals**

**Xin et al**, Masters degree in aerospace management, **2009**

(Sun Xin , Evelyn Panier, Cornelius Zünd, and Raul Gutiérrez Gómez, Toulouse Business School, May 2009 <http://www.nss.org/settlement/ssp/library/2009-FinancialAndOrganizationalAnalysisForSSP.pdf>, *AJ*)

The impact on public health is one of the major aspects of SSPS development because public concerns about radio wave exposure of SSPS. As we know, the only demonstrated biological effect of microwave exposure, which is, to date, heating. To put 30 mW/cm2 in perspective, the energy generated inside a typical kitchen microwave oven is approximately 1000 mW/cm2. This means the power density at the center of an SSPS beam is only 3% as strong as a typical countertop microwave oven. So such peak power densities envisioned for SSPS could never even come close to ‘cooking’ birds or aircraft in-flight. lxxii Other studies have shown that at 25 mW/cm2, some birds exhibit behaviours suggesting they might be able to detect microwave radiation. If true, some migratory birds, flying above the rectenna, might suffer disruption of their flying paths. At higher ambient temperatures, larger birds, having greater body mass and thus absorbing a relatively greater amount of microwave radiation, could tend to experience more heat stress than smaller ones. No doubt birds would learn to avoid areas of the sky associated with transient local heating. Research has been done on bees and birds exposed to microwave radiation at twice the dose expected for a creature flying through a typical microwave power transmission beam. Results to date indicate that there is no effect, at least on the animal’s directional flying ability. lxxiii Other testing has been performed on monkeys and is now under way with humans exposed to low-level microwave radiation. Results to date from this testing indicate that such exposure apparently does not render the subject sterile or result in cataracts or any other deleterious effects. lxxiv 9 No evidence has been found that continuous power densities from 1 to 50 mW/cm2 (at 2.45 GHz) have any biological effects on honey bees. This subject may seem irrelevant, but since bees are the main pollinators in nature, any impact on these insects may have catastrophic outcomes for agriculture.

**No effect on humans—studies prove**

**Xin et al**, Masters degree in aerospace management, **2009**

(Sun Xin , Evelyn Panier, Cornelius Zünd, and Raul Gutiérrez Gómez, Toulouse Business School, May 2009 <http://www.nss.org/settlement/ssp/library/2009-FinancialAndOrganizationalAnalysisForSSP.pdf>, *AJ*)

Having first been proposed in the 1960’s and studied ever since, the idea of a SSPS is not uncommon. Furthermore the technologies and systems behind its use are extremely well understood, enough so that there really is no scientific limitation to its constructionxxvii. This being said research stills need to be done on some of the finer points involved, such as power management, construction and assembly in space, and also the transmission of energy through the atmosphere. Many studies have been done with respect to the effects of a SSPS on the Earth. They have concluded that if constructed correctly, there will be either no or marginal impacts to humans, animals, and the environment as a result of a SSPS’ operation. This cannot be said for many state of the art electricity production methods currently in use.

# Counterplan Answers AT SPS unsafe—microwaves

**Studies prove that the sats so high that they don’t hurt people or birds**

**Salkever, author for Daily Finance, 2009**

(Alex Salkever, <http://www.dailyfinance.com/2009/12/04/california-gives-green-light-to-space-based-solar-power-project/>, 12/04/09, as)

"The technology is fairly well developed. If you look at today's communications satellites, they have solar cells that generate the electricity they need. These satellites convert the electricity into radio waves, then signal to your home to your television. That's what DirecTV does. Except unlike them, we don't throw away the center part of the beam where all the energy is located," Solaren's Director of Energy Services Cal Boerman told me in an[interview two months ago](http://www.dailyfinance.com/2009/09/26/plans-for-solar-power-from-outer-space-move-forward/).
Solaren might face some questions from the folks in Fresno who will be on the receiving end of those microwave beams, but Boerman explains that the energy beam won't even register with birds, people or passing planes.
"The energy levels we'll be working with are a lot less than you might feel if you were sitting out in the midday sun, because the beam will be spread out over a very wide area. The receiving antenna on the ground will be a couple of square miles. It's a big area, but that means the beams are at lower concentration. As for airplanes, they would feel more heat coming out from under clouds than they would entering our beam. Remember, the satellites are 22,000 miles up, far above where planes or birds fly. We're so high up that even space junk is not an issue," says Boerman.

# Counterplan Answers AT: SPS Beams Hurt Health

**SPS beams even at peak intensity not harmful**

**Mankins, 2008**

(John, National Space Security Office; Ad Astra; Spring 2008; <http://www.nss.org/adastra/AdAstra-SBSP-2008.pdf>;

tr)

**<**SBSP is not suitable for attacking ground targets. The peak intensity of the microwave beam that reaches the ground is less than a quarter of noon-sunlight; a worker could safely walk in the center of the beam. The physics of microwave transmission and deliberate safe-design of the transmitting antenna act to prevent beam focusing above a pre-determined maximum intensity level. Additionally, by coupling the transmitting beam to a unique ground-based pilot signal, the beam can be designed to instantly diffuse should pilot signal lock ever be lost or disrupted.>

# \*\*\*\*Case Turn Answers\*\*\*\*

# AT Terrestrial Solar Power tradeoff

**SBSP is clean, stable, plentiful, and flexible—and as cheap as other renewable sources AND won’t trade off with terrestrial solar power**

**Space Enterprise Council**, US Chamber of Commerce, **2008**

(Space Enterprise Council, July 2008 *Recommendation on Space-Based Solar Power,* [*http://www.nss.org/settlement/ssp/library/2008-SECSpaceBasedSolarPowerWhitePaper.pdf*](http://www.nss.org/settlement/ssp/library/2008-SECSpaceBasedSolarPowerWhitePaper.pdf)*, AJ)*

Potential Benefits: SBSP is unusual among renewable energy options because it might satisfy all four of the following criteria critical to investment decisions: environmental cleanliness, sustainability of supply, flexibility of location, and capacity to generate continuous rather than intermittent power. The cost of SBSP-generated electricity would initially be greater than that provided by fossil fuel or nuclear power but could be comparable to other alternative energy sources, particularly for baseload power. In addition, SBSP might offer an attractive approach, not only for satisfying today's needs but also for meeting tomorrow’s much greater requirements. We cannot accurately predict environmental and other consequences of harvesting energy from natural Earthbound sources (e.g., wind, ocean current, geothermal, biofuels), when these methods are scaled up to considerably higher levels. By providing an additional source of renewable energy, SBSP might help avoid potentially negative consequences if limits to the costeffective expansion of other renewable sources become evident. Beyond enhancement of energy production per se, SBSP might help create new economic opportunities through resultant technology advances in space launch, space utilization, and technological spin-offs applicable to a host of materials and processes. For example, SBSP research might lead to improvements in the efficiency of solar cells that power communications satellites, as well as power management systems for terrestrial solar power systems. Also, to the extent that SBSP is integrated into terrestrial solar power production, development of SBSP ground infrastructure might generate revenue even before deployment of systems in space. In this and related applications, SBSP could emerge as an enhancement for, rather than a competitor with, terrestrial solar power generation.

# AT: Terrestrial Solar Tradeoff

**Terrestrial solar power not sufficient for growing electricity needs**

**SolarHigh.org,** research group for solar power, **‘11**

(Solar high research group, NGO that studies SPS, <http://solarhigh.org/resources/16KwordBrief.pdf>, 2011, AJ)

The DOE Energy Information Administration (EIA) forecasts a 50% increase in worldwide electric

generating capacity by 2035, from ~ 4,650 gigawatts (GW) to just over 7,000 GW. This does not

include the additional plant that may be required to enable

* replacement of obsolete or environmentally unacceptable facilities;
* widespread adoption of plug-in hybrid or fully electric vehicles;
* desalination of seawater on a large scale; and
* substantial economic growth in poor nations.

Without decisive action to reduce the cost of renewable sources (especially solar) this expansion will involve much greater consumption of coal, nuclear energy and natural gas. Solar photovoltaic (PV) arrays are rated by their output when exposed to sunlight at its maximum intensity, 1,000 watts/sq.m. Using this measure, the present installed cost of a large array designed to feed power to the utility grid is ~ $5,000/kilowatt; the DOE hopes to reduce this to $2,000/kilowatt within 5 years. Because of nighttime, daily and seasonal variations and weather, the average intensity of sunlight is less than 285 watts/sq.m., even in favorable areas such as the Arizona desert. The real installed cost is therefore more than $17,500 per average kilowatt. A complete utility-scale system also requires extensive energy storage to compensate for the variations in sunlight, plus long-distance transmission lines to deliver power from the desert to load centers. When the inefficiencies and costs of these ancillary systems are taken into account; the cost rises to ~$37,000 per average kilowatt delivered to the load. The cost may fall to ~ $20,000/kW if the DOE meets its PV cost goals, but this is still far from competitive with fossil fueled power plants (even when external costs such as environmental impacts are included). The EIA therefore estimates that in 2035 the solar contribution to electric utilities, worldwide, will be a paltry 0.5% of their total consumption.

# AT: terrestrial Solar Power tradeoff

**SPS works 24/7 to provide energy—better than terrestrial solar power**

**Kotler 09**

(Steven Kotler, May 25 2009, <http://ecohearth.com/eco-op-ed/593-space-based-solar-power-the-time-has-come.html>, JP)

<A 2007 Pentagon study found that a one-kilometer-wide band of space in earth orbit receives solar energy in just one year equal to “the amount of energy contained within all known recoverable conventional oil reserves on Earth today.”

Without an atmospheric barrier, space-based solar panels could collect eight-to-ten times the amount of energy they would here on Earth. Even better, they could do so 24 hours a day, come rain or shine..>

# AT: Terrestrial solar power tradeoff

**land based solar power problems make it incapable of delivery energy needs**

**Loh 09**

(Kenny Loh, New Straits Times, September 18 2009, Proquest Sirs Jesuit, JP)

<IT'S been a long quest to harness energy from the most powerful and obvious source in the solar system. But even with modern breakthroughs in solar power technology, the ability to efficiently harness the sun's power and use it optimally continues to elude us - simply because there's no part of the planet where the sun shines 24 hours, 365 days a year.

Even if it exists, there's no guarantee against overcast days when solar panels will be rendered useless.

Despite the solar power solution's enormous potential, the drawbacks have been significant, especially when we need electricity every day and there's no way to generate the required amount.>

# AT Terrestrial Solar Trade Off

**Terrestrial solar doesn’t work—and takes lots of land that SPS doesn’t**

**Baker, Chronicle Staff Writer, 09**

(David R. Baker, Chronicle Staff, <http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2009/04/13/MN7S171PSL.DTL>

, 6/22/11, KJ)

<Placing solar panels in orbit would solve two of the biggest problems facing the solar industry.

Terrestrial large-scale solar farms only generate electricity during the day, and their output varies with the seasons. They also require large tracts of land, often hundreds of acres for a single installation.

Those problems vanish in space. The Solaren project would experience constant sunlight except for brief interruptions during the spring and fall equinox periods. Obviously, land wouldn't be an issue. And the sunlight hitting Solaren's facility would be eight to 10 times more powerful than the light reaching Earth through the planet's atmosphere.>

# AT SPS worsens climate change

**SPS effect on the climate even with microwaves not substantial**

**Xin et al**, Masters degree in aerospace management, **2009**

(Sun Xin , Evelyn Panier, Cornelius Zünd, and Raul Gutiérrez Gómez, Toulouse Business School, <http://www.nss.org/settlement/ssp/library/2009-FinancialAndOrganizationalAnalysisForSSP.pdf>, *AJ*)

As the beam passes through the atmosphere from geostationary orbit, a loss of no more than 2% of total beam power is predicted. In abnormal circumstances, such as scintillations in the ionosphere or rain cells in the troposphere, the power loss may temporarily be greater. lxviii The effects of powerful microwaves on the stratosphere have been studied, mostly to study the effects of ozone-destroying pollutants in the troposphere or to create an artificial ozone layer by interaction with high-energy electromagnetic waves. The field strength necessary to do this is much higher than power densities that would be used by SSPS systems. SSPS is therefore not expected to impact the atmosphere. lxix The energy transmitted by SSPS from space to Earth is five orders of magnitude less than the total solar radiation reaching the Earth (i.e. the power density of the beam is weaker than the power density of sunlight). The total energy used on the Earth is only 1/7000 of the amount of the solar energy reaching the Earth. Therefore, SSPS will not worsen global warming problems. Since rectenna efficiencies are very high, very little of the total energy is lost as heat. SSPS does not generate CO2, change atmospheric chemistry or contribute to climate change. lxx SSPS doesn’t affect the atmospheric chemistry, the ozone layer, and more generally on the climate.

# AT: “Legal Barriers to SPS development”

**No legal barriers—domestic or international**

**Rogue, Director of National Security Space Office 07**

(Joseph D. Rogue, Phase O Architecture Feasibility Study, JP)

<FINDING:The SBSP Study Group found that no outright policy or legal showstoppers exist to prevent the development of SBSP. Full‐scale SBSP, however, will require a permissive international regime, and construction of this new regime is in every way a challenge nearly equal to the construction of the satellite itself.

The interim review did not uncover any hard show‐stoppers in the international legal or regulatory regime. Many nations are actively studying Space‐Based Solar Power. Canada, the UK, France, the European Space Agency, Japan, Russia, India, and China, as well as several equatorial nations have all expressed past or present interest in SBSP. International conferences such as the United Nations‐connected UNISPACE III are continually held on the subject and there is even a UN‐affiliated non‐governmental organization, the Sunsat Energy Council, that is dedicated to promoting the study and development of SBSP. The International Union of Radio Science (URSI) has published at least one document supporting the concept, and a study of the subject by the International Telecommunications Union (ITU) is presently ongoing. >

# AT: “SPS causes Weaponization”

**SPS microwaves not a laser death ray**

**Baker**, Chronicle Staff Writier, **09**

(David R. Baker, Chronicle Staff, <http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2009/04/13/MN7S171PSL.DTL>

, 6/22/11, KJ)

<Not a 'laser death ray' He also dismissed fears, raised in the past, that the transmission beam could hurt birds or airline passengers who stray into its path. The beam would be too diffuse for that. "This isn't a laser death ray," Boerman said. "With an airplane flying at altitude, the sun is putting about four or five times more energy on the airplane than we would be

# \*\*\*Disad Answers\*\*\*

# China DA---no link China loves it

**No link—China businesses looking for business so like SPS**

**Xin et al**, Masters degree in aerospace management, **2009**

(Sun Xin , Evelyn Panier, Cornelius Zünd, and Raul Gutiérrez Gómez, Toulouse Business School, May 2009 <http://www.nss.org/settlement/ssp/library/2009-FinancialAndOrganizationalAnalysisForSSP.pdf>, *AJ*)

From this table of select launcher data we can see that the Falcon 9H from Space X provides the best cost to orbit of all the selected launchers. Although Space X is currently a newcomer to the launcher arena the time by the time significant investment in a SSPS is made, the launch technology will be sufficiently mature to be as reliable as the Ariane 5. In the future it is conceivable that the Indian GSLV or Chinese Long March 5 booster families may be selected, especially if other systems are unable to keep up with the necessary tempo of launch and deployment. It is interesting to consider that both the Chinese and Indian space industries growing quickly and are in need of new “business”. Considering their use for the SSPS project would them faster development and a chance to catch up with the traditional space powers. SSPS may be very interesting subject from their perspective. For all SSPS modelling efforts during the course of this report we shall assume a mature and reliable version of the Falcon 9H with listed payload capacity.

# Spending Answer-link turn

**SPS costs decrease over time—investment now creates economies of scale**

**Mahan, author for Citizens for Space Based Solar Power, No Date Given**

(Rob Mahan, <http://c-sbsp.org/sbsp-faq/#01>, Last Modified 06/24/2011, as)

The financial solution will admittedly be very expensive at first, so there must be an early adopter, like the Defense Department, to provide a market and rewards for those willing to invest in space based solar power and the supporting technologies. Engineering and scientific advancements and the commercialization of supporting technologies will soon lead to ubiquitous and low cost access to space and more widespread use of wireless power transmision. Economies of scale will eventually make space-based solar power affordable, but probably never cheap again, like energy was fifty years ago. Eventual Moon based operations will reduce costs significantly, since it takes twenty-two times less energy to launch from Moon than from Earth’s gravity well and the use of lunar materials will allow heavier, more robust structures.

# Spending Answers—no link

**cost of SPS only 20-30 billion in the next 5 years**

**Gauger, PhD at UCLA in cosmic ray studies, professional life in the aerospace industry, 2010**

(Joleroy, Online Journal of Space Communication

<http://spacejournal.ohio.edu/issue16/gauger.html>, date accessed 6/20/11, as)

<Solar Power Satellite costs are calculable if we make reasonable assumptions. We must lay out goals and plans for a fleet structure that are relatively complete. At this time, we anticipate that 20 to 30 billion dollars could be required in the next five years. >

# Spending DA—cost efficient

**SPS costs comparable to terrestrial power and without energy interruptions**

**Smith, president of the Long Island Space Society, 04**

(Arthur P. Smith, November 1 2004, National Space Society, <http://www.nss.org/adastra/volume16/smith.html>, JP)

Worldwide more than a trillion dollars a year goes to the energy industry, and utilities routinely construct multibillion-dollar power plants. The energy industry has a bigger wallet than the entire U.S. federal discretionary budget. Money is not directly the problem here; profitability is. The two essential factors in the cost equation are the cost per delivered watt of the solar power components, and the cost per delivered watt of getting those components to their final destination in space.

Current costs put the capital investment needed for a space solar power system well above the $2-per watt of competitive terrestrial options such as fission plants and wind turbines. R&D work is needed to bring these costs to where the vast energy resources of space are within reach of a large utility project.

The cost of components is the first problem here. Current prices for solar electric power systems are about $2.50 per peak watt, a price that has been declining by about 7 percent per year for the last few decades. The day/night cycle, non-ideal sun angles, weathering, and cloud cover reduce power output enough to make the final cost per average watt $10 or more. Terrestrial solar power is still too expensive for wholesale utility use, but it is now competitive for homeowner installation in many areas.

In space you can get peak power almost all the time. The $2.50-per-watt homeowner systems are not space-rated, but the space market is still small, with a larger market, suitable photovoltaic elements could be produced at comparable cost. Transmitting power from space will have somewhat higher losses than transmitting from a terrestrial power plant. Nevertheless, component costs are potentially much closer to wholesale utility requirements for space solar power than they are for terrestrial solar, and with continued improvement in prices, in another 10 to 15 years component costs should not be an obstacle to large-scale installation.

# Spending Answers—long term competitiveness

**Adv: SBSP increases economy in long run**

**Rogue, Director of National Security Space Office 07**

(Joseph D. Rogue, Phase O Architecture Feasibility Study, JP)

**<Finding:** The SBSP Study Group found that SBSP appears to have significant growth potential in the long run, and a national investment in SBSP may return many times its value.

Most of America’s spending in space does not provide any direct monetary revenue. SBSP, however, may create new markets and the need for new products that will provide many new, high‐paying technical jobs and net significant tax revenues. Great powers have historically succeeded by finding or inventing products and services not just to sell to themselves, but to others. Today, investments in space are measured in billions of dollars. The energy market is trillions of dollars, and there are many billions of people in the developing world that have yet to connect to the various global markets. Such a large export market could generate substantial new wealth for our nation and our world. Investments to mature SBSP are similarly likely to have significant economic spin‐offs, each with their own independent revenue stream, and open up or enable other new industries such as space industrial processes, space tourism, enhanced telecommunications, and use of off‐world resources. Not all of the returns may be obvious. SBSP is a both infrastructure and a global utility. Estimating the value of utilities is

difficult since they benefit society as a whole more than any one user in particular—consider what the contribution to productivity and GDP are by imagining what the world would be like without electric lines, roads, railroads, fiber, or airports. Not all of the economic impact is immediately captured in direct SBSP jobs, but also in the services and products that spring up to support those workers and their communities. Historically such infrastructure projects have received significant government support, from land grants for railroads, to subsidized rural electrification, to development of atomic energy. While the initial‐capability on‐ramp may be slow, SBSP has the capability to be a very significant portion of the world energy portfolio by mid‐century and beyond. >

# \*\*Miscellaneous \*\*

# Uniqueness- California wants now

**California wants SPS now**

**Salkever, author for Daily Finance, 2009**

(Alex Salkever, <http://www.dailyfinance.com/2009/12/04/california-gives-green-light-to-space-based-solar-power-project/>, 12/04/09, as)

Beaming solar power down from outer space is A-OK according to the California Public Utility Commission. The regulatory body [voted unanimously Thursday to approve](http://docs.cpuc.ca.gov/PUBLISHED/AGENDA_RESOLUTION/110216.htm) a "Power Purchase Agreement" signed between the state's largest utility, Pacific Gas & Electric ([PCG](http://finance.aol.com/quotes/pgande-corp-holding-co/pcg/nys)), and [Solaren Space](http://www.solarenspace.com/). The Southern California start-up is developing technology for what it hopes will be an orbiting solar power collection system that could add a whopping 200 megawatts to the Golden State's increasingly green grid. The project will cost $2 billion, Solaren executives estimate.