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# 1AC

## Inherency

### SBSP is not happening in the status quo- it’s perceived as too costly. NASA has already shot the idea down once due to budgetary issues.

Shiga, David, staff writer for NewScientist, Short, Sharp Science, “will Obama pursue Space Based Solar Power?”, 22 December 2008, http://www.newscientist.com/blogs/shortsharpscience/2008/12/will-obama-pursue-space-based.html

Could power beamed to Earth from space solve our energy problems? Advocates of space-based solar power may find a receptive ear in the Obama administration. The space-based solar power (SBSP) concept involves using geosynchronous satellites to [collect solar energy and beam it down to Earth](http://www.newscientist.com/article/dn12774-pentagon-backs-plan-to-beam-solar-power-from-space.html), most likely in the form of microwaves ([this graphic](http://www.newscientist.com/data/images/archive/2631/26311601.jpg) shows how the idea might work). The key advantage over Earth-based solar power is that such satellites would enjoy nearly continuous sunshine. A major challenge for Earth-based solar power is that it is so inconstant - it isn't available at night or when skies are cloudy. You could solve this problem by storing energy for later use, but it's difficult to do this in a cost-effective way, and something people are still researching. The major disadvantage for SBSP is that it's so costly to launch stuff into space. But advocates of the idea point to new launch vehicles being developed, like [SpaceX's Falcon 9 rocket](http://www.spacex.com/falcon9.php), which could [bring down the cost of access to space](http://www.newscientist.com/article/mg19926756.300-space-taxis-could-cut-the-cost-of-spaceflight.html), and make SBSP more attractive. Advocates for SBSP are hoping to secure some support for developing the technology from the Obama administration, given the incoming president's pledge to make developing alternative energy sources a top priority. They have posted a [white paper on the topic](http://change.gov/open_government/entry/space_solar_power_ssp_a_solution_for_energy_independence_climate_change/) on the transition website, [change.gov](http://change.gov/). One thing that surely helps their cause is that one of Obama's transition team members for NASA is George Whitesides, who has been a vocal advocate for SBSP. Whitesides is currently on leave from his post as executive director of the National Space Society, where he helped [push for SBSP research](http://www.spaceref.com/news/viewsr.html?pid=27921). On the downside, earlier this month NASA cancelled early work on a proposed SBSP demonstration project, which apparently could have involved putting a [demonstration device on the International Space Station](http://www.transterrestrial.com/?p=13094). But it sounds like the decision owes more to a tight budget at NASA than anything else, and I see no reason why the project couldn't be revived if the next administration takes an interest in SBSP. So I wouldn't count out SBSP just yet. On the other hand, I'm sure SBSP will be competing with lots of other alternative-energy ideas seeking research dollars. And even though Whitesides has a record of strong advocacy for SBSP, this doesn't guarantee that the Obama administration will go for it. There are more highly placed people who will undoubtedly get a bigger say in this, like [energy secretary nominee Steven Chu](http://www.newscientist.com/article/mg20026874.600-nobel-laureate-to-be-next-us-energy-secretary.html), who hasn't said much publicly about SBSP. I think it's fair to say that this could be a crucial moment for SBSP, however, so it's definitely something to watch over the next few months.

## Heg (1/6)

### Military reliance on fossil fuels is the root cause of conflict and military overstretch.

Erwin, 2006 (Sandra I., “Energy Conservation Plans Overlook Military Realities,” National Defense Magazine, September, <http://www.nationaldefensemagazine.org/issues/2006/September/DefenseWatch.htm>, accessed 7/7, JDC)

Are skyrocketing oil prices just a temporary drain on the U.S. economy or a lasting national security threat?  If one is to draw conclusions from a recent stream of Pentagon policy directives, studies and congressional rhetoric, the Defense Department will soon have to get serious about taming its gargantuan appetite for fuel, most of which is imported from the volatile Middle East.  “The fact is that nearly every military challenge we face is either derived from or impacted by one thing: our reliance on fossil fuels and foreign energy sources,” says Rep. Steve Israel, D-N.Y., who co-founded a “defense energy working group” with Rep. Roscoe Bartlett, R-Md., and former CIA Director James Woolsey.  “In a world where we borrow money from China to purchase oil from unstable Persian Gulf countries to fuel our Air Force planes that protect us against potential threats from these very countries, it’s high-time to make the choices and investments necessary to protect our country,” Israel says.  When oil prices began to surge, Defense Secretary Donald Rumsfeld issued one of his trademark “snowflake” memos asking aides to come up with energy-saving schemes and techfdnologies, such as hybrid vehicles and innovative power sources.  In truth, it is hard to see how Rumsfeld’s directive could change the reality of a military that mostly operates guzzlers, and has no tangible plans to change that. Just two years ago, the Environmental Protection Agency gave the Pentagon a “national security exemption” so it can continue to drive trucks with old, energy-inefficient engines that don’t meet the emissions standards required for commercial trucks.  The Army once considered replacing the mother of all fuel-gorgers, the Abrams tank engine, with a more efficient diesel plant. But the Army leadership then reversed course because it was too expensive. Most recently, the Army cancelled a program to produce hybrid-diesel humvees, and has slowed down the development of other hybrid trucks in the medium and heavy fleets.  The Air Force has been contemplating the replacement of its surveillance, cargo and tanker aircraft engines, but the project was deemed too costly, and not worth any potential fuel savings.  Subsequent to Rumsfeld’s 2005 snowflake, a number of military and civilian Pentagon officials have been eager to publicize various science projects aimed at energy conservation, such as research into synthetic fuels, biofuels, hydrogen fuel cells, wind farms and solar power, to name a few.  But while these efforts have paid off on the public-relations front, they are not expected to translate into any real energy savings, at least for the foreseeable future.  “In the short term, there is very little that politicians or anyone can do about the military’s dependence on fuel for transportation,” says Herman Franssen, an energy consultant and researcher at the Center for Strategic and International Studies.  New technologies in synthetic fuels and fuel cells will take decades to produce realistic alternatives that can migrate to military vehicles, airplanes and non-nuclear powered ships. For at least the next 20 to 30 years, says Franssen, “oil will still be the most important fuel.”  Synthetic fuels are mostly a pipe dream. The only country that makes any significant amount of synthetic fuel is South Africa, whose apartheid government was forced to find an alterative to petroleum in the 1970s during a trade embargo. “The technology exists, but it’s costly and creates environmental problems,” Franssen says. Biofuels are promising, but it will be decades before they can substantially help to reduce oil consumption. Currently, just 4 percent of the gasoline sold in the United States is mixed with corn-derived ethanol.

Heg (2/6)

### Overstretch kills heg- unipolarity requires the ability to meet all needs, but our current energy system makes that unsustainable.

Haass, 2005 (Richard N, “The Case for "Integration”, The national interest, http://www.nationalinterest.org/ME2/dirmod.asp?sid=&nm=&type=Publishing&mod=Publications%3A%3AArticle&mid=1ABA92EFCD 8348688A4EBEB3D69D33EF&tier=4&id=A561B96740654978B3472EFEEB14C84F

The second question is whether there will be sufficient capacity to carry out a foreign policy premised on integration. Integration requires U.S. leadership, which in turn requires U.S. strength. The United States will need considerable economic and military resources to meet the significant challenges of this era and to discourage a renewed great power challenge. The United States enjoys considerable primacy, but how long this primacy will continue is in doubt given the emergence of enormous fiscal and current account deficits, a strained military that may well be too small, an energy policy that leaves the United States overly dependent on costly imported oil and an educational system that over time seems likely to diminish U.S. competitiveness. Doctrines and foreign policy more generally do not operate in a vacuum; integration or any other American approach to the world will only succeed if carried out by a country that is both able and willing to devote the requisite resources to the many tasks at hand.

Heg (3/6)

### An energy crisis is coming, and threatens Pax Americana and the US economy- SBSP is key to maintain the world order and stop impending catastrophe.

Draiman 2008 [Jay, “Mandatory Renewable Energy: The Energy Evolution”, Energy Consultant and Energy Development Specialist with over 20 years experience in energy research, http://environment.newscientist.com/channel/earth/energy-fuels/dn12774-pentagon-backs-plan-to-beam-solar-power-from-space.html, DeFilippis]

"We strive to meet the needs of the present generation without compromising the ability of future generations to meet their own needs". Today’s energy industry is perhaps the worlds most powerful. Energy is the basis of this entire world wealth, and for perhaps earth entire history, the sun energy has fueled all ecological and economic systems. If early humans did not learn to exploit new sources of energy, humankind would still be living in the tropical forests. Without the continual exploitation of new energy sources, there would have been no civilization, no Industrial Revolution and no looming global catastrophe. In order to insure energy and economic independence as well as better economic growth without being blackmailed by foreign countries, our country, the United States of America utilization of energy sources must change. "Energy drives our entire economy. We must protect it. "Let's face it, without energy the whole economy and economic society we have set up would come to a halt. So you want to have control over such an important resource that you need for your society and your economy." The American way of life is not negotiable. Our continued dependence on fossil fuels could and will lead to catastrophic consequences.

Heg (4/6)

### Defense cuts are destroying our military readiness, which is key to our primacy- cutting costs would free up extra money and solve hege.

Eaglen 11 (Mackenzie, March 3, 2011, “Assessing the Strategic Readiness of the U.S. Armed Forces”, Testimony before The Readiness Subcommittee of The House Committee on Armed Services, http://www.heritage.org/research/testimony/2011/03/assessing-the-strategic-readiness-of-the-us-armed-forces)

Death by a Thousand Cuts Over the past two years, policymakers have cut plans and programs which are critical to recapitalizing the legacy fleets of all the military services. The Secretary of Defense has warned that a resource-constrained environment requires hard choices be made, and on that basis has cancelled or sought to kill a number of defense programs, including the F-22 fifth-generation fighter, the C-17 cargo aircraft, the VH-71 helicopter, the Air Force’s combat search and rescue helicopter, and the combat vehicle portion of the Army’s Future Combat System. While the Army is attempting to build a replacement ground combat vehicle, this is essentially the third generation of modernization skipped in the last 30 years. Missile defenses have suffered as well. In September 2009, the Administration cancelled America’s commitment to place land-based interceptors in Poland and a radar in the Czech Republic. Further, the Pentagon reduced the overall budget for missile defense in 2010 by $1.6 billion, or 16 percent from 2009 levels. Specifically, the Administration scaled back the number of ground-based midcourse interceptors in Alaska and California from the planned 44 to 30, terminated the multiple kill vehicle program for defeating countermeasures, deferred the purchase of a second Airborne Laser aircraft, abandoned the Kinetic Energy Interceptor program (designed for intercepting ballistic missiles in their boost phase), and purged funding for the space test bed for missile defense. These recent defense cuts come on top of the military’s dramatic reduction that began in the early 1990s. The size of the U.S. Navy has been cut by half since then, and today it is the smallest it has been since 1916. Yet in a speech last May, the Secretary of Defense ridiculed the idea that the U.S. Navy is too weak. Recent decisions are reducing core naval capabilities, however. On Gates’s watch, the Navy has already ended purchases of the next-generation DDG-1000 destroyers, extended the production of the next carrier from four years to five, killed the MPF-A large-deck aviation ship and its mobile landing platform, and delayed indefinitely the next-generation cruiser. Overall, defense spending is falling by every metric: as a percentage of the federal budget, as a percentage of the overall economy, and in real terms. Yet even with the dizzying pace of defense reductions of late, some policymakers are increasing their demands for more defense cuts. Defense budget cuts are already having dramatic negative consequences for the U.S. military today, and will compromise America’s ability to fight and win both war and peace tomorrow. If America’s elected officials do not reverse the rapid decline in long-standing core U.S. military capabilities, the United States will not only lose a core ingredient of the nation’s superpower status; it will be unable to sustain the capabilities necessary to defend vital American interests in an increasingly unsettled world. Because not every potential threat can be predicted and because procurement cycles typically take decades to field a particular system, the U.S. military must plan its forces around a grand strategy and hedge with specific capabilities to meet any future requirements. These core capabilities--many of which the military possesses today--should be the mainstays of strategic planning. They include: Protecting and defending the U.S. and its allies against attack, Air dominance, Maritime control, Space control, Counterterrorism, Counterinsurgency, The ability to seize and control territory against organized ground forces, Projecting power to distant regions, and Information dominance throughout cyberspace. The traditional margins of U.S. military technological superiority are declining across the services and domains. Those margins—too often considered a birthright—have helped uphold the implicit contract most Americans have had with the all-volunteer military and ensured our forces were never in a “fair fight.” That is simply no longer the case.

Heg (5/6)

### SBSP will improve strategic flexibility of the military by providing units with energy without relying on vulnerable, terrestrial systems.

National Security Space Office 07(10 October, 2007, **“**Space‐Based Solar Power As an Opportunity for Strategic Security”, Report to the Director, National Security Space Office)

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 21 st 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 security energy supply.

Heg (6/6)

### SPSB cuts the need for costly gasoline to be delivered to isolated bases, saving millions and lives.

Smith, 2007 (Colonel M.V. “Coyote” Smith, is a PhD student in the strategic studies program under Professor Colin Gray at the University of Reading in the UK and an expert on spacepower, “The Goal for 2050 and the Build Forward,” Aug. 7, Space Solar Power, <http://spacesolarpower.wordpress.com/2007/08/07/the-goal-for-2050/>, accessed 7/7, JDC)

To give you a basis for analysis, by 2050 the goal is to have forty or so concentrator-photovoltaic space-based solar power (SBSP) satellites in geostationary orbit, each broadcasting via microwave between 2-5 gigawatts of power to terrestrial electrical power grids, with 1-to-5 broadcast antennas that can beam power to as many locations. This must be done using a sound business case. John Mankins calculates that this can be achieved by keeping the costs of delivery and assembly on orbit below $3,500 per kilogram–keeping the cost to customers below $0.10 per kilowatt/hour. This will drive robotic assembly and tug systems to pull these enormous structures from low orbits to geostationary. On orbit fueling stations will be required. Paul Werbos believes the best way to do this is to get launch costs down below $200 per kilogram. But several other factors help make the business case. For example, if the prices of other energy sources goes up it helps to close the business case for SBSP. Other factors include the efficiencies associated with solar collectors, energy conversion, antennas/rectennas, signal path loss, etc. Dennis Wingo and others have suggested that the first customers for space-based solar power will be international–in areas such as India and Japan where the price per kilowatt/hour is astronomical compared to the Americas or Europe. All of this goes into making the business case. There will also be times when space-based solar power becomes priceless. When the Tsunami crushed the Pacific rim, when Hurricane Katrina flattened America’s Gulf Coast, and when United Nations forces responded to the beleaguered Darfur region the value of simply broadcasting power immediately to the relief efforts would have been priceless in assisting the salvation of countless lives and facilitated the more immediate recovery of these disaster torn regions. Keep in mind American and Allied forces operating inside Iraq. Convoying petroleum through the streets of Iraqi cities is a large source of casualties…and the electrical power plants that convert that petroleum into electricity are under frequent attack…and the lights go out…and the people aren’t happy. As I’ve mentioned before, one of our defense analysts calculated that the U.S. is paying between $300-to-$800 per gallon for fuel delivered to the Iraqi electric plants. Mike Hornetschek reports that 70% of all logistics movements inside Iraq is petroleum. Inside Iraq, at this very moment–where people are dying–a supply of space-based solar power would have that priceless quality. And this is true wherever military forces and others are engaged not only in combat, but in nation building, humanitarian relief, disaster response, etc, etc, etc. The question was posed to me today, “What does the military need.” Here goes: According to Mike Hornitschek, a military base inside the United States consumes approximately 10 megawatts of electrical power. Forward military base overseas are consuming approximately 5 megaWatts of electrical power. I need space-based solar power satellites of the 5 megawatt class. Let’s say by 2015. This capability will transform our logistics and reduce our vulnerabilities. The development of this class of space-based solar power satellite is designed to deliver that priceless quality of energy. Best of all, it can be done with current technology using current spacelift vehicles. Think about that. But most important of all, developing the 5 megawatt class of satellite gets the ball rolling towards the 2050 vision that started this discussion. We WILL learn a great deal and we WILL find new efficiencies. We may make huge adjustments in the trade spaces as detailed in a previous discusion, and must be prepared to do so. In pressing ahead to field a 5 megawatt system, we will also be building the space industrial base and developing the rquisite spacefaring infrastructure to make the business case for the 2050 vision all the more viable. There will likely be cities or regional utilities that will want to buy their own 5 megawatt satellite (or larger) as a backup, which will help the business case even more and give us a better look at problems that lie waiting for us as we build bigger systems.

## Energy (1/7)

### Dependence of oil drives up prices of consumer goods, prolongs the recession as well as increase terrorist activity.

Major Brian R. Stuart, USAF (April 2007. “Oil and Security Don’t Mix: Why the US can’t Ignore Dependency” pg 1-2)

The issue of United States (US) dependence on foreign oil impacts most Americans. Every time "prices rise at the pump." Americans feel and recognize the impact on the economy and their income. However, the price of gasoline is one very small aspect of the larger issues revolving around the amount of oil the US consumes, and more precisely, the amount of oil the US imports. The American lifestyle is currently dependent upon an uninterrupted flow of foreign oil into the US to meet the current and future needs of the nation. Halting or interrupting the flow of oil would have a detrimental impact on the US economy and way of life. From an economic perspective, the nation would sec an increase in the price of transporting goods and services, which would drive higher prices for all consumer goods without a corresponding increase in wages. Additionally, economists predict sharp spikes in oil and gasoline prices could easily drive the US into a prolonged recession. "All economic downturns in the United States since 1973...have been preceded by sharp increases in the price of oil."1 "Even a relatively minor disruption of the global oil supply has the potential to cause economic dislocation for tens of millions of Americans."2 But the economic implications are only part of the issue. The US military would suffer from budgetary constraints. Reasonable forecasts for the price of gasoline for tanks, airplanes, and vehicles establish the military fuel budget. A sharp and unexpected price increase would wreak havoc on the military budget. The military could be forced to cut spending in order to pay for gasoline required to maintain readiness and fight the Global War on Terrorism (GWOT). The ability of the US to utilize all instruments of power depends upon an uninterrupted supply of foreign oil. The United States dependence on foreign oil is significant national security concern. Oil dependence erodes national security, constrains US actions and diplomatic effectiveness, and retards global development by perpetuating corruption and terrorist activity? Political influences in regions of the world that supply oil are limited, and this is no secret. This fact inhibits the US' ability to promote its stated objectives and pursue national interests; at the same time, it strengthens terrorist networks. "The US has been forced to coddle some of the world's worst despots just because they held the key to our prosperity hence compromising American values and principles.'"1 Many Americans even believe that the US initiated a war in Iraq to gain control of oil resources for energy security. This belief does not appear to have merit when one looks at the entire situation; however, it does highlight the fact that oil dependence is a national problem. Senator Ken Salazar referred to it as a "major national security issue,"5 and President George Bush called it a "foreign lax on the American dream.""

Energy (2/7)

### A U.S. economic collapse leads to global economic depression

Walter Mead, Senior Fellow at the Council on Foreign Relations, March/April, 2004 America’s Sticky Power, Foreign Policy, Proquest

Similarly, in the last 60 years, as foreigners have acquired a greater value in the United States-government and private bonds, direct and portfolio private investments-more and more of them have acquired an interest in maintaining the strength of the U.S.-led system. A collapse of the U.S. economy and the ruin of the dollar would do more than dent the prosperity of the United States. Without their best customer, countries including China and Japan would fall into depressions. The financial strength of every country would be severely shaken should the United States collapse. Under those circumstances, debt becomes a strength, not a weakness, and other countries fear to break with the United States because they need its market and own its securities. Of course, pressed too far, a large national debt can turn from a source of strength to a crippling liability, and the United States must continue to justify other countries' faith by maintaining its long-term record of meeting its financial obligations. But, like Samson in the temple of the Philistines, a collapsing U.S. economy would inflict enormous, unacceptable damage on the rest of the world.

Energy (3/7)

### Global economic collapse causes extinction

Thomas Bearden, Association of Distinguished American Scientists and LTC, U.S. Army (Retired), 2000 ("The Unnecessary Energy Crisis: How to Solve It Quickly", http://www.seaspower.com/EnergyCrisis-Bearden.htm)

History bears out that desperate nations take desperate actions. Prior to the final economic collapse, the stress on nations will have increased the intensity and number of their conflicts, to the point where the arsenals of weapons of mass destruction (WMD) now possessed by some 25 nations, are almost certain to be released.~ As an example, suppose a starving North Korea {[7]} launches nuclear weapons upon Japan and South Korea, including U.S. forces there, in a spasmodic suicidal response. Or suppose a desperate China--whose long-range nuclear missiles (some) can reach the United States--attacks Taiwan. In addition to immediate responses, the mutual treaties involved in such scenarios will quickly draw other nations into the conflict, escalating it significantly. Strategic nuclear studies have shown for decades that, under such extreme stress conditions, once a few nukes are launched, adversaries and potential adversaries are then compelled to launch [nukes]on perception of preparations by one's adversary.~ The real legacy of the MAD concept is this side of the MAD coin that is almost never discussed. Without effective defense, the only chance a nation has to survive at all is to launch immediate full-bore pre-emptive strikes and try to take out its perceived foes as rapidly and massively as possible. As the studies showed, rapid escalation to full WMD exchange occurs. Today, a great percent of the WMD arsenals that will be unleashed, are already on site within the United States itself {[8]}. The resulting great Armageddon will destroy civilization as we know it, and perhaps most of the biosphere, at least for many decades.

Energy (4/7)

### Increased terrorist activity will lead to extinction

Jennifer Viegas, Discovery News Reporter November 11, 2009 (Discovery News: “Human Extinction: How Could it Happen?” http://news.discovery.com/human/human-extinction-doomsday.html)

Humans could become extinct, a new study concludes, but no single event, aside from complete destruction of the globe, could do us in, and all extinction scenarios would have to involve some kind of intent, either malicious or not, by people in power. The determinations suggest that the human race itself will ultimately determine its fate. "I think the ability to adapt very quickly is singular to humanity," project leader Tobin Lopes told Discovery News. "Species progress and evolve to enhance their chances, but it's done over a very long period of time." "Instinct guides a lot of what we do early in our lives, but the capacity to learn different behaviors as a result of different environments makes humanity capable of survival," added Lopes, who is associate director of global energy management programs at the University of Colorado Denver. For the study, accepted for publication in the journal Futures, Lopes and his team used a standardized approach for scenario planning called "intuitive logics," which is normally applied to predict business, economic and certain other outcomes. "The intuitive logics approach, and scenario planning as a practice, starts with the present and works forward to an unknown future," he explained. Co-authors served as "stakeholders," just as they would in planning a business, and identified key concerns that may adversely affect them. WATCH VIDEO: The Earth is in the middle of its sixth mass extinction. Kasey-Dee Gardner finds out why they happen in the first place, and how we can save our planet. The concerns were ranked according to possible impact and uncertainty before being plugged into the model, which also incorporated known outcomes, such as attack response times, prior pandemic death percentages, and detection-to-cure time frames. The result was three scenarios in which humans could go extinct. Each consists of multiple events, such as pandemic, warfare, global warming-related occurrences and a meteor strike, which occur in relative succession and result in equally destructive domino effects, such as societal breakdowns leading to economic decline and escalated terrorism.

Energy (5/7)

### SSP solves oil dependence, independently, the impact is great power war and prevents oil shocks.

NSSO, 2007, SBSP Study Group, 2007, 10 October 2007, (National Security Space Office, Space-Based Solar Power, As an Opportunity for Strategic Security, Phase 0 Architecture Feasibility Study, <http://www.acq.osd.mil/nsso/solar/SBSPInterimAssesment0.1.pdf>)

Overall, SBSP offers a hopeful path toward reduced fossil and fissile fuel dependence. FINDING: The SBSP Study Group found that SBSP offers a long-term route tu 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.

Energy (6/7)

### Oil shocks ensure extinction.

Richard Heinberg, core faculty member at New College of California, The Party’s Over: Oil, War and the Fate of Industrial Societies, 2003, p. 230

Today the average US citizen uses five times as much energy as the world average. Even citizens of nations that export oil – such as Venezuela and Iran – use only a small fraction of the energy US citizens use per capita. The Carter Doctrine, declared in 1980, made it plain that US military might would be applied to the project of dominating the world’s oil wealth: henceforth, any hostile effort to impede the flow of Persian Gulf oil would be regarded as an “assault on the vital interests of the United States” and would be “repelled by any means necessary, including military force.” In the past 60 years, the US military and intelligence services have grown to become bureaucracies of unrivaled scope, power, and durability. While the US has not declared war on any nation since 1945, it has nevertheless bombed or invaded a total of 19 countries and stationed troops, or engaged in direct or indirect military action, in dozens of others. During the Cold War, the US military apparatus grew exponentially, ostensibly in response to the threat posed by an archrival: the Soviet Union. But after the end of the Cold War the American military and intelligence establishments did not shrink in scale to any appreciable degree. Rather, their implicit agenda — the protection of global resource interests emerged as the semi-explicit justification for their continued existence. With resource hegemony came challenges from nations or sub-national groups opposing that hegemony. But the immensity of US military might ensured that such challenges would be overwhelmingly asymmetrical. US strategists labeled such challenges “terrorism” — a term with a definition malleable enough to be applicable to any threat from any potential enemy, foreign or domestic, while never referring to any violent action on the part of the US, its agents, or its allies. This policy puts the US on a collision course with the rest of the world. If all-out competition is pursued with the available weapons of awesome power, the result could be the destruction not just of industrial civilization, but of humanity and most of the biosphere.

Energy (7/7)

### SBSP technology creates energy independence.

NSS ‘7 [National Space Society, October, “Space Solar Power—Limitless clean energy from space”, http://www.nss.org/settlement/ssp/index.htm, DeFilippis]

The United States and the world need to find new sources of clean energy. Space Solar Power gathers energy from sunlight in space and transmits it wirelessly to Earth. Space solar power can solve our energy and greenhouse gas emissions problems. Not just help, not just take a step in the right direction, but solve. Space solar power can provide large quantities of energy to each and every person on Earth with very little environmental impact. The solar energy available in space is literally billions of times greater than we use today. The lifetime of the sun is an estimated 4-5 billion years, making space solar power a truly long-term energy solution. As Earth receives only one part in 2.3 billion of the Sun's output, space solar power is by far the largest potential energy source available, dwarfing all others combined. Solar energy is routinely used on nearly all spacecraft today. This technology on a larger scale, combined with already demonstrated wireless power transmission (see 2-minute video of demo), can supply nearly all the electrical needs of our planet. Another need is to move away from fossil fuels for our transportation system. While electricity powers few vehicles today, hybrids will soon evolve into plug-in hybrids which can use electric energy from the grid. As batteries, super-capacitors, and fuel cells improve, the gasoline engine will gradually play a smaller and smaller role in transportation — but only if we can generate the enormous quantities of electrical energy we need. It doesn't help to remove fossil fuels from vehicles if you just turn around and use fossil fuels again to generate the electricity to power those vehicles. Space solar power can provide the needed clean power for any future electric transportation system. While all viable energy options should be pursued with vigor, space solar power has a number of substantial advantages over other energy sources. Advantages of Space Solar Power (also known as Space-Based Solar Power, or SBSP) Unlike oil, gas, ethanol, and coal plants, space solar power does not emit greenhouse gases. Unlike coal and nuclear plants, space solar power does not compete for or depend upon increasingly scarce fresh water resources. Unlike bio-ethanol or bio-diesel, space solar power does not compete for increasingly valuable farm land or depend on natural-gas-derived fertilizer. Food can continue to be a major export instead of a fuel provider. Unlike nuclear power plants, space solar power will not produce hazardous waste, which needs to be stored and guarded for hundreds of years. Unlike terrestrial solar and wind power plants, space solar power is available 24 hours a day, 7 days a week, in huge quantities. It works regardless of cloud cover, daylight, or wind speed. Unlike nuclear power plants, space solar power does not provide easy targets for terrorists. Unlike coal and nuclear fuels, space solar power does not require environmentally problematic mining operations. eliminating a major Space solar power will provide true energy independence for the nations that develop it, source of national competition for limited Earth-based energy resources. Space solar power will not require dependence on unstableor hostile foreign oil providers to meet energy needs, enabling us to expend resources in other ways. Space solar power can be exported to virtually any place in the world, and its energy can be converted for local needs — such as manufacture of methanol for use in places like rural India where there are no electric power grids. Space solar power can also be used for desalination of sea water. Space solar power can take advantage of our current and historic investment in aerospace expertise to expand employment opportunities in solving the difficult problems of energy security and climate change. Space solar power can provide a market large enough to develop the low-cost space transportation system that is required for its deployment. This, in turn, will also bring the resources of the solar system within economic reach.

## Warming (1/6)

### Scientific consensus proves warming is real and caused by humans. Neg authors are *paid off*.

Suzuki 7/19/10 (David, Chair of the David Suzuki Foundation, is an award-winning scientist, Environmentalist, Science deals blow to deluded climate change deniers, http://www.bclocalnews.com/opinion/98758379.html)

It must be difficult, if not downright embarrassing, to be a climate change denier these days. After all, the scientists they’ve attacked have been exonerated, London’s Sunday Times newspaper ran a retraction and apology for an article deniers were using to discredit climate change science, and more and more denier “experts” are being exposed as shills for industry or just disingenuous clowns. (Naomi Oreskes’s excellent book Merchants of Doubt offers insight into how the deniers operate.) Meanwhile, evidence that fossil fuel emissions contribute to dangerous climate change just keeps building. We use the term deniers deliberately. People who deny overwhelming scientific evidence without providing any compelling evidence of their own and who remain steadfast in their beliefs even as every argument they propose gets shot down do not demonstrate the intellectual rigour to be called skeptics. Mean-while, evidence of the harm our fossil fuel addiction causes beyond climate change mounts every day, as oil spews into the Gulf of Mexico and as industry and governments spend huge sums of money to keep us hooked. Of course, the deniers will ignore the evidence. Nothing would please us more than if they were right. Life really would be easier if fossil fuels like oil and coal did not cause environmental damage or pose risks to life on our small planet. But this is the real world, with real scientific evidence pointing to the urgent need to make changes in the way we live and get energy. We have many ways to confront the threat of catastrophic climate change, from individual efforts to conserve energy and pollute less to government initiatives to encourage research and development into clean energy technology.

And then we have the spectacle of the fossil fuel industry and petro-fuelled governments doing all they can to prolong our addiction to nonrenewable and polluting sources of energy as oil continues to gush into the Gulf of Mexico, threatening bird, marine, and human life, as well as local economies.

Warming (2/6)

### We will hit the brink by 2030

Stein 6/26/2011 ((Science editor for the magazine the Canadian) http://www.agoracosmopolitan.com/home/Frontpage/2007/02/26/01381.html) ja

Given time lags of 30-50 years, we might have already put enough extra greenhouse gases into the atmosphere to have crossed a threshold to these bombs exploding, their released greenhouse gases leading to ever accelerating global warming with future global temperatures maybe tens of degrees higher than our norms of human habitation and therefore extinction or very near extinction of humanity. "(T)he science is clear. We need not a 20% cut by 2020; not a 60% cut by 2050, but a 90% cut by 2030 (1). Only then do we stand a good chance of keeping carbon concentrations in the atmosphere below 430 parts per million, which means that only then do we stand a good chance of preventing some of the threatened positive feedbacks. If we let it get beyond that point there is nothing we can do. The biosphere takes over as the primary source of carbon. It is out of our hands," George Monbiot says. Ticking Time Bomb by John Atcheson , a geologist writing in the Baltimore Sun, is the best and almost only mainstream media explanation of runaway global warming and how close we are to extinction. "There are enormous quantities of naturally occurring greenhouse gasses trapped in ice-like structures in the cold northern muds and at the bottom of the seas. These ices, called clathrates, contain 3,000 times as much methane as is in the atmosphere. Methane is more than 20 times as strong a greenhouse gas as carbon dioxide." Stephen Connor reported in the February 16, edition of The Independent that, "The long-term stability of the massive ice sheets of Antarctica, which have the potential to raise sea levels by hundreds of metres, has been called into question with the discovery of fast-moving rivers of water sliding beneath their base."

Warming (3/6)

### Independently, warming is the only existential risk.

Deibel ’07—Prof IR @ National War College (Terry, “Foreign Affairs Strategy: Logic for American Statecraft,” Conclusion: American Foreign Affairs Strategy Today)

Finally, there is one major existential threat to American security (as well as prosperity) of a nonviolent nature, which, though far in the future, demands urgent action. It is the threat of global warming to the stability of the climate upon which all earthly life depends. Scientists worldwide have been observing the gathering of this threat for three decades now, and what was once a mere possibility has passed through probability to near certainty. Indeed not one of more than 900 articles on climate change published in refereed scientific journals from 1993 to 2003 doubted that anthropogenic warming is occurring. “In legitimate scientific circles,” writes Elizabeth Kolbert, “it is virtually impossible to find evidence of disagreement over the fundamentals of global warming.” Evidence from a vast international scientific monitoring effort accumulates almost weekly, as this sample of newspaper reports shows: an international panel predicts “brutal droughts, floods and violent storms across the planet over the next century”; climate change could “literally alter ocean currents, wipe away huge portions of Alpine Snowcaps and aid the spread of cholera and malaria”; “glaciers in the Antarctic and in Greenland are melting much faster than expected, and…worldwide, plants are blooming several days earlier than a decade ago”; “rising sea temperatures have been accompanied by a significant global increase in the most destructive hurricanes”; “NASA scientists have concluded from direct temperature measurements that 2005 was the hottest year on record, with 1998 a close second”; “Earth’s warming climate is estimated to contribute to more than 150,000 deaths and 5 million illnesses each year” as disease spreads; “widespread bleaching from Texas to Trinidad…killed broad swaths of corals” due to a 2-degree rise in sea temperatures. “The world is slowly disintegrating,” concluded Inuit hunter Noah Metuq, who lives 30 miles from the Arctic Circle. “They call it climate change…but we just call it breaking up.” From the founding of the first cities some 6,000 years ago until the beginning of the industrial revolution, carbon dioxide levels in the atmosphere remained relatively constant at about 280 parts per million (ppm). At present they are accelerating toward 400 ppm, and by 2050 they will reach 500 ppm, about double pre-industrial levels. Unfortunately, atmospheric CO2 lasts about a century, so there is no way immediately to reduce levels, only to slow their increase, we are thus in for significant global warming; the only debate is how much and how serous the effects will be. As the newspaper stories quoted above show, we are already experiencing the effects of 1-2 degree warming in more violent storms, spread of disease, mass die offs of plants and animals, species extinction, and threatened inundation of low-lying countries like the Pacific nation of Kiribati and the Netherlands at a warming of 5 degrees or less the Greenland and West Antarctic ice sheets could disintegrate, leading to a sea level of rise of 20 feet that would cover North Carolina’s outer banks, swamp the southern third of Florida, and inundate Manhattan up to the middle of Greenwich Village. Another catastrophic effect would be the collapse of the Atlantic thermohaline circulation that keeps the winter weather in Europe far warmer than its latitude would otherwise allow. Economist William Cline once estimated the damage to the United States alone from moderate levels of warming at 1-6 percent of GDP annually; severe warming could cost 13-26 percent of GDP. But the most frightening scenario is runaway greenhouse warming, based on positive feedback from the buildup of water vapor in the atmosphere that is both caused by and causes hotter surface temperatures. Past ice age transitions, associated with only 5-10 degree changes in average global temperatures, took place in just decades, even though no one was then pouring ever-increasing amounts of carbon into the atmosphere. Faced with this specter, the best one can conclude is that “humankind’s continuing enhancement of the natural greenhouse effect is akin to playing Russian roulette with the earth’s climate and humanity’s life support system. At worst, says physics professor Marty Hoffert of New York University, “we’re just going to burn everything up; we’re going to heat the atmosphere to the temperature it was in the Cretaceous when there were crocodiles at the poles, and then everything will collapse.” During the Cold War, astronomer Carl Sagan popularized a theory of nuclear winter to describe how a thermonuclear war between the Untied States and the Soviet Union would not only destroy both countries but possibly end life on this planet. Global warming is the post-Cold War era’s equivalent of nuclear winter at least as serious and considerably better supported scientifically. Over the long run it puts dangers from terrorism and traditional military challenges to shame. It is a threat not only to the security and prosperity to the United States, but potentially to the continued existence of life on this planet

Warming (4/6)

### Warming causes the Earth’s core to overheat-makes the world go death star.

Dr. Tom J. Chalko, MS, Engineering & PhD, Laser Holography, “Global Warming: Can Earth Explode?” 2002, <http://www.bioresonant.com/news.htm>.

The real danger for our entire civilization comes not from slow climate changes, but from overheating the planetary interior. Galileo discovered that Earth moves. Copernicus discovered that Earth moves around the Sun. In 2000 Tom Chalko, inspired by Desmarquet's report, discovered that the solid nucleus of our planet is in principle a nuclear reactor and that our collective ignorance may cause it to overheat and explode. The discovery has been published in June 2001 by the new scientific journal NUJournal.net. Polar ice caps melt not because the air there is warmer than 0 deg Celsius, but because they are overheated from underneath. Volcanoes become active and erupt violently not because the Earth's interior "crystallizes", but because the planetary nucleus is a nuclear fission reactor that needs COOLING. It seems that the currently adopted doctrine of a "crystalline inner core of Earth" is more dangerous for humanity than all weapons of mass destruction taken together, because it prevents us from imagining, predicting and preventing truly global disasters. In any nuclear reactor, the danger of overheating has to be recognized early. When external symptoms intensify it is usually too late to prevent disaster. Do we have enough imagination, intelligence and integrity to comprehend the danger before the situation becomes irreversible? Did you see the figure above? It seems that if we do not do anything today about Greenhouse Emissions that cause the entire atmosphere to trap more Solar Heat, we may not survive the next decade. In a systematically under-cooled spherical core reactor the cumulative cause-effect relationship is hyperbolic and leads to explosion. It seems that there will be no second chance.

Warming (5/6)

### SPS solves warming entirely, it’s comparatively better than all other solutions.

NSS ’11, National Space Society June 3, 2011, “Space Solar Power: Limitless clean energy from space”, http://www.nss.org/settlement/ssp/)

The United States and the world need to find new sources of clean energy. Space Solar Power gathers energy from sunlight in space and transmits it wirelessly to Earth. Space solar power can solve our energy and greenhouse gas emissions problems. Not just help, not just take a step in the right direction, but solve. Space solar power can provide large quantities of energy to each and every person on Earth with very little environmental impact. The solar energy available in space is literally billions of times greater than we use today. The lifetime of the sun is an estimated 4-5 billion years, making space solar power a truly long-term energy solution. As Earth receives only one part in 2.3 billion of the Sun's output, space solar power is by far the largest potential energy source available, dwarfing all others combined. Solar energy is routinely used on nearly all spacecraft today. This technology on a larger scale, combined with already demonstrated wireless power transmission (see 2-minute video of demo), can supply nearly all the electrical needs of our planet.

Warming (6/6)

### Even if the plan doesn’t immediately solve-it would facilitate greater research and development that would.

Fan et al ‘10, William Fan, Harold Martin, James Wo, Brian Mak, “Industry and Technology Assesment”, Space Based Solar Power, June 2, 2011, http://www.pickar.caltech.edu/e103/Final%20Exams/Space%20Based%20Solar%20Power.pdf

SBSP is environmentally net positive when including the negative effects of space launches (space launches are 3% of CFC emissions, but we have not calculated emissions saved. There are also too many different kinds of rocket fuels with different effects). It is possible to increase launches from approximately 15 (in US) to around 120. The objective is to create a space based solar power system that will be able to provide enough power to offset a more traditional power plant. Due to the developing nature of space based solar, most short term goals will be to progress in research and development. Within 10 years, the business should send a preliminary pilot satellite into low earth orbit to determine the viability of the incorporated wireless power transmission technique. Longer term goals will concentrate on making the company into a viable alternative energy provider and encouraging further investment into the industry. In 25- 30 years, the business should to launch a satellite that could satisfy the needs of the niche markets such as energy generation for forward military installations. Shortly after, the business should follow up with additional launches to create a satellite capable of outputting 0.5-1 GigaWatts.

## Plan

### And, thus the Plan: The United States federal government should demonstrate wireless power transmission from the International Space Station to Earth.

## Solvency (1/2)

### Space-based solar power can be ready in less than a decade; a demonstration on the ISS would spur private-sector development.

Morring 07 (Frank, “NSSO Backs Space Solar Power”, Oct 11, 2007, Aviation Weekly, http://www.aviationweek.com/aw/generic/story\_generic.jsp?channel=space&id=news/solar101107.xml&headline=NSSO%20Backs%20Space%20Solar%20Power”

Collecting solar power in space and beaming it back to Earth is a relatively near-term possibility that could solve strategic and tactical security problems for the U.S. and its deployed forces, the Pentagon's National Security Space Office (NSSO) says in a report issued Oct. 10. As a clean source of energy that would be independent of foreign supplies in the strife-torn Middle East and elsewhere, space solar power (SSP) could ease America's longstanding strategic energy vulnerability, according to the "interim assessment" released at a press conference and on the Web site spacesolarpower.wordpress.com. And the U.S. military could meet tactical energy needs for forward-deployed forces with a demonstration system, eliminating the need for a long logistical tail to deliver fuel for terrestrial generators while reducing risk for eventual large-scale commercial development of the technology, the report says. "The business case still doesn't close, but it's closer than ever," said Marine Corps Lt. Col. Paul E. Damphousse of the NSSO, in presenting his office's report. That could change if the Pentagon were to act as an anchor tenant for a demonstration SSP system, paying above-market rates for power generated with a collection plant in geostationary orbit beaming power to U.S. forces abroad or in the continental U.S., according to Charles Miller, CEO of Constellation Services International and director of the Space Frontier Foundation. By buying down the risk with a demonstration at the tactical level, the U.S. government could spark a new industry able to meet not just U.S. energy needs, but those of its allies and the developing world as well. The technology essentially exists, and needs only to be matured. A risk buy-down by government could make that happen, according to the NSSO report. "This is not a 50-year solution," said John Mankins, an expert in the field and president of the Space Power Association. "The kinds of things that are possible today say a truly transformational demonstration at a large scale is achievable within this decade." As an example, Mankins listed the rapid progress in boosting the efficiency of solar cells. While 20-25 percent efficiency was once considered a long-term goal, efficiencies on the order of 40 percent already have been achieved. And the modularity and scalability of the systems needed to build an SSP platform make testing relatively straightforward. Even from its perch in low-Earth orbit, for example, the International Space Station could be used as a test bed for SSP components and even demonstrate low-level power transmission from orbit to Earth. The exposed facility on Japan's Kibo laboratory, due for launch in the first half of next year, could be used to test pointing and transmitting hardware, Mankins said, as well as to conduct space-exposure experiments on materials that might be used in building the large structures needed to collect sunlight in meaningful amounts. The Internet-based group of experts who prepared the report for the NSSO recommended that the U.S. government organize itself to tackle the problem of developing SSP; use its resources to "retire a major portion of the technical risk for business development; establish tax and other policies to encourage private development of SSP, and "become an early demonstrator/adopter/customer" of SSP to spur its development. That, in turn, could spur development of space launch and other industries. Damphousse said a functioning reusable launch vehicle - preferably single-stage-to-orbit - probably would be required to develop a full-scale SSP infrastructure in geostationary orbit. That, in turn, could enable utilization of the moon and exploration of Mars under NASA's vision for space exploration.

Solvency (2/2)

### The private sector still lacks a proof of concept of SBSP; a demonstration on the ISS would catalyze commercial interest in the technology.

Boyle 07 (Alan, “Power from space? Pentagon likes the idea”, 10/12/2007, MSNBC, http://www.msnbc.msn.com/id/21253268/ns/technology\_and\_science-space/t/power-space-pentagon-likes-idea/)

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 Agency, or NASA, or the proposed Advanced Research Projects Energy. 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. Time for a reality check 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, 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."

# Eco-1AC

## Inherency

### Contention 1 is Inherency-

### SBSP is drastically underfunded-this kills effectiveness.

Hamilton, 2007 (Tyler, “Space-based solar power back in play,” Oct. 15, The Toronto Star, lexis)

High oil prices, energy security fears and the potentially devastating effects of climate change have prompted the U.S. government to again explore the idea of placing millions of solar panels in orbit to beam immense amounts of clean power back to Earth. Seriously.  An agency called the National Security Space Office, which reports to the U.S. Department of Defence, released a feasibility study last week recommending that "space-based solar power," an idea first proposed in the U.S. some 40 years ago, be pursued in the name of national security.  The sun, after all, shines more strongly and for 24 hours a day in space, outside the filters of Earth's clouds and its relatively dirty atmosphere. There are also few real-estate problems up there, fewer people to complain and the potential of having a fuelling post for Richard Branson and other private space travellers.  According to the study, the energy collected would be electromagnetically beamed back to Earth and connected to the electrical grid, or used in the manufacture of synthetic fuels. It even suggests that weaker beams could be directed at individual households.  Seriously.  "A single kilometre-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," the study states. "There is 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 (the) capability."  It also says that Canada, among others, has expressed interest in such a project.  Again, the discussion has come up before. NASA and the U.S. Department of Defense have together spent about $80 million (U.S.) over the last three decades studying the idea. Seems like decent money, until you see that the U.S. government has spent about $21 billion over 50 years on that elusive energy utopia called nuclear fusion.  Perhaps it is time to give space-based solar power another look, given that such a system might already exist today had it received the money dumped into fusion.

## Plan

### Plan: The United States federal government should demonstrate wireless power transmission from the International Space Station to Earth.

## Warming (1/6)

### Contention 2 is Warming-

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Warming (2/6)

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Warming (3/6)

### Timeframe is now-warming will become irreversible in 100 months-that’s 65 now.

Guardian Weekly, 8 (Andrew Simms, “Guardian Weekly: Just 100 months left to save Earth: Andrew Simms on a New Green Deal that could forestall the climate change tipping point”, 8/15, L/N)

In just 100 months' time, if we are lucky, and based on a conservative estimate, we could reach a tipping point for the beginnings of runaway climate change. Let us be clear exactly what we mean. The concentration of carbon dioxide (CO2) in the atmosphere today, the most prevalent greenhouse gas, is the highest it has been for the past 650,000 years. In just 250 years, as a result of the coal-fired Industrial Revolution, and changes to land use such as the growth of cities and the felling of forests, we have released more than 1,800bn tonnes of CO2 into the atmosphere. Currently, approximately 1,000 tonnes of CO2 are released into the atmosphere every second, due to human activity. Greenhouse gases trap incoming solar radiation, warming the atmosphere. When these gases accumulate beyond a certain level - a "tipping point" - global warming will accelerate, potentially beyond control. Faced with circumstances that threaten human civilisation, scientists at least have the sense of humour to term what drives this process as "positive feedback". In climate change, a number of feedback loops amplify warming through physical processes that are either triggered by the initial warming, or the increase in greenhouse gases. One example is the melting of ice sheets. The loss of ice cover reduces the ability of the Earth's surface to reflect heat and, by revealing darker surfaces, increases the amount of heat absorbed. Other dynamics include the decreasing ability of oceans to absorb CO2 due to higher wind strengths, linked to climate change. This has already been observed in the Southern Ocean and North Atlantic, increasing the amount of CO2 in the atmosphere, and adding to climate change. Because of such self-reinforcing feedbacks, once a critical greenhouse concentration threshold is passed, global warming will continue even if we stop releasing greenhouse gases into the atmosphere. If that happens, the Earth's climate will shift into a more volatile state, with different ocean circulation, wind and rainfall patterns, the implications of which are potentially catastrophic for life on Earth. This is often referred to as irreversible climate change. So, how do we arrive at the ticking clock of 100 months?

Warming (4/6)

### Warming is real and is caused by humans, all scientific consensus goes aff and your authors are *paid off*.

Suzuki 7/19/10 (David, Chair of the David Suzuki Foundation, is an award-winning scientist, Environmentalist, Science deals blow to deluded climate change deniers, http://www.bclocalnews.com/opinion/98758379.html)

It must be difficult, if not downright embarrassing, to be a climate change denier these days. After all, the scientists they’ve attacked have been exonerated, London’s Sunday Times newspaper ran a retraction and apology for an article deniers were using to discredit climate change science, and more and more denier “experts” are being exposed as shills for industry or just disingenuous clowns. (Naomi Oreskes’s excellent book Merchants of Doubt offers insight into how the deniers operate.) Meanwhile, evidence that fossil fuel emissions contribute to dangerous climate change just keeps building. We use the term deniers deliberately. People who deny overwhelming scientific evidence without providing any compelling evidence of their own and who remain steadfast in their beliefs even as every argument they propose gets shot down do not demonstrate the intellectual rigour to be called skeptics. Mean-while, evidence of the harm our fossil fuel addiction causes beyond climate change mounts every day, as oil spews into the Gulf of Mexico and as industry and governments spend huge sums of money to keep us hooked. Of course, the deniers will ignore the evidence. Nothing would please us more than if they were right. Life really would be easier if fossil fuels like oil and coal did not cause environmental damage or pose risks to life on our small planet. But this is the real world, with real scientific evidence pointing to the urgent need to make changes in the way we live and get energy. We have many ways to confront the threat of catastrophic climate change, from individual efforts to conserve energy and pollute less to government initiatives to encourage research and development into clean energy technology.

And then we have the spectacle of the fossil fuel industry and petro-fuelled governments doing all they can to prolong our addiction to nonrenewable and polluting sources of energy as oil continues to gush into the Gulf of Mexico, threatening bird, marine, and human life, as well as local economies.

Warming (5/6)

### Independently, warming is the only existential risk.

**Deibel ’07—Prof IR @ National War College (Terry, “Foreign Affairs Strategy: Logic for American Statecraft,” Conclusion: American Foreign Affairs Strategy Today)**

Finally, there is one major existential threat to American security (as well as prosperity) of a nonviolent nature, which, though far in the future, demands urgent action. It is the threat of global warming to the stability of the climate upon which all earthly life depends. Scientists worldwide have been observing the gathering of this threat for three decades now, and what was once a mere possibility has passed through probability to near certainty. Indeed not one of more than 900 articles on climate change published in refereed scientific journals from 1993 to 2003 doubted that anthropogenic warming is occurring. “In legitimate scientific circles,” writes Elizabeth Kolbert, “it is virtually impossible to find evidence of disagreement over the fundamentals of global warming.” Evidence from a vast international scientific monitoring effort accumulates almost weekly, as this sample of newspaper reports shows: an international panel predicts “brutal droughts, floods and violent storms across the planet over the next century”; climate change could “literally alter ocean currents, wipe away huge portions of Alpine Snowcaps and aid the spread of cholera and malaria”; “glaciers in the Antarctic and in Greenland are melting much faster than expected, and…worldwide, plants are blooming several days earlier than a decade ago”; “rising sea temperatures have been accompanied by a significant global increase in the most destructive hurricanes”; “NASA scientists have concluded from direct temperature measurements that 2005 was the hottest year on record, with 1998 a close second”; “Earth’s warming climate is estimated to contribute to more than 150,000 deaths and 5 million illnesses each year” as disease spreads; “widespread bleaching from Texas to Trinidad…killed broad swaths of corals” due to a 2-degree rise in sea temperatures. “The world is slowly disintegrating,” concluded Inuit hunter Noah Metuq, who lives 30 miles from the Arctic Circle. “They call it climate change…but we just call it breaking up.” From the founding of the first cities some 6,000 years ago until the beginning of the industrial revolution, carbon dioxide levels in the atmosphere remained relatively constant at about 280 parts per million (ppm). At present they are accelerating toward 400 ppm, and by 2050 they will reach 500 ppm, about double pre-industrial levels. Unfortunately, atmospheric CO2 lasts about a century, so there is no way immediately to reduce levels, only to slow their increase, we are thus in for significant global warming; the only debate is how much and how serous the effects will be. As the newspaper stories quoted above show, we are already experiencing the effects of 1-2 degree warming in more violent storms, spread of disease, mass die offs of plants and animals, species extinction, and threatened inundation of low-lying countries like the Pacific nation of Kiribati and the Netherlands at a warming of 5 degrees or less the Greenland and West Antarctic ice sheets could disintegrate, leading to a sea level of rise of 20 feet that would cover North Carolina’s outer banks, swamp the southern third of Florida, and inundate Manhattan up to the middle of Greenwich Village. Another catastrophic effect would be the collapse of the Atlantic thermohaline circulation that keeps the winter weather in Europe far warmer than its latitude would otherwise allow. Economist William Cline once estimated the damage to the United States alone from moderate levels of warming at 1-6 percent of GDP annually; severe warming could cost 13-26 percent of GDP. But the most frightening scenario is runaway greenhouse warming, based on positive feedback from the buildup of water vapor in the atmosphere that is both caused by and causes hotter surface temperatures. Past ice age transitions, associated with only 5-10 degree changes in average global temperatures, took place in just decades, even though no one was then pouring ever-increasing amounts of carbon into the atmosphere. Faced with this specter, the best one can conclude is that “humankind’s continuing enhancement of the natural greenhouse effect is akin to playing Russian roulette with the earth’s climate and humanity’s life support system. At worst, says physics professor Marty Hoffert of New York University, “we’re just going to burn everything up; we’re going to heat the atmosphere to the temperature it was in the Cretaceous when there were crocodiles at the poles, and then everything will collapse.” During the Cold War, astronomer Carl Sagan popularized a theory of nuclear winter to describe how a thermonuclear war between the Untied States and the Soviet Union would not only destroy both countries but possibly end life on this planet. Global warming is the post-Cold War era’s equivalent of nuclear winter at least as serious and considerably better supported scientifically. Over the long run it puts dangers from terrorism and traditional military challenges to shame. It is a threat not only to the security and prosperity to the United States, but potentially to the continued existence of life on this planet

Warming (6/6)

### Warming causes the Earth’s core to overheat-makes the world go death star.

Dr. Tom J. Chalko, MS, Engineering & PhD, Laser Holography, “Global Warming: Can Earth Explode?” 2002, <http://www.bioresonant.com/news.htm>.

The real danger for our entire civilization comes not from slow climate changes, but from overheating the planetary interior. Galileo discovered that Earth moves. Copernicus discovered that Earth moves around the Sun. In 2000 Tom Chalko, inspired by Desmarquet's report, discovered that the solid nucleus of our planet is in principle a nuclear reactor and that our collective ignorance may cause it to overheat and explode. The discovery has been published in June 2001 by the new scientific journal NUJournal.net. Polar ice caps melt not because the air there is warmer than 0 deg Celsius, but because they are overheated from underneath. Volcanoes become active and erupt violently not because the Earth's interior "crystallizes", but because the planetary nucleus is a nuclear fission reactor that needs COOLING. It seems that the currently adopted doctrine of a "crystalline inner core of Earth" is more dangerous for humanity than all weapons of mass destruction taken together, because it prevents us from imagining, predicting and preventing truly global disasters. In any nuclear reactor, the danger of overheating has to be recognized early. When external symptoms intensify it is usually too late to prevent disaster. Do we have enough imagination, intelligence and integrity to comprehend the danger before the situation becomes irreversible? Did you see the figure above? It seems that if we do not do anything today about Greenhouse Emissions that cause the entire atmosphere to trap more Solar Heat, we may not survive the next decade. In a systematically under-cooled spherical core reactor the cumulative cause-effect relationship is hyperbolic and leads to explosion. It seems that there will be no second chance.

## Agriculture (1/12)

### Contention 3 is Agriculture-

### Three internal links-

### First, all other alternative energy takes up space for farm land-only SSP avoids this.

NSS 7 [National Space Society, October, “Space Solar Power—Limitless clean energy from space”, http://www.nss.org/settlement/ssp/index.htm]

Unlike coal and nuclear plants, space solar power does not compete for or depend upon increasingly scarce fresh water resources. Unlike bio-ethanol or bio-diesel, space solar power does not compete for increasingly valuable farm land or depend on natural-gas-derived fertilizer. Food can continue to be a major export instead of a fuel provider. Unlike nuclear power plants, space solar power will not produce hazardous waste, which needs to be stored and guarded for hundreds of years. Unlike terrestrial solar and wind power plants, space solar power is available 24 hours a day, 7 days a week, in huge quantities. It works regardless of cloud cover, daylight, or wind speed.

Agriculture (2/12)

### And, space solar panels are the best way to provide energy to remote areas of the world and provide energy 24/7-that’s key to small farms, maximizes agricultural productivity, and eliminates the need for pesticides.

McMahon ‘7, Robert McMahon-Founder of Mr. Solar Power, a prominent solar advocacy source, Solar Powered Energy, Solar Power Energy, Solar Water Heating, Newsletter-June 2007, http://docs.google.com/viewer?a=v&q=cache:aqklnz\_MZdUJ:www.mrsolarenergy.com/index2.php%3Foption%3Dcom\_content%26do\_pdf%3D1%26id%3D35+%22space+solar+power%22+%22small+farms%22&hl=en&gl=us&pid=bl&srcid=ADGEESgFj7mk58EZakIEY0ou45yuNbS5R8la-tGrpiv-xCTkAD9a-D1XX3np3caeWcq2-FkLvD2NKTWLADPb8UMI\_xI5Ssns\_Yr4fYuaKtUJvqFIXcdAe\_OP-93U1viO5b5Vx6gcDZKp&sig=AHIEtbTEykZdUZTaRUVrPgCrbBIujeeKgQ

Experts predict that solar power will become the planet's dominant energy source during the next 50 years. This is largely driven by the world’s need to reduce greenhouse gases contributing to climate change. All countries are predicted to greatly benefit (from the changes towards harnessing more renewable energy. However, the poorer countries in the world stand to see the greatest economic growth from the shift to renewable energy This growth will be driven by the manufacturing, operation, and maintenance of many medium, small and micro-renewable energy projects in these countries analysis say. One of these experts is Earth Day co-founder Denis Hayes who spoke at a lecture at Buffalo USA University. 4Wquo;We have so much sunshine hitting the earth; said Denis Hayes every time we have doubled the production of solar panels, the cost has come down 20% and we see strong growth it we can get the production cost down to $1 a Mr John Maina from Kenya has won the Energy Globe Award from the European Parliament a prize for outstanding projects in energy efficiency. Mr Maina has pioneered ways of increasing harvests of small farms by SO% using solar power John Maina has developed a solar energy oven which allows (fruit and vegetables to be dried and (hereby preserved. This has permitted higher yields on (arms without using more water or pesticides. Australia - Heat Reflective Paint Used in Queensland Government Schools This commercial reflective roof coating can lower the internal heat under a roof by up to 1BC according to the supplier. This can result in considerable power savings of up to 60% in aircondiboning usage costs. The lower temperatures inside industrial and commercial buildings results in lower air conditioning power consumption and a higher level of personal comfort. The heat reflective paints are made of a co-polymer compound containing inert pigments and special filters uniquely formulated to re-radiate 90% of solar infrared and 85% of ultraviolet rays back into the atmosphere says the manufacturer. This effectively stops heat transfer through the roof. Examples of use are on the roofs of 431 Queensland schools resulting in a significant increase in comfort for students and staff as well as lower maintenance costs. The Insultec membrane coating has also been used effectively in large scale road construction projects in Saudi Arabia where extreme temperatures caused expansion and contraction gaps on concrete road surfaces. India - Mumbai Introduces Compulsory Energy Audits 'or Government Buildings and Politicians Homes The Public Works Deparlmenl in Mumbai now monitors the electricity bills of ministers and helps them bring down power consumption the Minister for Alternative Energy Vinay Kore told the Mumbai News last week. Vinay Kore said that conference halls in his department have been fitted with split air conditioners and CFL lamps and one wall has been replaced with frosted glass to let in natural light. The Public Works Minister. Chhagan Bhrybal. said that he doesn't leave tights on when nobody is at home and he only uses CFL lamps and one air conditioner at a time Legislator, Vinod Tawde, said that he arranged to switch off lights in his apartment complex and residents only use the lift sparingly. No one uses it for going down and he only leaves his air conditioner on for one hour, he said. The mayor, Or Shubha Raul said that he will be installing a solar cooker and CFL lamps and in the office he leaves the lights and air conditioner switched off. also he has installed a solar energy unit in his bungalow. Switzerland • Solar Powered Football Stadium. Swiss architect Renato Marazzi has designed the world's biggest solar power installation ever (o be incorporated into the roof ol a football stadium. The Stade de Suisse at Wankdorf will be hosbng the 2006 Football Championships. The stadium has 5.152 solar panels and generates 700.000kw hours of electricity per annum supplying energy to the nabonal power grid. This corresponds to the energy used by 260 households a year, explained Renato Marazzi speaking in Doha, Qatar where his firm Marazzi and Paul was poinbng out that Qatar enjoys more sunshine than Switzerland. Marazzi and Paul are currently working on other European solar powered football stadiums and arenas in Belgrade. Vienna. Budapest and Lucerne. USA - Space Solar Power Study Proposed John Mankins president of the Space Solar Power Association in Washington DC is reported in Washington as proposing a study of satellite based solar power devices for supplying energy to remote areas on earth. Mr Mankins reported to Fox News that space based solar power generation could offer a massive improvement over earth based collectors because the sun shines 24 hours a day in space.

Agriculture (3/12)

### Small farms are key to sustain genetic diversity-impact is extinction. AND, they’re key to food security.

Boyce ‘4 – dept. of Economics & Political Economy Research and Environmental research at the University of Massachusetts (James K, July, “A Future for Small Farms? Biodiversity and Sustainable Agriculture”. Political Economic Research Institute, <http://ideas.repec.org/p/uma/periwp/wp86.html>, RG)

There is a future for small farms. Or, to be more precise, there can be and should be a future for them. Given the dependence of ‘modern’ low-diversity agriculture on ‘traditional’ high-diversity agriculture, the long-term food security of humankind will depend on small farms and their continued provision of the environmental service of in situ conservation of crop genetic diversity. Policies to support small farms can be advocated, therefore, not merely as a matter of sympathy, or nostalgia, or equity. Such policies are also a matter of human survival. The diversity that underpins the sustainability of world agriculture did not fall from the sky. It was bequeathed to us by the 400 generations of farmers who have carried on the process of artificial selection since plants were first domesticated. Until recently, we took this diversity for granted. The ancient reservoirs of crop genetic diversity, plant geneticist Jack Harlan (1975, p. 619) wrote three decades ago, ‘seemed to most people as inexhaustible as oil in Arabia.’ Yet, Harlan warned, ‘the speed which enormous crop diversity can be essentially wiped out is astonishing.’ The central thesis of this essay is that efforts to conserve in situ diversity must go hand-in-hand with efforts to support the small farmers around the world who sustain this diversity. Economists and environmentalists alike by and large have neglected this issue. In thrall to a myopic notion of efficiency, many economists fail to appreciate that diversity is the sine qua non of resilience and sustainability. In thrall to a romantic notion of ‘wilderness,’ many environmentalists fail to appreciate that agricultural biodiversity is just as valuable – indeed, arguably more valuable from the standpoint of human well-being – as the diversity found in tropical rainforests or the spotted owls found in the ancient forests of the northwestern United States.

Agriculture (4/12)

### Small farms minimize the magnitude of inevitable agricultural diseases-large scale farms ensure its spread.

Kohnen 2K, Anne Kohnen, Responding to the threat of Agro-terrorism: Specific Recommendations for the United States Department of Agriculture, Published by Harvard, http://docs.google.com/viewer?a=v&q=cache:TPLGcqWqp1IJ:belfercenter.ksg.harvard.edu/files/responding\_to\_the\_threat\_of\_agroterrorism.pdf+%22small+farms

Trends in the agricultural sector toward more intensive farming of both animals and crops have helped keep food prices low in America, but these practices have also increased the risk of disease or pest introduction through facility management techniques that increase farm biosecurity. Intensive Farming Conditions Five of the top ten agricultural commodities come from animals that are raised in highly concentrated conditions: cattle, dairy products, boilers, hogs, and eggs. Figure 3 demonstrates the increase in intensive farming practices for boilers. Figure 3 shows that in 1987 about 50 percent of the broilers sold each year came from large farms (those that sold 300,000 per year). Ten years later, 75 percent came from these farms. Only nine farm produce 59 percent of the nation's broiler inventory. Likewise, the number of large hog and cattle herds has increased. Just 2 percent of the nation's feedlots supply three quarters of its cattle. The increased density of animal per farm heightens the epidemiological risk: one infected animal can expose several thousand others.

Agriculture (5/12)

### Disease spread risks extinction.

**Daswani ’96** [Kavita, Interviewing an Israeli doctor, “Leading the way to a cure for AIDS,” South China Morning Post, January 4, LN]

Dr Ben-Abraham said: "Nature isn't benign. The survival of the human species is not a preordained evolutionary programme. Abundant sources of genetic variation exist for viruses to learn how to mutate and evade the immune system." He cites the 1968 Hong Kong flu outbreak as an example of how viruses have outsmarted human intelligence. And as new "mega-cities" are being developed in the Third World and rainforests are destroyed, disease-carrying animals and insects are forced into areas of human habitation. "This raises the very real possibility that lethal, mysterious viruses would, for the first time, infect humanity at a large scale and imperil the survival of the human race," he said.

Agriculture (6/12)

### And, unless we maximize agricultural productivity, deforestation is inevitable.

Lugar 2k (Richard, a US Senator from Indiana, is Chairman of the Senate Foreign Relations Committee, and a member and former chairman of the Senate Agriculture Committee. “calls for a new green revolution to combat global warming and reduce world instability,” pg online @ <http://www.unep.org/OurPlanet/imgversn/143/lugar.html> //)

In a world confronted by global terrorism, turmoil in the Middle East, burgeoning nuclear threats and other crises, it is easy to lose sight of the long-range challenges. But we do so at our peril**.** One of the most daunting of them is meeting the world’s need for food and energy in this century. At stake is not only preventing starvation and saving the environment, but also world peace and security. History tells us that states may go to war over access to resources, and that poverty and famine have often bred fanaticism and terrorism. Working to feed the world will minimize factors that contribute to global instability and the proliferation of weapons of mass destruction. With the world population expected to grow from 6 billion people today to 9 billion by mid-century, the demand for affordable food will increase well beyond current international production levels. People in rapidly developing nations will have the means greatly to improve their standard of living and caloric intake. Inevitably, that means eating more meat. This will raise demand for feed grain at the same time that the growing world population will need vastly more basic food to eat. Complicating a solution to this problem is a dynamic that must be better understood in the West: developing countries often use limited arable land to expand cities to house their growing populations. As good land disappears, people destroy timber resources and even rainforests as they try to create more arable land to feed themselves.

Agriculture (7/12)

### Deforestation crushes indigenous cultures.

Carmen G. Gonzalez, Assistant Professor, Law, Seattle University, “Beyond Eco-Imperialism: An Environmental Justice Critique of Free Trade,” DENVER UNIVERSITY LAW REVIEW v. 78, 2001, p, 997-998.

Deforestation also has global consequences, and the costs and benefits are likewise unevenly distributed between North and South. Deforestation degrades the global environment through loss of biodiversity, release of greenhouse gases and loss of carbon sinks. n87 The North is responsible for 90 percent of the anthropogenic greenhouse gas emitted during the past 150 years, and it has, therefore, benefited from its ability to use the global atmosphere as a sink for the harmful by-products of industrialization. n88 However, Southern countries will bear a disproportionate share of the environmental consequences of global warming, including droughts, floods, rise in sea level, and more frequent storms and [\*998] hurricanes, due to their more vulnerable geographies and economies. n89 Loss of biodiversity will also have disproportionate impacts in the South. Tropical forests contain most of the world's biodiversity, providing habitat for 70 percent of all known species. n90 For the North, loss of biodiversity constitutes foregone opportunities for biotechnology, agribusiness and pharmaceutical industries to commercially exploit the valuable raw materials of the South. n91 For local and indigenous communities in the South, biodiversity represents food, medicine, clothing, shelter, and cultural integrity. n92 Conserving biodiversity is essential to the physical and cultural survival of the more than 500 million people who depend on tropical forests for their wellbeing, and includes fighting to protect rights to land, natural resources and cultural knowledge. n93

Agriculture (8/12)

### And, cultural diversity solves extinction-it infuses an ethic of justice into world society and is the foundation of civilization.

Barsh ’93 – prof. of Native American Studies @ Univ. of Lethbridge (Russel Lawrence, Winter, University of Michigan Journal of Law Reform, 25 U. MICH. J. L. REF. 671)

There no longer seems to be much difference in the Westernization of the Third World and of the indigenous world. Indigenous societies are usually more isolated geographically, so the process of convergence is understandably slower. But they are catching up. While world leaders lament the loss of biological diversity, which holds the key to the renewal and survival of ecosystems, our planet rapidly is losing its cultural diversity, which holds the key to the renewal and survival of human societies. Scientists and scholars search for an alternative in their theories while real alternative cultures disappear. It will be a real struggle to reassert an indigenous perspective on social justice, democracy, and environmental security. The hardest part of the struggle will be converting words to action, going beyond the familiar, empty rhetoric of sovereignty and cultural superiority. The struggle will be hardest here in the United States, where the gaps between rhetoric and reality have grown greater than anywhere on earth. This is the best place to begin, however, because this is the illusory "demonstration" that is studied by the rest of the world, including the indigenous peoples of other regions. Are American Indians ready to accept this global responsibility? The current generation of tribal leadership appears unwilling to try. It is firmly committed by its actions to the materialist path, and it is neutralized by its dependence on a continuing financial relationship with the national government and developers. The next generation of American Indians may be another matter. Disillusioned and critical, they may yet find a voice of their own that is both modern and truly indigenous, and they may have the courage to practice theideals that their parents merely sloganize. Let us hope so. There is no alternative for Indian survival or for global survival.

Agriculture (9/12)

### Pesticides cause toxic damage-spills over to other ecosystems and tanks global biodiversity.

Oliver ‘1, Jan Oliver, Prof @ Cal, Pesticides and Biodiversity, http://dp.biology.dal.ca/reports/zoliver/oliverst.html

Pesticides can enter non-agricultural landscapes in numerous ways, including direct overspray. Field margins are often sprayed directly for control of insects and weeds that might spread into the crop (Boutin et al., 1999). Indirectly, pesticides can "drift" from the site of application in numerous ways. These mechanisms, together with the ability of some chemicals to persist in the environment for a number of years (\*EPA) means that pesticides have the potential to affect an immense variety of wildlife, from birds feeding on infected seeds to polar bears feeding on saltwater fish hundreds of kilometers away.

Agriculture (10/12)

### Impact is extinction.

Diner, 94 [David, Ph.D., Planetary Science and Geology, "The Army and the Endangered Species Act: Who's Endangering Whom?," Military Law Review, 143 Mil. L. Rev. 161]

To accept that the snail darter, harelip sucker, or Dismal Swamp southeastern shrew 74 could save [hu]mankind may be difficult for some. Many, if not most, species are useless to[hu]man[s] in a direct utilitarian sense. Nonetheless, they may be critical in an indirect role, because their extirpations could affect a directly useful species negatively. In a closely interconnected ecosystem, the loss of a species affects other species dependent on it. 75 Moreover, as the number of species decline, the effect of each new extinction on the remaining species increases dramatically. 4. Biological Diversity. -- The main premise of species preservation is that diversity is better than simplicity. 77 As the current mass extinction has progressed, the world's biological diversity generally has decreased. This trend occurs within ecosystems by reducing the number of species, and within species by reducing the number of individuals. Both trends carry serious future implications. 78 [\*173] Biologically diverse ecosystems are characterized by a large number of specialist species, filling narrow ecological niches. These ecosystems inherently are more stable than less diverse systems. "The more complex the ecosystem, the more successfully it can resist a stress. . . . [l]ike a net, in which each knot is connected to others by several strands, such a fabric can resist collapse better than a simple, unbranched circle of threads -- which if cut anywhere breaks down as a whole." 79 By causing widespread extinctions, humans have artificially simplified many ecosystems. As biologic simplicity increases, so does the risk of ecosystem failure. The spreading Sahara Desert in Africa, and the dustbowl conditions of the 1930s in the United States are relatively mild examples of what might be expected if this trend continues. Theoretically, each new animal or plant extinction, with all its dimly perceived and intertwined affects, could cause total ecosystem collapse and human extinction. Each new extinction increases the risk of disaster. Like a mechanic removing, one by one, the rivets from an aircraft's wings, 80 [hu]mankind may be edging closer to the abyss.

Agriculture (11/12)

### And, pollution from pesticides collapses the world water supply.

Bachtell 02 [John Bachtell, “Life in the balance: Capitalism at war with nature and humanity,” Opening to the National Board June 20, 2002, pg. <http://www.cpusa.org/article/articleview/465/1/47/edlee>]

A large amount enters nature's chain through nitrogen based fertilizers. The use of nitrogen fertilizer has accelerated world wide to overcome the mineral depletion of soil. Little of it is absorbed by the soil and it turns to runoff**.** It further depletes the soil by leaching other essential nutrients. The amount of nitrogen in our rivers and streams has grown dramatically. Nitrogen content has doubled in the Mississippi River since 1965. Many scientists believe this is responsible for creating large scale ecological crises**,** particularly in the oceans. It causes Eutrophication, mass algae blooms, in estuaries and coastal areas, leading to creeping "dead zones." These are areas where the bottom water is devoid of oxygen. For example a huge dead zone many miles across has appeared at the mouth of the Mississippi River. Eutrophication is linked to the loss of oceanic biodiversity, destruction of the corral reefs, sea grasses and seaweeds. In the last few decades 35 million acres of corral reefs have been destroyed. This has reverberating effects all the way up the food chain. We are experiencing mass deforestation and desertification, particularly in Asia and Africa. Many tropical forests which contain the greatest concentrations of biodiversity are being destroyed. We have our own desertification crisis in Montana and some western states reminiscent of the Dust Bowl. Worldwide over 135 million people in 110 countries are affected, particularly in poor rural regions. Some 60 million people are expected to leave the Sahelian region of North Africa if desertification there is not halted. The shortage of water for human consumption is a world crisis. Water tables are dropping drastically, agricultural production is threatened over vast areas, and conflicts are brewing between countries over water resources.

Agriculture (12/12)

### Collapsing global water supply causes extinction.

Maude Barlow, Spring 2001. National Chairperson of the Council of Canadians and IFG Committee on the Globalization of Water. “BLUE GOLD: The Global Water Crisis and the Commodification of the World's Water Supply,” <http://www.ratical.org/co-globalize/BlueGold.pdf>

Perhaps the most devastating analysis of the global water crisis comes from hydrological engineer Michal Kravèík and his team of scientists at the Slovakia non-governmental organization (NGO) People and Water. Kravèík, who has a distinguished career with the Slovak Academy of Sciences, has studied the effect of urbanization, industrial agriculture, deforestation, dam construction, and infrastructure and paving on water systems in Slovakia and surrounding countries and has come up with an alarming finding. Destroying water's natural habitat not only creates a supply crisis for people and animals, it also dramatically diminishes the amount of available fresh water on the planet. Kravèík describes the hydrologic cycle of a drop of water. It must first evaporate from a plant, earth surface, swamp, river, lake or the sea, then fall back down to earth as precipitation. If the drop of water falls back onto a forest, lake, blade of grass, meadow or field, it cooperates with nature to return to the hydrologic cycle. "Right of domicile of a drop is one of the basic rights, a more serious right than human rights," says Kravèík. However, if the earth's surface is paved over, denuded of forests and meadows, and drained of natural springs and creeks, the drop will not form part of river basins and continental watersheds, where it is needed by people and animals, but head out to sea, where it will be stored. It is like rain falling onto a huge roof, or umbrella; everything underneath stays dry and the water runs off to the perimeter. The consequent reduction in continental water basins results in reduced water evaporation from the earth's surface, and becomes a net loss, while the seas begin to rise. In Slovakia, the scientists found, for every 1 percent of roofing, paving, car parks and highways constructed, water supplies decrease in volume by more than 100 billion meters per year. Kravèík issues a dire warning about the growing number of what he calls the earth's "hot stains"—places already drained of water. The "drying out" of the earth will cause massive global warming, with the attendant extremes in weather: drought, decreased protection from the atmosphere, increased solar radiation, decreased biodiversity, melting of the polar icecaps, submersion of vast territories, massive continental desertification and, eventually, "global collapse."

## Solvency (1/2)

### Contention 4 is Solvency-

### SBSP is a viable option to provide green energy, but requires a government funded proof-of-concept demonstration to spark investment.

Jenkins, ’09, Issues in development of space-based solar power, L.M. Jenkins, 10/17/09

Space-Based Solar Power - (SBSP) is a concept that has considerable potential to provide clean renewable energy. Increased population coupled with reduced natural resources represent a challenge to national and world security. The SBSP concept is to collect energy from the Sun in Earth orbit. The electrical energy is converted to microwave frequency for transmission to the surface of the Earth. There it is converted back in to electricity for use. Possible usages are base-load power, fuel conversion or direct delivery to consumers in isolated locations. The available potential of solar energy is greater than energy in petroleum reserves. The primary issue is defining the path to development of SBSP capability. A critical parameter is the cost of delivery of components to orbit. There are a variety of concepts with the potential to reduce cost of payload in orbit. It is important to make a commitment to the development of a capability with cost efficiency as the prime objective. Current technology supports viability of the SBSP. A government-supported proof of concept demonstration would focus initial efforts. There are a number of ideas to be described that fit the demonstration objectives. Analysis of SBSP has defined certain key questions. Can the SBSP system be designed to be environmentally safe? Can clear targets for economic viability in markets of interest be identified? Are there technical development goals and a roadmap for reducing risk? Selection of design trades could enable the best options. The government is expected to take the lead in initial action. The transition to commercial application requires a defined vision. This goal needs to be funded with a focus on development of this solution to energy security.

Solvency (2/2)

### No other actor solves spillover-the U.S. is key and causes other nations to model.

Feng Hsu, Ph.D. and Ken Cox, Ph.D. 2009 NASA GSFC Sr. Fellow, Aerospace Technology Working Group and Founder & Director

Aerospace Technology Working Group, respectively. “Sustainable Space Exploration and Space Development ••• A Unified Strategic Vision” Aerospace Technology Working group.

So while some might argue that RLV or SBSP are too expensive or too difficult to realize, we must not forget that what makes a nation and its people thrive and prosper are not what they do for easy or short-term gain, but what they accomplish that others dare not do or cannot do. How many of history’s great endeavors have brought profound benefits to humanity across the economic, scientific and social fronts? It is precisely such an opportunity that lies before us today. Hence, we recommend the new paradigm of a strategic vision for space development (VSD) be considered by the new administration, consisting of the following key strategic elements, as a roadmap for propelling America and humanity’s outward expansion into space-based economic and commercial frontiers: 1. Set the goal of a low-cost, reliable space transportation infrastructure development within the Earth-moon system as the highest priority to be implemented by the proposed new Department of Space. The U.S. should build strong support and invite global participation from the entire international community. In this effort to achieve the proposed VSD, the U.S. and its international partners In this effort to achieve the proposed VSD, the U.S. and its international partners should focus heavily on the development of RLVs, such as crew & cargo transport and launch vehicle systems with top-level requirements of low-cost, low system complexity, and aircraft-like reliability, maintainability and operability. 3. We should develop and establish an international Fuel-Depot and Orbital Staging or Service point (station) in the LEO environment to support and service commercial space-transportation traffic, including space tourism, Lunar and Earth orbital transfers, and commercial satellite services. 4. We should also promote and support the establishment and construction of spaceport infrastructure in several strategic locations within the U.S. and around the globe, which will meet the emerging demand for increased commercial launch and spacetransport economic activities. 5. We must develop enabling space infrastructure observation and tracking capabilities for planetary defense. In particular, develop ground and orbital systems, in close collaboration with international partners, for monitoring, tracking and deflecting asteroids, comets, and other cosmic objects in near-Earth orbit, which threaten the safety of our home planet. And we must invest in projects with multiple benefits such as space-based solar power (SBSP) research and development, which would be developed by first funding a series of space-to-space or space-to-Earth SBSP demonstration projects. Technology demonstrations, such as wireless power transmission (WPT), highefficiency microwave beam generation and control, system safety and reliability, onorbit robotic assembly technology, and deployment of large-scale orbital solar structures would also be advisable to help reduce risks, thus triggering large-scale investments by private industries. The upside potential, if successful, would ultimately lead to the capacity to harness solar energy from space to alleviate Earth’s dependence on fossil fuels, thereby addressing global climate-change concerns.

## No War (1/3)

### Contention 5 is No War-

### No major war for six reasons-no great power rivalries, few large-scale militaries, presence of nuclear weapons, prevalence of self-determination, democracies check, and lack of aggressive U.S. foreign policy.

Mandelbaum, Professor of American Foreign Policy, ’96 (Michael, Paul H. Nitze School of Advanced International Studies, “Turbulent Peace,” <http://www.ndu.edu/inss/strforum/SF_64/forum64.html>, [TGA])

The post-Cold War era, although scarcely free of violence, is freer of the danger of a world war than any other time in modern history. For this there are two reasons. First, at present the traditional great power rivalries that have given rise to great wars do not exist. The international system is more peaceful than ever before at its core, centering on the five great powers: the United States, Western Europe, Japan, China, and Russia. A second reason for this unprecedented peace is an historically unusual disjunction between the core--the major powers--on the one hand, and the periphery--everyone and every place else--on the other. The reasons for the unusual harmony among the major powers are familiar, but bear repeating. First is the collapse of communism as a militant ideology stressing the inevitability of international struggle. A second reason is the primacy of economics--virtually all core governments emphasize domestic economic growth. Moreover, the rise of the market as the principal method for organizing economic activity within, between, and among most countries has promoted international harmony. According to market principles, the control of territory is not the key to wealth, which comes instead from participation in the international division of labor. Insofar as this principle is accepted by sovereign states, one of the major incentives for war disappears. Yet a third reason for post-Cold War tranquillity, carried over from the Cold War period, is the presence of nuclear weapons. They make war exceedingly dangerous, and thus dampen the incentives for conflict. Fourth, two principles espoused by Woodrow Wilson after World War I are coming into their own eight decades later. The first is the principle that the basis for organizing sovereign states should be national self-determination. This principle does not always ensure peace. Struggles for national self-determination have often been bloody. Indeed, most of the wars in the world today are being fought over some version of this issue. However, where the national self-determination principle coincides with the borders of sovereign states, the result is usually a certain measure of stability. The second Wilsonian principle is the spread of democracy. Wilson believed democracies were less inclined to disturb the peace and commit aggression against their neighbors than undemocratic countries. In general, with some qualifications, this is true, and it is also true that democracy is more widespread in the post-Cold War era than ever before. Perhaps the clearest evidence and most important consequence of these two principles, from the American point of view, is that for the first time since the United States became a great power--a period that coincides roughly with the twentieth century--American policy in the Asia-Pacific region does not revolve around a clear strategic choice between China and Japan; nor, in Europe, is the United States forced to choose clearly between Russia and Germany.

No War (2/3)

### Evolution of human thought makes large-scale war inconceivable.

Fettweis, Assistant Professor in the Political Science Department at Tulane University, 2006 (Christopher J., strategist for two year at the US Naval War College, “A Revolution in International Relation Theory: Or What if Mueller Is Right?” International Studies Review, pp. 677-697)

Almost as significant, all these proposed explanations have one important point in common: they all imply that change will be permanent. Normative/ideational evolution is typically unidirectional—few would argue that it is likely, for instance, for slavery or dueling to return in this century. The complexity of economic interdependence is deepening as time goes on and going at a quicker pace. And, obviously, nuclear weapons cannot be uninvented and (at least at this point) no foolproof defense against their use seems to be on the horizon. The combination of forces that may have brought major war to an end seems to be unlikely to allow its return. The twentieth century witnessed an unprecedented pace of evolution in all areas of human endeavor, from science and medicine to philosophy and religion. In such an atmosphere, it is not difficult to imagine that attitudes toward the venerable institution of war may also have experienced rapid evolution and that its obsolescence could become plausible, perhaps even probable, in spite of thousands of years of violent precedent. The burden of proof would seem to be on those who maintain that the "rules of the game" of international politics, including the rules of war, are the lone area of human interaction immune to fundamental evolution and that, due to these immutable and eternal rules, war will always be with us. Rather than ask how major war could have grown obsolete, perhaps scholars should ask why anyone should believe that it could not.

No War (3/3)

### And, nuclear winter is a government misinformation campaign, proponents falsify data, all conclusive studies go aff, fallout would be short, natural disasters disprove nuclear winter, and modern nukes are more precise.

Nyquist,  regular geopolitical columnist for Financial Sense Online, 1999

(J.R., regular columnist for [WorldNetDaily](http://en.wikipedia.org/wiki/WorldNetDaily) from 1999 until 2001, “Is Nuclear War Survivable?”

http://www.wnd.com/news/article.asp?ARTICLE\_ID=19722)

As I write about Russia's nuclear war preparations, I get some interesting mail in response. Some correspondents imagine I am totally ignorant. They point out that nuclear war would cause "nuclear winter," and everyone would die. Since nobody wants to die, nobody would ever start a nuclear war (and nobody would ever seriously prepare for one). Other correspondents suggest I am ignorant of the world-destroying effects of nuclear radiation. I patiently reply to these correspondents that nuclear war would not be the end of the world. I then point to studies showing that "nuclear winter" has no scientific basis, that fallout from a nuclear war would not kill all life on earth. Surprisingly, few of my correspondents are convinced. They prefer apocalyptic myths created by pop scientists, movie producers and journalists. If Dr. Carl Sagan once said "nuclear winter" would follow a nuclear war, then it must be true. If radiation wipes out mankind in a movie, then that's what we can expect in real life. But Carl Sagan was wrong about nuclear winter. And the movie "On the Beach" misled American filmgoers about the effects of fallout. It is time, once and for all, to lay these myths to rest. Nuclear war would not bring about the end of the world, though it would be horribly destructive. The truth is, many prominent physicists have condemned the nuclear winter hypothesis. Nobel laureate Freeman Dyson once said of nuclear winter research, "It's an absolutely atrocious piece of science, but I quite despair of setting the public record straight." Professor Michael McElroy, a Harvard physics professor, also criticized the nuclear winter hypothesis. McElroy said that nuclear winter researchers "stacked the deck" in their study, which was titled "Nuclear Winter: Global Consequences of Multiple Nuclear Explosions" (Science, December 1983). Nuclear winter is the theory that the mass use of nuclear weapons would create enough smoke and dust to blot out the sun, causing a catastrophic drop in global temperatures. According to Carl Sagan, in this situation the earth would freeze. No crops could be grown. Humanity would die of cold and starvation. In truth, natural disasters have frequently produced smoke and dust far greater than those expected from a nuclear war. In 1883 Krakatoa exploded with a blast equivalent to 10,000 one-megaton bombs, a detonation greater than the combined nuclear arsenals of planet earth. The Krakatoa explosion had negligible weather effects. Even more disastrous, going back many thousands of years, a meteor struck Quebec with the force of 17.5 million one-megaton bombs, creating a crater 63 kilometers in diameter. But the world did not freeze. Life on earth was not extinguished. Consider the views of Professor George Rathjens of MIT, a known antinuclear activist, who said, "Nuclear winter is the worst example of misrepresentation of science to the public in my memory." Also consider Professor Russell Seitz, at Harvard University's Center for International Affairs, who says that the nuclear winter hypothesis has been discredited. Two researchers, Starley Thompson and Stephen Schneider, debunked the nuclear winter hypothesis in the summer 1986 issue of Foreign Affairs. Thompson and Schneider stated: "the global apocalyptic conclusions of the initial nuclear winter hypothesis can now be relegated to a vanishingly low level of probability." OK, so nuclear winter isn't going to happen. What about nuclear fallout? Wouldn't the radiation from a nuclear war contaminate the whole earth, killing everyone? The short answer is: absolutely not. Nuclear fallout is a problem, but we should not exaggerate its effects. As it happens, there are two types of fallout produced by nuclear detonations. These are: 1) delayed fallout; and 2) short-term fallout. According to researcher Peter V. Pry, "Delayed fallout will not, contrary to popular belief, gradually kill billions of people everywhere in the world." Of course, delayed fallout would increase the number of people dying of lymphatic cancer, leukemia, and cancer of the thyroid. "However," says Pry, "these deaths would probably be far fewer than deaths now resulting from ... smoking, or from automobile accidents." The real hazard in a nuclear war is the short-term fallout. This is a type of fallout created when a nuclear weapon is detonated at ground level. This type of fallout could kill millions of people, depending on the targeting strategy of the attacking country. But short-term fallout rapidly subsides to safe levels in 13 to 18 days. It is not permanent. People who live outside of the affected areas will be fine. Those in affected areas can survive if they have access to underground shelters. In some areas, staying indoors may even suffice. Contrary to popular misconception, there were no documented deaths from short-term or delayed fallout at either Hiroshima or Nagasaki. These blasts were low airbursts, which produced minimal fallout effects. Today's thermonuclear weapons are even "cleaner." If used in airburst mode, these weapons would produce few (if any) fallout casualties. On their side, Russian military experts believe that the next world war will be a nuclear missile war. They know that nuclear weapons cannot cause the end of the world. According to the Russian military writer, A. S. Milovidov, "There is profound error and harm in the disoriented claims of bourgeois ideologues that there will be no victor in a thermonuclear world war." Milovidov explains that Western objections to the mass use of nuclear weapons are based on "a subjective judgment. It expresses mere protest against nuclear war." Another Russian theorist, Captain First Rank V. Kulakov, believes that a mass nuclear strike may not be enough to defeat "a strong enemy, with extensive territory enabling him to use space and time for the organizations of active and passive defense. ..." Russian military theory regards nuclear war as highly destructive, but nonetheless winnable. Russian generals do not exaggerate the effects of mass destruction weapons. Although nuclear war would be unprecedented in its death-dealing potential, Russian strategists believe that a well-prepared system of tunnels and underground bunkers could save many millions of lives. That is why Russia has built a comprehensive shelter system for its urban populace. On the American side as well, there have been studies which suggest that nuclear war is survivable.

# Inherency

## Energy Needed Increasing

### Our energy needs are increasing

US EIA 7/27/2010 ((United States energy information center) <http://www.eia.gov/oiaf/ieo/world.html>) JA

In non-OECD nations, economic activity and commerce increase rapidly, fueling additional demand for energy in the service sectors. Population growth also is more rapid than in OECD countries, portending increases in the need for education, health care, and social services and the energy required to provide them. In addition, as developing nations mature, they transition to more service-related enterprises, increasing demand for energy in the commercial sector. The energy needed to fuel growth in commercial buildings will be substantial, with total delivered commercial energy use among non-OECD nations growing by 2.7 percent per year from 2007 to 2035.

## No Funding Now

### SBSP not being developed because of budget restrictions

Dinerman 2008 [Taylor, “NASA and space solar power,” The Space Review, <http://www.thespacereview.com/article/1130/1>, July 8, BLS]

NASA has good reason to be afraid that the Congress or maybe even the White House will give them a mandate to work on space solar power at a time when the agency’s budget is even tighter than usual and when everything that can be safely cut has been cut. This includes almost all technology development programs that are not directly tied to the Exploration Missions System Directorate’s Project Constellation. Not only that, the management talent inside the organization is similarly under stress. Adding a new program might bring down the US civil space program like a house of cards.

### Costs are preventing developments for space technology

Mankins 2008 [Space-Based Solar Power-Inexhaustible Energy From Orbit’, The Magazine of the National Space Society,   http://www.nss.org/adastra/AdAstra-SBSP-2008.pdf, Date Accessed: 07/09/2008,

Lower-Cost Space Systems and Operations.The cost of space activities has several important components, including the cost of the hardware (initial and recurring), the cost of the people involved inoperations and sustaining engineering, and the cost of launching the system (and its consumables) into space. As a result of these factors, a major spacecraft development project can cost many tens, if not hundreds,of millions of dollars. The International Space Station will have cost approximately $35 billion dollars in hardware, and perhaps that  much again in launch costs by the time it is completed around 2010. (Fortunately, those costs have been spread across some 25 years and shared by 16 international partners.)

### Status quo funding is miniscule. More is needed to develop the technology and other countries would get on board once the US developed.

Hamilton, 2007 (Tyler, “Space-based solar power back in play,” Oct. 15, The Toronto Star, lexis)

High oil prices, energy security fears and the potentially devastating effects of climate change have prompted the U.S. government to again explore the idea of placing millions of solar panels in orbit to beam immense amounts of clean power back to Earth. Seriously.  An agency called the National Security Space Office, which reports to the U.S. Department of Defence, released a feasibility study last week recommending that "space-based solar power," an idea first proposed in the U.S. some 40 years ago, be pursued in the name of national security.  The sun, after all, shines more strongly and for 24 hours a day in space, outside the filters of Earth's clouds and its relatively dirty atmosphere. There are also few real-estate problems up there, fewer people to complain and the potential of having a fuelling post for Richard Branson and other private space travellers.  According to the study, the energy collected would be electromagnetically beamed back to Earth and connected to the electrical grid, or used in the manufacture of synthetic fuels. It even suggests that weaker beams could be directed at individual households.  Seriously.  "A single kilometre-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," the study states. "There is 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 (the) capability."  It also says that Canada, among others, has expressed interest in such a project.  Again, the discussion has come up before. NASA and the U.S. Department of Defence have together spent about $80 million (U.S.) over the last three decades studying the idea. Seems like decent money, until you see that the U.S. government has spent about $21 billion over 50 years on that elusive energy utopia called nuclear fusion.  Perhaps it is time to give space-based solar power another look, given that such a system might already exist today had it received the money dumped into fusion. Oil has surged past $80 a barrel and there's a desperate need for low- or zero-carbon energy sources. Lob a few bombs at Iran and the situation gets worse, not better.

## SBSP Needed

### The U.S. is dependent upon fossil fuels. New technologies are only devoted to making them cleaner.

Department Of Energy, “Fossil Fuels”, US Department Of Energy (official website), accessed 6/21/11, http://www.energy.gov/energysources/fossilfuels.htm

Fossil fuels - coal, oil and natural gas -- provide more than 85% of all the energy used in the United States. They are also used to create nearly two-thirds of our electricity and almost all of our transportation fuels. It is likely that our reliance on fossil fuels will increase over the next two decades, even with aggressive development and use of new renewable and nuclear technologies. DOE's [Office of Fossil Energy](http://www.fossil.energy.gov/) (FE) has a key role in helping America meet its growing need for secure, fairly priced, and environmentally sound fossil energy supplies. FE's main goal is to ensure the U.S. can continue to rely on fossil fuels for clean, affordable energy. This is accomplished through two major efforts: Emergency stockpiles of crude oil and heating oil    The Department is in charge of maintaining the [Strategic Petroleum Reserve](http://www.fossil.energy.gov/programs/reserves/) and the [Northeast Home Heating Oil Reserve](http://www.fossil.energy.gov/programs/reserves/heatingoil/). In the event of a major supply interruption, the President can release oil from these reserves into the market.   Research and development of future fossil energy technologies    New technologies can make the future production and use of fossil fuels more efficient and environmentally cleaner. Coal-based power plants, due to FE's cutting edge R&D, can now produce electricity while creating almost no emissions.

# Hegemony

## SBSP Solves & ISS demonstration

### SBSP is a critical consideration and tactical advantage for the Armed forces

Frank Morring, Jr./Aerospace Daily & Defense Report. Oct 11, 2007 “NSSO Backs Space Solar Power”

http://www.aviationweek.com/aw/generic/story\_generic.jsp?channel=space&id=news/solar101107.xml&headline=NSSO%20Backs%20Space%20Solar%20Power

Collecting solar power in space and beaming it back to Earth is a relatively near-term possibility that could solve strategic and tactical security problems for the U.S. and its deployed forces, the Pentagon's National Security Space Office (NSSO) says in a report issued Oct. 10. As a clean source of energy that would be independent of foreign supplies in the strife-torn Middle East and elsewhere, space solar power (SSP) could ease America's longstanding strategic energy vulnerability, according to the "interim assessment" released at a press conference and on the Web site spacesolarpower.wordpress.com. And the U.S. military could meet tactical energy needs for forward-deployed forces with a demonstration system, eliminating the need for a long logistical tail to deliver fuel for terrestrial generators while reducing risk for eventual large-scale commercial development of the technology, the report says. "The business case still doesn't close, but it's closer than ever," said Marine Corps Lt. Col. Paul E. Damphousse of the NSSO, in presenting his office's report. That could change if the Pentagon were to act as an anchor tenant for a demonstration SSP system, paying above-market rates for power generated with a collection plant in geostationary orbit beaming power to U.S. forces abroad or in the continental U.S., according to Charles Miller, CEO of Constellation Services International and director of the Space Frontier Foundation. By buying down the risk with a demonstration at the tactical level, the U.S. government could spark a new industry able to meet not just U.S. energy needs, but those of its allies and the developing world as well. The technology essentially exists, and needs only to be matured. A risk buy-down by government could make that happen, according to the NSSO report. "This is not a 50-year solution," said John Mankins, an expert in the field and president of the Space Power Association. "The kinds of things that are possible today say a truly transformational demonstration at a large scale is achievable within this decade." As an example, Mankins listed the rapid progress in boosting the efficiency of solar cells. While 20-25 percent efficiency was once considered a long-term goal, efficiencies on the order of 40 percent already have been achieved. And the modularity and scalability of the systems needed to build an SSP platform make testing relatively straightforward. Even from its perch in low-Earth orbit, for example, the International Space Station could be used as a test bed for SSP components and even demonstrate low-level power transmission from orbit to Earth. The exposed facility on Japan's Kibo laboratory, due for launch in the first half of next year, could be used to test pointing and transmitting hardware, Mankins said, as well as to conduct space-exposure experiments on materials that might be used in building the large structures needed to collect sunlight in meaningful amounts.

## SBSP Solves War

### And, literally no negative scenario can happen in the world of the aff—SBSP solves warming and eliminates the possibility of war.

Morgan 2007 [James, “Ray of Hope on Energy,” Science Notebook, <http://www.lexisnexis.com/us/lnacademic/search/homesubmitForm.do>, July 9, BLS]

These dreams were always shot down by the costs - exorbitant when compared with the plentiful reserves of fossil fuels. Now, with spiraling oil prices and the threat of runaway climate change, the balance has tipped, according to the National Security Space Office, part of the Department of Defense. Its study claims that space-based solar power (SBSP) could be economically competitive in the near future. In just a year, it calculates, satellites orbiting in a continuous sunlight could generate energy nearly equivalent to all of the energy available in the world's oil reserves. Not only might that put the brakes on global warming, it says, it could help to stifle the wars and political tension that the oil trade creates. The result - a peaceful world."This is a solution for [human]mankind," said former astronaut Buzz Aldrin, chairman of the space f light advocacy group, ShareSpace Foundation, at the unveiling of the report in Washington. The report urges the US government to invest GBP5bn in a pilot project, to spur private investment in the concept. It argues that SBSP could generate so much power it could transform the gas guzzling United States into an energy-exporting nation.

## SBSP Solves Heg 1/3

### Space-based solar power is key to U.S. leadership in international affairs.

McCrown 8 [Debra, April 8th, “Dominion CEO Touts Using All Available Energy Options”, http://news.edgaronline.com/news/fis\_story.asp?textpath=COMTEX%5Cko%5C2008%5C04%5C08%5C107164729.html&clientid=168&provider=KNIGHT-RIDDER, DeFilippis]

Lt. Col. Paul Damphousse, of the National Security Space Office, spoke about a solution he thinks can replace fossil fuels -- including coal -- within the next four decades: space-based solar power. He said it's an important technology to maintain U.S. leadership in the world while eliminating international conflicts that arise over energy resources. "We consider that the fourth generation after wood, coal and oil," Damphousse said, adding that the technology is bringing the concept closer to reality. Ultimately, it will be up to the private sector to develop the space technology, but government can do a lot to help by demonstrating that it can work, he added. Also during the conference, Wise County Administrator "Skip" Skinner announced plans for a "research and development center" adjacent to UVA-Wise in the Lonesome Pine Regional Business and Technology Park. "We think that this is a perfect location in the heart of the coalfields just to be able to prove and do research on some of these technologies," Skinner said. He said cost estimates and job creation numbers are still being developed, but with the help of a $1 million grant from the Virginia Tobacco Commission, he expects to break ground in 18 months on the Appalachia America Energy Research Center. J. Glynn Loope, speaking for NanoChemonics Corp., said the company plans to occupy a 15,000-square-foot building that will initially have six employees.

SBSP Solves Heg 2/3

### Increase of SBSP decreases military fuel reliance- decreases violent attacks

DOD, October 2007, “Space Based Solar Power As An Opportunity For Strategic Security”, http://www.nss.org/settlement/ssp/library/final-sbsp-interim-assessment-release-01.pdf

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.

SBSP Solves Heg 3/3

### Alternative energy keeps military convoys safer, more effective and saves the DOD money

Rosenthal, Elizabeth, staff writer for the New York Times, “U.S. military orders les dependence on fossil fuels”, October 4, 2010, http://www.nytimes.com/2010/10/05/science/earth/05fossil.html?\_r=1&hp=&adxnnl=1&adxnnlx=1308776451-1H8JB1irSLZljoeYpqSuLg

With insurgents increasingly attacking the American fuel supply convoys that lumber across the Khyber Pass into Afghanistan, the military is pushing aggressively to develop, test and deploy renewable energy to decrease its need to transport fossil fuels. Solar power was tested in May in Morocco. A Marine company brought some renewable energy equipment to Afghanistan. Last week, a Marine company from California arrived in the rugged outback of Helmand Province bearing novel equipment: portable solar panels that fold up into boxes; energy-conserving lights; solar tent shields that provide shade and electricity; solar chargers for computers and communications equipment. The 150 Marines of Company I, Third Battalion, Fifth Marines, will be the first to take renewable technology into a battle zone, where the new equipment will replace diesel and kerosene-based fuels that would ordinarily generate power to run their encampment. Even as Congress has struggled unsuccessfully to pass an energy bill and many states have put renewable energy on hold because of the recession, the military this year has pushed rapidly forward. After a decade of waging wars in remote corners of the globe where fuel is not readily available, senior commanders have come to see overdependence on fossil fuel as a big liability, and renewable technologies — which have become more reliable and less expensive over the past few years — as providing a potential answer. These new types of renewable energy now account for only a small percentage of the power used by the armed forces, but military leaders plan to rapidly expand their use over the next decade. In Iraq and Afghanistan, the huge truck convoys that haul fuel to bases have been sitting ducks for enemy fighters — in the latest attack, oil tankers carrying fuel for NATO troops in Afghanistan were set on fire in Rawalpindi, Pakistan, early Monday. In Iraq and Afghanistan, one Army study found, for every 24 fuel convoys that set out, one soldier or civilian engaged in fuel transport was killed. In the past three months, six Marines have been wounded guarding fuel runs in Afghanistan. “There are a lot of profound reasons for doing this, but for us at the core it’s practical,” said Ray Mabus, the Navy secretary and a former ambassador to Saudi Arabia, who has said he wants 50 percent of the power for the Navy and Marines to come from renewable energy sources by 2020. That figure includes energy for bases as well as fuel for cars and ships. “Fossil fuel is the No. 1 thing we import to Afghanistan,” Mr. Mabus said, “and guarding that fuel is keeping the troops from doing what they were sent there to do, to fight or engage local people.” He and other experts also said that greater reliance on renewable energy improved national security, because fossil fuels often came from unstable regions and scarce supplies were a potential source of international conflict. Fossil fuel accounts for 30 to 80 percent of the load in convoys into Afghanistan, bringing costs as well as risk. While the military buys gas for just over $1 a gallon, getting that gallon to some forward operating bases costs $400.

## Alt Energy Solves Heg 1/2

### Military green initiatives save money for the taxpayers and allow money to be spent more effectively within the military itself.

Staff Writers, Washington UPI, MilTech, “Energy Overhaul For US Defense?”, http://www.spacewar.com/reports/Energy\_overhaul\_for\_US\_Defense\_999.html

The U.S Defense Department's new energy strategy will pave the way for a more secure, agile and flexible fighting force, an official said. Under the new strategy, military equipment, as well as forces in the field, will use less energy and more alternative forms of energy, such as solar and biofuels rather than fossil fuels. "To build and sustain this 21st century military force, particularly in an era of fiscal duress, the Department of Defense must use its resources wisely, and that includes our energy resources," states the strategy. As the biggest single energy consumer in the nation, the Defense Department last year spent $15 billion on fuel, 75 percent of which was for military operations, Deputy Secretary of Defense William Lynn said in unveiling the plan this week. Amid soaring fuel costs and a growing reliance on energy to carry out military operations, the department has seen its gasoline costs skyrocket 225 percent in the last decade. "Not only does [energy] cost the taxpayers, it costs the warfighters," the deputy defense chief said. "Every dollar spent on energy use is a dollar not spent on other warfighting priorities." In addition to reducing costs, the strategy aims to improve military capabilities. Currently, the Department of Defense "tends to treat energy as a commodity that will always be readily available, regardless of the strategic, operational and tactical costs," the strategy states. Under the new strategy, energy is redefined as a "military capability," giving it a role in top military strategies."As conflicts become longer in duration and more expeditionary in nature, the amount of fuel that it takes to keep forces in the field has become a significant vulnerability," Lynn said.

Alt Energy Solves Heg 2/2

### Fossil fuels waste money that the military could be spending elsewhere- renewables mean increased power projection and strategic flexibility.

Worthington 11 (David, April 27, 2011, “Pentagon: renewable energy means (military) power”. http://www.smartplanet.com/blog/intelligent-energy/pentagon-renewable-energy-means-military-power/5846)

The Air Force has flight tested a A-10C Thunderbolt II on a biofuel blend. The advancement of renewable energy technologies is now a vital strategic interest of the U.S. military, Deputy Defense Secretary William Lynn said in a speech today. Reducing the military’s dependence on fossil fuel sources is correlated with its ability to project power overseas, Lynn said. The secretary explained that an energy strategy must become a “fundamental part” of military planning, according to UPI. The U.S. military’s involvement in several long-term engagements has made fuel management an important consideration in the Pentagon’s war planning, Lynn noted. He also called for increased energy conservation in military operations. The secretary highlighted the military’s recent biofuel and solar pilot projects. In March 2010, the U.S. Air Force launched an A-10C Thunderbolt II fighter plane that was powered by a biofuel blend. The flight was considered a success. The reasoning behind the test flights is obvious: The Air Force alone burns 2.4 billion gallons of jet fuel every year. It can either spend its resources on fuel or fighting wars - think of its as a ‘guns and butter’ argument, but affecting the military. Marines in Afghanistan have been innovating the use of solar technologies in the Central Asian theater. One unit of Marines is now functioning entirely on solar power that is used to charge radio batteries during long patrols, lighting for tents at night, and lowering the fuel requirements of mobile command centers. In January, U.S. President Barack Obama signed an appropriations bill requiring the military to buy only American made solar panels. Lawmakers added the provision over concerns that China unfairly subsidizes its renewable energy industries.

## SBSP Solves Freedom of Action

### SBSP enables the military to place bases in strategic locations without fuel conveys, increasing our freedom of action and strategic flexibility.

Berger 07 (Brian, 12 October, “Report Urges U.S. to Pursue Space-Based Solar Power”, Space News, http://www.space.com/4478-report-urges-pursue-space-based-solar-power.html)

WASHINGTON – A Pentagon-chartered report urges the United States to take the lead in developing space platforms capable of capturing sunlight and beaming electrical power to Earth. Space-based solar power, according to the report, has the potential to help the United States stave off climate change and avoid future conflicts over oil by harnessing the Sun's power to provide an essentially inexhaustible supply of clean energy. The report, "Space-Based Solar Power as an Opportunity for Strategic Security," was undertaken by the Pentagon's National Security Space Office this spring as a collaborative effort that relied heavily on Internet discussions by more than 170 scientific, legal, and business experts around the world. The Space Frontier Foundation, an activist organization normally critical of government-led space programs, hosted the website used to collect input for the report. Speaking at a press conference held here Oct. 10 to unveil the report, U.S. Marine Corps Lt. Col. Paul Damphousse of the National Space Security Space Office said the six-month study, while "done on the cheap," produced some very positive findings about the feasibility of space-based solar power and its potential to strengthen U.S. national security. "One of the major findings was that space-based solar power does present strategic opportunity for us in the 21st century," Damphousse said. "It can advance our U.S. and partner security capability and freedom of action and merits significant additional study and demonstration on the part of the United States so we can help either the United States develop this, or allow the commercial sector to step up." Demonstrations needed Specifically, the report calls for the U.S. government to underwrite the development of space-based solar power by funding a progressively bigger and more expensive technology demonstrations that would culminate with building a platform in geosynchronous orbit bigger than the international space station and capable of beaming 5-10 megawatts of power to a receiving station on the ground. Nearer term, the U.S. government should fund in depth studies and some initial proof-of-concept demonstrations to show that space-based solar power is a technically and economically viable to solution to the world's growing energy needs. Aside from its potential to defuse future energy wars and mitigate global warming, Damphousse said beaming power down from space could also enable the U.S. military to operate forward bases in far flung, hostile regions such as Iraq without relying on vulnerable convoys to truck in fossil fuels to run the electrical generators needed to keep the lights on. As the report puts it, "beamed energy from space in quantities greater than 5 megawatts has the potential to be a disruptive game changer on the battlefield. [Space-based solar power] and its enabling wireless power transmission technology could facilitate extremely flexible 'energy on demand' for combat units and installations across and entire theater, while significantly reducing dependence on over-land fuel deliveries." Although the U.S. military would reap tremendous benefits from space-based solar power, Damphousse said the Pentagon is unlikely to fund development and demonstration of the technology. That role, he said, would be more appropriate for NASA or the Department of Energy, both of which have studied space-based solar power in the past. The Pentagon would, however, be a willing early adopter of the new technology, Damphousse said, and provide a potentially robust market for firms trying to build a business around space-based solar power. "While challenges do remain and the business case does not necessarily close at this time from a financial sense, space-based solar power is closer than ever," he said. "We are the day after next from being able to actually do this." Damphousse, however, cautioned that the private sector will not invest in space-based solar power until the United States buys down some of the risk through a technology development and demonstration effort at least on par with what the government spends on nuclear fusion research and perhaps as much as it is spending to construct and operate the international space station. "Demonstrations are key here," he said. "If we can demonstrate this, the business case will close rapidly." Charles Miller, one of the Space Frontier Foundation's directors, agreed public funding is vital to getting space-based solar power off the ground. Miller told reporters here that the space-based solar power industry could take off within 10 years if the White House and Congress embrace the report's recommendations by funding a robust demonstration program and provide the same kind of incentives it offers the nuclear power industry. The Pentagon's interest is another important factor. Military officials involved in the report calculate that the United States is paying $1 per kilowatt hour or more to supply power to its forward operating bases in Iraq. "The biggest issue with previous studies is they were trying to get five or ten cents per kilowatt hour, so when you have a near term customer who's potentially willing to pay much more for power, it's much easier to close the business case," Miller said. NASA first studied space-based solar power in the 1970s, concluding then that the concept was technically feasible but not economically viable. Cost estimates produced at the time estimated the United States would have to spend $300 billion to $1 trillion to deliver the first kilowatt hour of space-based power to the ground, said John Mankins, a former NASA technologist who led the agency's space-based solar power research and now consults and runs the Space Power Association. Advances in computing, robotics, solar cell efficiency, and other technologies helped drive that estimate down by the time NASA took a fresh look at space-based solar power in the mid-1990s, Mankins said, but still not enough justify the upfront expense of such an undertaking at a time when oil was going for $15 a barrel. With oil currently trading today as high as $80 a barrel and the U.S. military paying dearly to keep kerosene-powered generators humming in an oil-rich region like Iraq, the economics have change significantly since NASA pulled the plug on space-based solar power research in around 2002. On the technical front, solar cell efficiency has improved faster than expected. Ten years ago, when solar cells were topping out around 15 percent efficiency, experts predicted that 25 percent efficiency would not be achieved until close to 2020, Mankins said, yet Sylmar, Calif.-based Spectrolab – a Boeing subsidiary – last year unveiled an advanced solar cell with a 40.7 percent conversion efficiency. One critical area that has not made many advances since the 1990s or even the 1970s is the cost of launch. Mankins said commercially-viable space-based solar power platforms will only become feasible with the kind of dramatically cheaper launch costs promised by fully reusable launch vehicles flying dozens of times a year. "If somebody tries to sell you stock in a space solar power company today saying we are going to start building immediately, you should probably call your broker and not take that at face value," Mankins said. "There's a lot of challenges that need to be overcome." Mankins said the space station could be used to host some early technology validation demonstrations, from testing appropriate materials to tapping into the station's solar-powered electrical grid to transmit a low level of energy back to Earth. Worthwhile component tests could be accomplished for "a few million" dollars, Mankins estimated, while a space station-based power-beaming experiment would cost "tens of millions" of dollars. Placing a free-flying space-based solar power demonstrator in low-Earth orbit, he said, would cost $500 million to $1 billion. A geosynchronous system capable of transmitting a sustained 5-10 megawatts of power down to the ground would cost around $10 billion, he said, and provide enough electricity for a military base. Commercial platforms, likewise, would be very expensive to build. "These things are not going to be small or cheap," Mankins said. "It's not like buying a jetliner. It's going to be like buying the Hoover Dam." While the upfront costs are steep, Mankins and others said space-based solar power's potential to meet the world's future energy needs is huge. According to the report, "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."

## Renewable Energy Good

### US needs to transition away from fossil fuels in order to maintain global dominance and to avoid global warming.

Dennison 11, Mike, IR State Bureau, “Military Officers: Fossil-Fuel Reliance Threatens US Security, Economy”, Independent Record, February 7, 2011, http://helenair.com/news/article\_f3ee5098-327f-11e0-86e2-001cc4c03286.html

HELENA — Montana legislators last week heard from an unlikely duo about how the United States must pursue renewable power and move away from fossil fuels: A retired U.S. Navy vice-admiral and a Marine Corps colonel. Dennis McGinn, a retired vice admiral who now works for CNA, a Virginia-based think tank, said the United States won't abandon traditional fuels like oil or coal anytime soon. But relying primarily on these fuels puts the country at risk militarily and economically, and the government should aggressively pursue development of alternative, renewable fuels, he said.“We need to, in an environmentally and sensible way, continue to access those extractive resources in Montana, for Montana and the U.S.,” he said in an interview. “But to think that that is the only approach that we should take, that is going to sustain us into the foreseeable future, is very, very short-sighted.” McGinn and Col. Bob Charette of the U.S. Marine Corps came to Helena last week at the invitation of Rep. Mike Phillips, D-Bozeman, and Sen. Ryan Zinke, R-Whitefish. They met with legislative leaders, Gov. Brian Schweitzer and the media, and made a presentation to about 150 people at the Capitol Wednesday evening, including many legislators. McGinn said Montana should continue with its incentives to encourage renewable-power development.Charette, director of the Marine Corps' Expeditionary Energy Office, said the military's reliance on fossil fuels often makes it more vulnerable to enemies. Marines in Afghanistan must move fuel convoys through Pakistan for many weeks, he said. For every 50 fuel and water convoys, one Marine is killed or wounded, he said.To reduce the threat, the Marine Corps has been developing patrols that use renewable energy, such as small, flexible solar systems to power equipment that had been powered by generators, Charette said.McGinn said he has studied the science on climate change, and is convinced the science is valid.He said while the issue has become highly politicized, he noted that 95 percent of climate-change scientists believe change is occurring and is caused by man-made greenhouse gases.“If I'm a Marine captain in Afghanistan and I've got 95 percent of the intel reports telling me there's a likelihood of a Taliban ambush over the pass that I'm going to escort a fuel convoy on, and I've got 5 percent of those reports that are table-pounding intel saying 'No problem,' who do you think I'm going to listen to?” he said.“Even if the guy who says 'No problem' is right, the fact that 95 percent of the overwhelming evidence says there is a problem, prudence would dictate that you'd better be careful.”McGinn said America needs a diverse portfolio of energy to reduce the security threat created by reliance on foreign oil and reduce the need to place American forces overseas to protect fossil fuel sources.“Every year that goes by, the options are less and the cost is more,” he said. “Montana is in a great spot to be really, really pro-active in formulating the kind of policies that will create a great energy future.“It has to be a (diverse) portfolio of energy. It can't be just clinging to the old fossil fuels.”

## Heg Unsustainable- Spending

### Heg unsustainable – US defense spending

Eland 08 (Ivan Eland, senior fellow at the Independent Institute, “Back to the Future: Rediscovering America’s Foreign Policy Traditions,” Mediterranean Quarterly, http://mq.dukejournals.org/cgi/reprint/19/3/88.pdf)

To support the informal US worldwide empire of alliances, overseas bases, and personnel, which are used to justify and conduct frequent military interventions, the United States spends huge sums on defense compared to other nations. The United States spends on defense more than the combined security expenditures of the next sixteen highest-spending countries.8 In all, the United States accounts for 44.0 percent of the world’s defense spending,9 but only 27.5 percent of the world’s gross domestic product (GDP).10 This comparison, along with the strain that the two small wars in Iraq and Afghanistan have imposed on US forces, indicate that the informal US empire might be overstretched. Many prior empires have declined because their security spending, overseas defense commitments, and military interventions exceeded their ability to pay for them. Even the British and French empires, on the winning side of both world wars, became financially exhausted — because of fighting those wars and maintaining their vast territories — and went into decline. More recently, the Soviet Union’s empire, and even the country itself, collapsed because its giant military, Eastern European alliances, and military interventions in the developing world became too much for its dysfunctional economy to bear. Many in the United States say that the US economy is much bigger than these failed empires and that decline cannot happen here. But that is what the elites of past empires believed, too. Furthermore, over time, small differences in economic growth rates between competing countries can lead to a reordering of great powers on the world scene. Most of the United States’ economic competitors have less defense spending as a portion of GDP to be a drag on their economies. Thus, even “national greatness” conservatives should be wary of too much defense spending, excessive military commitments overseas, and unnecessary wars, such as Iraq, that sap national resources. All other forms of national power — military, technological, and cultural — derive from maintaining a healthy economy.

## Energy Crisis Kills Heg

### And, independently, America has thus far afforded both “guns and butter” with investors who trusted the dollar’s stability, but a looming energy crisis is killing investor confidence; renewable energies are key to ensure US control of the world economy and sustain hegemony.

Karlin 11 (Anatoly, May 14, 2011, “Decade Forecast, Part 1 – The Downsizing Of Pax Americana”, http://www.sublimeoblivion.com/2011/05/14/decade-forecast-1/)

Contrary to the “doomer” worldview, it is almost certainly possible to sustain an industrial civilization without a drop of oil (though ceteris paribus it will be a materially poorer one, because of oil’s uniquely high EROEI). The problem is that today’s industrial system, especially in the US, is built in such a way – gas-guzzling SUV’s on asphalt roads slithering across endless vistas of soulless suburbia – that cheap oil is indispensable to making the commutes and credit flows, the jet flights and JIT production systems, function. An even bigger problem is that Hubbert’s predictions of a global oil peak are (roughly) on schedule: though delayed by the 1970′s oil shocks, it is likely that either 2008 or 2010 was the all-time peak, and oil production will now decline at an accelerating rate – even without accounting for possible discontinuities like a global credit implosion, a sudden collapse of Ghawar, the spread of revolution to Saudi Arabia, or Iranian mining of the Straits of Hormuz. The US spent prodigious sums to fight a war to open up Iraq’s oil reserves, but today its oil production is no higher than in 2000 (and hopes of massively increasing it are probably unrealistic). Russia has reconsolidated state control over its hydrocarbon deposits, discounting Western recriminations over its “resource nationalism”, and has successfully pushed back against Washington-backed “color revolutions”. Central Asia never proved to be the black gold lode of American geostrategic fantasy, and in any case it has since been closed off again by Russia. Due to their immense capital costs, environmental impact, and low energy-return-on-energy-invested (EROEI), there can be no salvation in tar sands or shale. Nor have there been any efforts at mitigation of the kind recommended in the Hirsch report. Any energy transition will be a very drawn-out process, considering the sheer scale of the infrastructure that will have to be replaced – and using continuously lower-EROEI energy sources! As such, it can be said with a high degree of certainty that the world will soon experience a severe shortfall in liquid fuels. Because of its high degree of dependence on cheap oil, this will affect the US disproportionately, which will have to make good with demand destruction. The consequences will include major knock-on effects on consumers, who constitute the mainstay of American economic power. State Insolvency The geological realities of peak oil (2005-2010), in combination with soaring demand from industrializing Asia, have led to the worst crisis since the Great Depression, with the free-fall only being checked by a dizzying panoply of monetary flooding, fiscal stimulus, and government bailouts. As if this weren’t enough, the US faces rising entitlements costs as the baby boomers start retiring, a bloated military-industrial complex, and increasing commitments to Afghanistan with no timetable in sight (where there are now more US troops than there were at the peak of the Soviet intervention). [The US budget deficit is predicted to permanently remain in the red even under the rosiest assumptions. As of now, it is the more pessimistic scenarios that are being born out - Republican refusals to raise tax rates or cooperate on Medicare; Soviet-like rhetoric about "defense cuts" while real military spending continues rising; etc.] Now the major reason why the US has been able to afford both guns (the US military) and butter (its double deficits) in the face of deindustrialization was by giving its many foreign investors an atrocious rate of return, which they accepted in return for America’s “alpha” – its reputation as the largest economy, sole superpower, and global financial center, in other words, the “safe haven” par excellence. It also draws immense strength from the US dollar’s role as the global reserve currency, for instance by allowing it to comfortably buy oil at $-denominated prices even when the currency is weak. But with its “imperial overstretch” (see Afghanistan), moribund financial system, and a budget deficit north of 10% of GDP and projected to remain in the red for the foreseeable future – by some measures, US debt and fiscal metrics are worse than those of the PIGS on aggregate – will this American “alpha” survive? Probably not for much longer. The creeping monetization of US debt will destroy investor confidence that they will ever make a positive return on their US bond investment. The withdrawal of a single major investor, especially if it coincides with a geopolitical shock, could set off a “cascading collapse” as other investors scurry away from US Treasury bonds. This will leave the US incapable of generating the primary surpluses to service its negative net foreign investment position, leading either to a compound debt trap or a classic emerging market-style currency crisis. Ice or fire? Given America’s democratic system and the bipartisan consensus on fiscal profligacy, I would bet on the latter.

## Casualties Kill Support

### High casualties are the primary contributor to low support for war

Gartner 8

SCOTT SIGMUND GARTNER February 2008 The University of California, Davis “The Multiple Effects of Casualties on Public Support for War: An

Experimental Approach” American Political Science Review http://psfaculty.ucdavis.edu/sgartner/experiment\_workshop/Gartner.pdf

The rational expectations theory of casualties and wartime support makes two major claims. First, wartime approval represents the result of an expected utility, cost–benefit calculation, where casualties represent the key (but not the only) cost. Some people will oppose or support a conflict regardless of casualties, but most determine their support by observing a war’s results. As rational consumers, individuals weigh a war’s anticipated costs and benefits (Gartner and Segura 2005; Gelpi, Feaver, and Reifter 2005). Casualties are the most salient, visible, and systematic measure of a war’s cost (Gartner and Segura 2000). As a result, in war, people pay special attention to casualties and attempt to estimate their future direction (they also look at other factors, such as economic costs—–see Fordham 2006). If individuals’ utility for estimated costs exceeds their estimated value of the benefits, they oppose the conflict.

## Public Support-> Heg

### Public support is the most important source of American leadership – it is the most likely threat to leadership

Ikenberry, ‘2 - Professor of Geopolitics and Global Justice, Georgetown University, 2002 (G. John, Winter “American Strategy in the Age of Terror” – Survival, p. 21-22)

The United States may be ‘indispensable’ to the stable operation of global order, but American voters are not really aware of this or much impressed by its imperatives. Charles Kupchan argues that a shrinking American willingness to be the global protector of last resort will be the primary engine of a change to that order. Today’s hegemonic order will crack from a growing mismatch between domestic support and external commitments. The foundation is shaky because America has a dwindling interest in paying the construction and upkeep … Rather than pursue a hollow hegemony that misleads and creates unmet expectations, it is better for the United States to give advance notice that its days as a guarantor of last resort may be numbered. The big oak tree of American hegemony has grown steadily over the decades. Others still want it and benefit from it and the fact of its existence makes alternative ordering systems less viable – but it still depends on a subterranean water supply – United States public support – that could be drying up.

## Hege Good 1/5

### U.S.withdrawal would leave behind a power vacuum, spurring terrorism, economic turmoil, racism, and multiple nuclear wars.

Niall Ferguson, July/August 2004 “A World Without Power,” FOREIGN POLICY Issue 143

So what is left? Waning empires. Religious revivals. Incipient anarchy. A coming retreat into fortified cities. These are the Dark Age experiences that a world without a hyperpower might quickly find itself reliving. The trouble is, of course, that this Dark Age would be an altogether more dangerous one than the Dark Age of the ninth century. For the world is much more populous-roughly 20 times more--so friction between the world's disparate "tribes" is bound to be more frequent. Technology has transformed production; now human societies depend not merely on freshwater and the harvest but also on supplies of fossil fuels that are known to be finite. Technology has upgraded destruction, too, so it is now possible not just to sack a city but to obliterate it. For more than two decades, globalization--the integration of world markets for commodities, labor, and capital--has raised living standards throughout the world, except where countries have shut themselves off from the process through tyranny or civil war. The reversal of globalization--which a new Dark Age would produce--would certainly lead to economic stagnation and even depression. As the United States sought to protect itself after a second September 11 devastates, say, Houston or Chicago, it would inevitably become a less open society, less hospitable for foreigners seeking to work, visit, or do business. Meanwhile, as Europe's Muslim enclaves grew, Islamist extremists' infiltration of the EU would become irreversible, increasing trans-Atlantic tensions over the Middle East to the breaking point. An economic meltdown in China would plunge the Communist system into crisis, unleashing the centrifugal forces that undermined previous Chinese empires. Western investors would lose out and conclude that lower returns at home are preferable to the risks of default abroad. The worst effects of the new Dark Age would be felt on the edges of the waning great powers. The wealthiest ports of the global economy--from New York to Rotterdam to Shanghai--would become the targets of plunderers and pirates. With ease, terrorists could disrupt the freedom of the seas, targeting oil tankers, aircraft carriers, and cruise liners, while Western nations frantically concentrated on making their airports secure. Meanwhile, limited nuclear wars could devastate numerous regions, beginning in the Korean peninsula and Kashmir, perhaps ending catastrophically in the Middle East. In Latin America, wretchedly poor citizens would seek solace in Evangelical Christianity imported by U.S. religious orders. In Africa, the great plagues of aids and malaria would continue their deadly work. The few remaining solvent airlines would simply suspend services to many cities in these continents; who would wish to leave their privately guarded safe havens to go there? For all these reasons, the prospect of an apolar world should frighten us today a great deal more than it frightened the heirs of Charlemagne. If the United States retreats from global hegemony--its fragile self-image dented by minor setbacks on the imperial frontier--its critics at home and abroad must not pretend that they are ushering in a new era of multipolar harmony, or even a return to the good old balance of power. Be careful what you wish for. The alternative to unipolarity would not be multipolarity at all. It would be apolarity--a global vacuum of power. And far more dangerous forces than rival great powers would benefit from such a not-so-new world disorder.

Hege Good 2/5

### U.S. leadership solves every impact—extinction is only possible without hegemony

Thayer 6—professor of security studies at Missouri State—(Bradley, “In Defense of Primacy”, November/December, The National Interest, p. 32-37)

A grand strategy based on American primacy means ensuring the United States stays the world's number one power‑the diplomatic, economic and military leader. Those arguing against primacy claim that the United States should retrench, ei­ther because the United States lacks the power to maintain its primacy and should withdraw from its global commitments, or because the maintenance of primacy will lead the United States into the trap of "imperial overstretch." In the previous issue of The National Interest, Christopher Layne warned of these dangers of pri­macy and called for retrenchment.1 Those arguing for a grand strategy of retrenchment are a diverse lot. They include isolationists, who want no foreign military commitments; selective engagers, who want U.S. military commitments to centers of economic might; and offshore balancers, who want a modified form of selective engagement that would have the United States abandon its landpower presence abroad in favor of relying on airpower and seapower to defend its in­terests. But retrenchment, in any of its guis­es, must be avoided. If the United States adopted such a strategy, it would be a profound strategic mistake that would lead to far greater instability and war in the world, imperil American security and deny the United States and its allies the benefits of primacy. There are two critical issues in any discussion of America's grand strategy: Can America remain the dominant state? Should it strive to do this? America can remain dominant due to its prodigious military, economic and soft power capa­bilities. The totality of that equation of power answers the first issue. The United States has overwhelming military capa­bilities and wealth in comparison to other states or likely potential alliances. Barring some disaster or tremendous folly, that will remain the case for the foreseeable future. With few exceptions, even those who advocate retrenchment acknowledge this. So the debate revolves around the desirability of maintaining American pri­macy. Proponents of retrenchment focus a great deal on the costs of U.S. action­ but they fall to realize what is good about American primacy. The price and risks of primacy are reported in newspapers every day; the benefits that stem from it are not. A GRAND strategy of ensur­ing American primacy takes as its starting point the protec­tion of the U.S. homeland and American global interests. These interests include ensuring that critical resources like oil flow around the world, that the global trade and monetary regimes flourish and that Washington's worldwide network of allies is reassured and protected. Allies are a great asset to the United States, in part because they shoulder some of its burdens. Thus, it is no surprise to see NATO in Afghanistan or the Australians in East Timor. In contrast, a strategy based on re­trenchment will not be able to achieve these fundamental objectives of the United States. Indeed, retrenchment will make the United States less secure than the present grand strategy of primacy. This is because threats will exist no mat­ter what role America chooses to play in international politics. Washington can­not call a "time out", and it cannot hide from threats. Whether they are terror­ists, rogue states or rising powers, his­tory shows that threats must be confront­ed. Simply by declaring that the United States is "going home", thus abandoning its commitments or making unconvinc­ing half‑pledges to defend its interests and allies, does not mean that others will respect American wishes to retreat. To make such a declaration implies weak­ness and emboldens aggression. In the anarchic world of the animal kingdom, predators prefer to eat the weak rather than confront the strong. The same is true of the anarchic world of interna­tional politics. If there is no diplomatic solution to the threats that confront the United States, then the conventional and strategic military power of the United States is what protects the country from such threats. And when enemies must be confront­ed, a strategy based on primacy focuses on engaging enemies overseas, away from .American soil. Indeed, a key tenet of the Bush Doctrine is to attack terrorists far from America's shores and not to wait while they use bases in other countries to plan and train for attacks against the United States itself. This requires a phys­ical, on‑the‑ground presence that cannot be achieved by offshore balancing. Indeed, as Barry Posen has noted, U.S. primacy is secured because America, at present, commands the "global com­mon"‑‑the oceans, the world's airspace and outer space‑allowing the United States to project its power far from its borders, while denying those common avenues to its enemies. As a consequence, the costs of power projection for the United States and its allies are reduced, and the robustness of the United States' conventional and strategic deterrent ca­pabilities is increased.' This is not an advantage that should be relinquished lightly. A remarkable fact about international politics today‑-in a world where Ameri­can primacy is clearly and unambiguous­ly on display--is that countries want to align themselves with the United States. Of course, this is not out of any sense of altruism, in most cases, but because doing so allows them to use the power of the United States for their own purposes, ­their own protection, or to gain greater influence. Of 192 countries, 84 are allied with America‑-their security is tied to the United States through treaties and other informal arrangements‑and they include almost all of the major economic and military powers. That is a ratio of almost 17 to one (85 to five), and a big change from the Cold War when the ratio was about 1.8 to one of states aligned with the United States versus the Soviet Union. Never before in its history has this coun­try, or any country, had so many allies.

Hege Good 3/5

### Hegemony collapse guarantees several scenarios for extinction within a year

Drezner, ‘3

[Daniel W., Assistant Professor of Political Science at University of Chicago, “The perils of hegemonic power”, January 6, 2003, http://www.danieldrezner.com/archives/2003\_01.html]

Michael Ignatieff's cover story on empire in yesterday's New York Times Magazine will be discussed in the next few days, but I actually think James Dao's Week in Review piece on U.S. troops in Korea makes many of the same points more concisely. The problem facing the U.S. is that even though critics on all sides are currently attacking the U.S. right now for trying to dictate affairs across the globe, these same critics are also likely to assail the U.S. for any retreat from its current positions. Imagine for a second that the U.S. announced that it had decided to heed the calls to reign in its power. Say U.S. troops were pulled out of Europe, Korea, and the Middle East. No change in our economic or cultural policies, just a withdrawal of troops from the globe. What would happen? Undoubtedly, some of the animus towards the U.S. would dissipate in the short run. However, within the next year: 1) Japan would go nuclear. 2) The Balkans would be likely to erupt again, with Macedonia being the trigger this time. 3) Afghanistan would implode. 4) India and Pakistan would likely escalate their border skirmishes. 5) Israel would escalate its quasi-military actions in the occupied territories. 6) Arab fury at the U.S. inaction in the Middle East would rise even further. 7) Anti-American activists would criticize the U.S. for isolationism and inaction in the face of global instability. I don't deny that the looming specter of U.S. hard power in Iraq and elsewhere is eroding our capital of soft power. However, to paraphrase Churchill, the current policy is without question an awful one, until you consider the alternatives. On the margins, I believe that more accommodating U.S. policies on trade and the environment might buy an additional amount of good will from the developing and developed world, respectively. But those changes will not conceal the overwhelming U.S. advantage in military might, nor will it erase the natural emnity that comes with it.

Hege Good 4/5

### US primacy reduces risk of power wars – no risk of challenge or miscalc

Walt 02 (Dr. Stephen M. Walt, professor of international affairs at Harvard, professor of political science at the University of Chicago, assistant professor of politics and international affairs at Princeton, guest scholar at Brookings, associate at Carnegie Endowment for International Peace, “American Primacy,” Naval War College Review, Spring 2002)

A second consequence of U.S. primacy is a decreased danger of great-power rivalry and a higher level of overall international tranquility. Ironically, those who argue that primacy is no longer important, because the danger of war is slight, overlook the fact that the extent of American primacy is one of the main reasons why the risk of great-power war is as low as it is. For most of the past four centuries, relations among the major powers have been intensely competitive, often punctuated by major wars and occasionally by all-out struggles for hegemony. In the first half of the twentieth century, for example, great-power wars killed over eighty million people. Today, however, the dominant position of the United States places significant limits on the possibility of great-power competition, for at least two reasons. One reason is that because the United States is currently so far ahead, other major powers are not inclined to challenge its dominant position. Not only is there no possibility of a “hegemonic war” (because there is no potential hegemon to mount a challenge), but the risk of war via miscalculation is reduced by the overwhelming gap between the United States and the other major powers. Miscalculation is more likely to lead to war when the balance of power is fairly even, because in this situation both sides can convince themselves that they might be able to win. When the balance of power is heavily skewed, however, the leading state does not need to go to war and weaker states dare not try.

Heg Good 5/5

### Heg solves great power wars - it’s key to peace

Thayer, 07 – Associate Professor in the Department of Defense and Strategic Studies, Missouri State University (Bradley A., American Empire, Routledge, page 42)

Peace, like good health, is not often noticed, but certainly is missed when absent. Throughout history, peace and stability have been a major benefit of empires. In fact, pax Romana in Latin means the Roman peace, or the stabil-ity brought about by the Roman Empire. Rome’s power was so overwhelming that no one could challenge it successfully for hundreds of years. The result was stability within the Roman Empire. Where Rome conquered, peace, law, order, education, a common language, and much else followed. That was true of the British Empire (pax Britannica) too. So it is with the United States today. Peace and stability are major benefits of the American Empire. The fact that America is so powerful actually reduces the likelihood of major war. Scholars of international politics have found that the presence of a dominant state in international politics actually reduces the likelihood of war because weaker states, including even great powers, know that it is unlikely that they could challenge the dominant state and win. They may resort to other mechanisms or tactics to challenge the dominant coun-try, but are unlikely to do so directly. This means that there will be no wars between great powers. At least, not until a challenger (certainly China) thinks it can overthrow the dominant state (the United States). But there will be intense security competition—both China and the United States will watch each other closely, with their intelligence communities increasingly focused on each other, their diplomats striving to ensure that countries around the world do not align with the other, and their militaries seeing the other as their principal threat. This is not unusual in international politics but, in fact, is its “normal” condition. Americans may not pay much attention to it until a crisis occurs. But right now states are competing with one another. This is because international politics does not sleep; it never takes a rest

# Energy Independence

## Energy Needs Up

### Our energy needs are increasing

US EIA 7/27/2010 ((United States energy information center) <http://www.eia.gov/oiaf/ieo/world.html>) JA

In non-OECD nations, economic activity and commerce increase rapidly, fueling additional demand for energy in the service sectors. Population growth also is more rapid than in OECD countries, portending increases in the need for education, health care, and social services and the energy required to provide them. In addition, as developing nations mature, they transition to more service-related enterprises, increasing demand for energy in the commercial sector. The energy needed to fuel growth in commercial buildings will be substantial, with total delivered commercial energy use among non-OECD nations growing by 2.7 percent per year from 2007 to 2035.

### Oil companies want to maintain the status quo

Rebecca Lefton, Daniel Weiss Politica Analysts January 13, 2010 (Center for American Progress “Oil Dependence Is a Dangerous Habit”) http://www.americanprogress.org/issues/2010/01/oil\_imports\_security.html

Approximately 25 percent of ConocoPhillips’ imports were from “dangerous or unstable” countries—116.7 million barrels—in 2008, contributing to its $52.7 billion profit. And Shell raked in $31.4 billion that year, also importing one-quarter of its oil—61.8 million barrels—from these countries. (Note: Shell includes Shell Chemical LP, Shell Chemical Yabucoa Inc, Shell US Trading Co, Shell Oil Co, and Shell Oil Co Deer Park). With that kind of money it’s no wonder Big Oil is doing everything in its power to maintain the status quo. The companies are spending record amounts on lobbying to stop clean-energy and climate legislation. The American Petroleum Institute spent $75.2 million for public relations and advertising in 2008, and in the third quarter of 2009 the oil and gas industry outspent all other sectors lobbying on climate change, with Exxon Mobil leading the pack spending $7.2 million.

## SBSP Solves Energy Independence + Impact

### SSP key to solve energy independence-impact is extinction.

Draiman 2008 [Jay, “Mandatory Renewable Energy: The Energy Evolution”, Energy Consultant and Energy Development Specialist with over 20 years experience in energy research, http://environment.newscientist.com/channel/earth/energy-fuels/dn12774-pentagon-backs-plan-to-beam-solar-power-from-space.html]

"We strive to meet the needs of the present generation without compromising the ability of future generations to meet their own needs". Today’s energy industry is perhaps the worlds most powerful. Energy is the basis of this entire world wealth, and for perhaps earth entire history, the sun energy has fueled all ecological and economic systems. If early humans did not learn to exploit new sources of energy, humankind would still be living in the tropical forests. Without the continual exploitation of new energy sources, there would have been no civilization, no Industrial Revolution and no looming global catastrophe. In order to insure energy and economic independence as well as better economic growth without being blackmailed by foreign countries, our country, the United States of America utilization of energy sources must change. "Energy drives our entire economy. We must protect it. "Let's face it, without energy the whole economy and economic society we have set up would come to a halt. So you want to have control over such an important resource that you need for your society and your economy." The American way of life is not negotiable. Our continued dependence on fossil fuels could and will lead to catastrophic consequences.

## SBSP Solves Oil Dependence

### SSP solves oil dependence, independently, the impact is great power war, AND, it causes oil shocks.

NSSO, 2007, SBSP Study Group, 2007, 10 October 2007, (National Security Space Office, Space-Based Solar Power, As an Opportunity for Strategic Security, Phase 0 Architecture Feasibility Study, <http://www.acq.osd.mil/nsso/solar/SBSPInterimAssesment0.1.pdf>)

Overall, SBSP offers a hopeful path toward reduced fossil and fissile fuel dependence. FINDING: The SBSP Study Group found that SBSP offers a long-term route tu 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.

## Oil Dependence Impact

### AND, oil shocks ensure extinction.

Richard Heinberg, core faculty member at New College of California, The Party’s Over: Oil, War and the Fate of Industrial Societies, 2003, p. 230

Today the average US citizen uses five times as much energy as the world average. Even citizens of nations that export oil – such as Venezuela and Iran – use only a small fraction of the energy US citizens use per capita. The Carter Doctrine, declared in 1980, made it plain that US military might would be applied to the project of dominating the world’s oil wealth: henceforth, any hostile effort to impede the flow of Persian Gulf oil would be regarded as an “assault on the vital interests of the United States” and would be “repelled by any means necessary, including military force.” In the past 60 years, the US military and intelligence services have grown to become bureaucracies of unrivaled scope, power, and durability. While the US has not declared war on any nation since 1945, it has nevertheless bombed or invaded a total of 19 countries and stationed troops, or engaged in direct or indirect military action, in dozens of others. During the Cold War, the US military apparatus grew exponentially, ostensibly in response to the threat posed by an archrival: the Soviet Union. But after the end of the Cold War the American military and intelligence establishments did not shrink in scale to any appreciable degree. Rather, their implicit agenda — the protection of global resource interests emerged as the semi-explicit justification for their continued existence. With resource hegemony came challenges from nations or sub-national groups opposing that hegemony. But the immensity of US military might ensured that such challenges would be overwhelmingly asymmetrical. US strategists labeled such challenges “terrorism” — a term with a definition malleable enough to be applicable to any threat from any potential enemy, foreign or domestic, while never referring to any violent action on the part of the US, its agents, or its allies. This policy puts the US on a collision course with the rest of the world. If all-out competition is pursued with the available weapons of awesome power, the result could be the destruction not just of industrial civilization, but of humanity and most of the biosphere.

## SBSP Solves

### SPSB is key to solving the current energy deficit solving all scenarios for threats to national security and economic recession.

National Security Space Office, October 10, 2007 (“Space-Based Solar Power As an Opportunity for Strategic Security” pg 1)

The magnitude of the looming energy and environmental problems is significant enough to warrant consideration of all options, to include revisiting a concept called Space Based Solar Power (SBSP) first invented in the United States almost 40 years ago. The basic idea is very straightforward: place very large solar arrays into continuously and intensely sunlit Earth orbit (1,366 watts/mJ), collect gigawatts of electrical energy, electromagnetically beam it to Earth, and receive it on the surface for use either as baseload power via direct connection to the existing electrical grid, conversion into manufactured synthetic hydrocarbon fuels, or as low-intensity broadcast power beamed directly to consumers. 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. This amount of energy Indicates that there is 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 SBSP capability.

# Warming

## SBSP Solves Warming 1/2

### Ground-based solutions to climate change are ineffective—space-based energy is key to stop warming.

Hanley 8 [Charles J, “'Drilling Up' Into Space for Energy `Beam Me Down Some Energy': Giant Pentagon, Tiny Palau Eye Space Solar Power”, AP Special Correspondent The Associated Press, The Associated Press, http://abcnews.go.com/print?id=4045164, DeFilippis]

While great nations fretted over coal, oil and global warming, one of the smallest at the U.N. climate conference was looking toward the heavens for its energy. The annual meeting's corridors can be a sounding board for unlikely "solutions" to climate changefrom filling the skies with soot to block the sun, to cultivating oceans of seaweed to absorb the atmosphere's heat-trapping carbon dioxide. Unlike other ideas, however, one this year had an influential backer, the Pentagon, which is investigating whether space-based solar power beaming energy down from satellites will provide "affordable, clean, safe, reliable, sustainable and expandable energy for mankind." Tommy Remengesau Jr. is interested, too. "We'd like to look at it," said the president of the tiny western Pacific nation of Palau. The Defense Department this October quietly issued a 75-page study conducted for its National Security Space Office concluding that space power collection of energy by vast arrays of solar panels aboard mammoth satellites offers a potential energy source for global U.S. military operations. It could be done with today's technology, experts say. But the prohibitive cost of lifting thousands of tons of equipment into space makes it uneconomical. That's where Palau, a scattering of islands and 20,000 islanders, comes in. In September, American entrepreneur Kevin Reed proposed at the 58th International Astronautical Congress in Hyderabad, India, that Palau's uninhabited Helen Island would be an ideal spot for a small demonstration project, a 260-foot-diameter "rectifying antenna," or rectenna, to take in 1 megawatt of power transmitted earthward by a satellite orbiting 300 miles above Earth. That's enough electricity to power 1,000 homes, but on that empty island the project would "be intended to show its safety for everywhere else," Reed said in a telephone interview from California. Reed said he expects his U.S.-Swiss-German consortium to begin manufacturing the necessary ultralight solar panels within two years, and to attract financial support from manufacturers wanting to show how their technology launch vehicles, satellites, transmission technology could make such a system work. He estimates project costs at $800 million and completion as early as 2012. At the U.N. climate conference here this month, a Reed partner discussed the idea with the Palauans, who Reed said could benefit from beamed-down energy if the project is expanded to populated areas. "We are keen on alternative energy," Palau's Remengesau said. "And if this is something that can benefit Palau, I'm sure we'd like to look at it." Space power has been explored since the 1960s by NASA and the Japanese and European space agencies, based on the fundamental fact that solar energy is eight times more powerful in outer space than it is after passing through Earth's atmosphere. The energy captured by space-based photovoltaic arrays would be converted into microwaves for transmission to Earth, where it would be transformed into direct-current electricity. Low-orbiting satellites, as proposed for Palau, would pass over once every 90 minutes or so, transmitting power to a rectenna for perhaps five minutes, requiring long-term battery storage or immediate use for example, in recharging electric automobiles via built-in rectennas. Most studies have focused instead on geostationary satellites, those whose orbit 22,300 miles above the Earth keeps them over a single location, to which they would transmit a continuous flow of power. The scale of that vision is enormous: One NASA study visualized solar-panel arrays 3 by 6 miles in size, transmitting power to similarly sized rectennas on Earth. Each such mega-orbiter might produce 5 gigawatts of power, more than twice the output of a Hoover Dam. But how safe would those beams be? Patrick Collins of Japan's Azabu University, who participated in Japanese government studies of space power, said a lower-power beam, because of its breadth, might be no more powerful than the energy emanating from a microwave oven's door. The beams from giant satellites would likely require precautionary no-go zones for aircraft and people on the ground, he said. Rising oil costs and fears of global warming will lead more people to look seriously at space power, boosters believe. "The climate change implications are pretty clear. You can get basically unlimited carbon-free power from this," said Mark Hopkins, senior vice president of the National Space Society in Washington. "You just have to find a way to make it cost-effective." Advocates say the U.S. and other governments must invest in developing lower-cost space-launch vehicles. "It is imperative that this work for `drilling up' vs. drilling down for energy security begins immediately," concludes October's Pentagon report. Some seem to hear the call. The European Space Agency has scheduled a conference on space-based solar power for next Feb. 29. Space Island Group, another entrepreneurial U.S. endeavor, reports "very positive" discussions with a European utility and the Indian government about buying future power from satellite systems. To Robert N. Schock, an expert on future energy with the U.N.'s Intergovernmental Panel on Climate Change, space power doesn't look like science fiction.

SBSP Solves Warming 2/2

### Space solar power will access much more energy than any other alternative energy source, and would solve global warming.

National Space Society 2011 (June 3, 2011, “Space Solar Power: Limitless clean energy from space”, http://www.nss.org/settlement/ssp/)

The United States and the world need to find new sources of clean energy. Space Solar Power gathers energy from sunlight in space and transmits it wirelessly to Earth. Space solar power can solve our energy and greenhouse gas emissions problems. Not just help, not just take a step in the right direction, but solve. Space solar power can provide large quantities of energy to each and every person on Earth with very little environmental impact. The solar energy available in space is literally billions of times greater than we use today. The lifetime of the sun is an estimated 4-5 billion years, making space solar power a truly long-term energy solution. As Earth receives only one part in 2.3 billion of the Sun's output, space solar power is by far the largest potential energy source available, dwarfing all others combined. Solar energy is routinely used on nearly all spacecraft today. This technology on a larger scale, combined with already demonstrated wireless power transmission (see 2-minute video of demo), can supply nearly all the electrical needs of our planet. Another need is to move away from fossil fuels for our transportation system. While electricity powers few vehicles today, hybrids will soon evolve into plug-in hybrids which can use electric energy from the grid. As batteries, super-capacitors, and fuel cells improve, the gasoline engine will gradually play a smaller and smaller role in transportation — but only if we can generate the enormous quantities of electrical energy we need. It doesn't help to remove fossil fuels from vehicles if you just turn around and use fossil fuels again to generate the electricity to power those vehicles. Space solar power can provide the needed clean power for any future electric transportation system. While all viable energy options should be pursued with vigor, space solar power has a number of substantial advantages over other energy sources. Advantages of Space Solar Power Unlike oil, gas, ethanol, and coal plants, space solar power does not emit greenhouse gases. Unlike coal and nuclear plants, space solar power does not compete for or depend upon increasingly scarce fresh water resources. Unlike bio-ethanol or bio-diesel, space solar power does not compete for increasingly valuable farm land or depend on natural-gas-derived fertilizer. Food can continue to be a major export instead of a fuel provider. Unlike nuclear power plants, space solar power will not produce hazardous waste, which needs to be stored and guarded for hundreds of years. Unlike terrestrial solar and wind power plants, space solar power is available 24 hours a day, 7 days a week, in huge quantities. It works regardless of cloud cover, daylight, or wind speed. Unlike nuclear power plants, space solar power does not provide easy targets for terrorists. Unlike coal and nuclear fuels, space solar power does not require environmentally problematic mining operations. Space solar power will provide true energy independence for the nations that develop it, eliminating a major source of national competition for limited Earth-based energy resources. Space solar power will not require dependence on unstable or hostile foreign oil providers to meet energy needs, enabling us to expend resources in other ways. Space solar power can be exported to virtually any place in the world, and its energy can be converted for local needs — such as manufacture of methanol for use in places like rural India where there are no electric power grids. Space solar power can also be used for desalination of sea water. Space solar power can take advantage of our current and historic investment in aerospace expertise to expand employment opportunities in solving the difficult problems of energy security and climate change. Space solar power can provide a market large enough to develop the low-cost space transportation system that is required for its deployment. This, in turn, will also bring the resources of the solar system within economic reach. Disadvantages of Space Solar Power High development cost. Yes, space solar power development costs will be very large, although much smaller than American military presence in the Persian Gulf or the costs of global warming, climate change, or carbon sequestration. The cost of space solar power development always needs to be compared to the cost of not developing space solar power. Requirements for Space Solar Power The technologies and infrastructure required to make space solar power feasible include: Low-cost, environmentally-friendly launch vehicles. Current launch vehicles are too expensive, and at high launch rates may pose atmospheric pollution problems of their own. Cheaper, cleaner launch vehicles are needed. Large scale in-orbit construction and operations. To gather massive quantities of energy, solar power satellites must be large, far larger than the International Space Station (ISS), the largest spacecraft built to date. Fortunately, solar power satellites will be simpler than the ISS as they will consist of many identical parts. Power transmission. A relatively small effort is also necessary to assess how to best transmit power from satellites to the Earth’s surface with minimal environmental impact. All of these technologies are reasonably near-term and have multiple attractive approaches. However, a great deal of work is needed to bring them to practical fruition. In the longer term, with sufficient investments in space infrastructure, space solar power can be built from materials from space. The full environmental benefits of space solar power derive from doing most of the work outside of Earth's biosphere. With materials extraction from the Moon or near-Earth asteroids, and space-based manufacture of components, space solar power would have essentially zero terrestrial environmental impact. Only the energy receivers need be built on Earth. Space solar power can completely solve our energy problems long term. The sooner we start and the harder we work, the shorter "long term" will be.

## Warming Impact

### Warming destroys all life on earth

Brandenburg, ’99. ( Dr. John Brandenburg is a physicist, rocket scientist, and Mars expert. He is one of the pioneers in Mars anomaly research and, since 1994, has been the principal investigator on the Microwave Electro-Thermal (MET) rocket thruster project for Research Support Instruments (RSI) in collaboration with the Center for Space Power at Texas A&M. He was a member of the NASA Technical Advisory Committee of Technology and Commercialization and served on its former Space Transportation Subcommittee.), Dead Mars, Dying Earth, p. 232-3

The world goes on its merry way and fossil fuel use continues to power it. Rather than making painful or politically difficult choices such as inventing in fusion or enacting a rigorous plan of conserving, the industrial world chooses to muddle through the temperature climb. Let’s imagine that America and Europe are too worried about economic dislocation to change course. The ozone hole expands, driven by a monstrous synergy with global warming that puts more catalytic ice crystals into the stratosphere, but this affects the far north and south and not the major nations’ heartlands. The seas rise, the tropics roast but the media networks no longer cover it. The Amazon rainforest becomes the Amazon desert. Oxygen levels fall, but profits rise for those who can provide it in bottles. An equatorial high pressure zone forms, forcing drought in central Africa and Brazil, the Nile dries up and the monsoons fall. Then inevitably, at some unlucky point in time, a major unexpected event occurs—a major volcanic eruption, a sudden and dramatic shift in ocean circulation or a large asteroid impact (those who think freakish accidents do not occur have paid little attention to life on Mars), or a nuclear war that starts between Pakistan and India and escalates to involve China and Russia… Suddenly, the gradual climb in global temperatures goes on a mad excursion as the oceans warm and release large amounts of dissolved carbon dioxide from their lower depths into the atmosphere. Oxygen levels go down as oxygen replaces lost oceanic carbon dioxide. Asthma cases double and then double again. Now a third of the world fears breathing. As the oceans dump carbon dioxide, the greenhouse effect increases, which further warms the oceans, causing them to dump even more carbon. Because of the heat, plants die and burn in enormous fires which release more carbon dioxide, and the oceans evaporate, adding more water vapor to the greenhouse. Soon, we are in what is termed a runaway greenhouse effect, as happened to Venus eons ago. The last two surviving scientists inevitably argue, one telling the other, “See, I told you the missing sink was in the ocean!” Earth, as we know it, dies. After this Venusian excursion in temperatures, the oxygen disappears into the soil, the oceans evaporate and are lost and the dead Earth loses its ozone layer completely. Earth is too far from the Sun for it to be a second Venus for long. Its atmosphere is slowly lost – as is its water—because of the ultraviolet bombardment breaking up all the molecules apart from carbon dioxide. As the atmosphere becomes thin, the Earth becomes colder. For a short while temperatures are nearly normal, but the ultraviolet sears any life that tries to make a comeback. The carbon dioxide thins out to form a thin veneer with a few wispy clouds and dust devils. Earth becomes the second Mars – red, desolate, with perhaps a few hardy microbes surviving.

## SBSP Solves Warming, Prolif

### SBSP will not only replace fossil fuels and solve global warming, but also prevent the widespread proliferation of nuclear technology that would otherwise replace oil in third-world countries.

National Security Space Office 07 (10 October, 2007, “Space‐Based Solar Power As an Opportunity for Strategic Security”, Report to the Director, National Security Space Office)

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. - 13 - 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

## Warming Impact

### Global warming causes extinction and famine Aff solves

Harvey 6/21/2011 ((Reporter for yahoo news on the environment) <http://news.yahoo.com/s/nm/20110621/sc_nm/us_oceans>) ja

OSLO (Reuters) – Life in the oceans is at imminent risk of the worst spate of extinctions in millions of years due to threats such as climate change and over-fishing, a study showed on Tuesday. Time was running short to counter hazards such as a collapse of coral reefs or a spread of low-oxygen "dead zones," according to the study led by the International Programme on the State of the Ocean (IPSO). "We now face losing marine species and entire marine ecosystems, such as coral reefs, within a single generation," according to the study by 27 experts to be presented to the United Nations. "Unless action is taken now, the consequences of our activities are at a high risk of causing, through the combined effects of climate change, over-exploitation, pollution and habitat loss, the next globally significant extinction event in the ocean," it said. Scientists list five mass extinctions over 600 million years -- most recently when the dinosaurs vanished 65 million years ago, apparently after an asteroid struck. Among others, the Permian period abruptly ended 250 million years ago. "The findings are shocking," Alex Rogers, scientific director of IPSO, wrote of the conclusions from a 2011 workshop of ocean experts staged by IPSO and the International Union for Conservation of Nature (IUCN) at Oxford University. Fish are the main source of protein for a fifth of the world's population and the seas cycle oxygen and help absorb carbon dioxide, the main greenhouse gas from human activities. OXYGEN Jelle Bijma, of the Alfred Wegener Institute, said the seas faced a "deadly trio" of threats of higher temperatures, acidification and lack of oxygen, known as anoxia, that had featured in several past mass extinctions. A build-up of carbon dioxide, blamed by the U.N. panel of climate scientists on human use of fossil fuels, is heating the planet. Absorbed into the oceans, it causes acidification, while run-off of fertilizers and pollution stokes anoxia. "From a geological point of view, mass extinctions happen overnight, but on human timescales we may not realize that we are in the middle of such an event," Bijma wrote. The study said that over-fishing is the easiest for governments to reverse -- countering global warming means a shift from fossil fuels, for instance, toward cleaner energies such as wind and solar power. "Unlike climate change, it can be directly, immediately and effectively tackled by policy change,"

## SBSP Solves Warming

### SBSP is environmentally net positive.

Fan, Martin, Wo & Mok, William, Harold, James, Brian, “Industry and Technology Assesment”, Space Based Solar Power, June 2, 2011, http://www.pickar.caltech.edu/e103/Final%20Exams/Space%20Based%20Solar%20Power.pdf

SBSP is environmentally net positive when including the negative effects of space launches (space launches are 3% of CFC emissions, but we have not calculated emissions saved. There are also too many different kinds of rocket fuels with different effects). It is possible to increase launches from approximately 15 (in US) to around 120. The objective is to create a space based solar power system that will be able to provide enough power to offset a more traditional power plant. Due to the developing nature of space based solar, most short term goals will be to progress in research and development. Within 10 years, the business should send a preliminary pilot satellite into low earth orbit to determine the viability of the incorporated wireless power transmission technique. Longer term goals will concentrate on making the company into a viable alternative energy provider and encouraging further investment into the industry. In 25- 30 years, the business should to launch a satellite that could satisfy the needs of the niche markets such as energy generation for forward military installations. Shortly after, the business should follow up with additional launches to create a satellite capable of outputting 0.5-1 GigaWatts.

## Warming is real

### Warming is real and is caused by humans, all scientific consensus goes aff and your authors are *paid off*.

Suzuki 7/19/10 (David, Chair of the David Suzuki Foundation, is an award-winning scientist, Environmentalist, Science deals blow to deluded climate change deniers, http://www.bclocalnews.com/opinion/98758379.html)

It must be difficult, if not downright embarrassing, to be a climate change denier these days. After all, the scientists they’ve attacked have been exonerated, London’s Sunday Times newspaper ran a retraction and apology for an article deniers were using to discredit climate change science, and more and more denier “experts” are being exposed as shills for industry or just disingenuous clowns. (Naomi Oreskes’s excellent book Merchants of Doubt offers insight into how the deniers operate.) Meanwhile, evidence that fossil fuel emissions contribute to dangerous climate change just keeps building. We use the term deniers deliberately. People who deny overwhelming scientific evidence without providing any compelling evidence of their own and who remain steadfast in their beliefs even as every argument they propose gets shot down do not demonstrate the intellectual rigour to be called skeptics. Mean-while, evidence of the harm our fossil fuel addiction causes beyond climate change mounts every day, as oil spews into the Gulf of Mexico and as industry and governments spend huge sums of money to keep us hooked. Of course, the deniers will ignore the evidence. Nothing would please us more than if they were right. Life really would be easier if fossil fuels like oil and coal did not cause environmental damage or pose risks to life on our small planet. But this is the real world, with real scientific evidence pointing to the urgent need to make changes in the way we live and get energy. We have many ways to confront the threat of catastrophic climate change, from individual efforts to conserve energy and pollute less to government initiatives to encourage research and development into clean energy technology.

And then we have the spectacle of the fossil fuel industry and petro-fuelled governments doing all they can to prolong our addiction to nonrenewable and polluting sources of energy as oil continues to gush into the Gulf of Mexico, threatening bird, marine, and human life, as well as local economies.

## Warming Timeframe

### Warming will become irreversible in 100 months-that’s 65 now.

Guardian Weekly, 8 (Andrew Simms, “Guardian Weekly: Just 100 months left to save Earth: Andrew Simms on a New Green Deal that could forestall the climate change tipping point”, 8/15, L/N)

In just 100 months' time, if we are lucky, and based on a conservative estimate, we could reach a tipping point for the beginnings of runaway climate change. Let us be clear exactly what we mean. The concentration of carbon dioxide (CO2) in the atmosphere today, the most prevalent greenhouse gas, is the highest it has been for the past 650,000 years. In just 250 years, as a result of the coal-fired Industrial Revolution, and changes to land use such as the growth of cities and the felling of forests, we have released more than 1,800bn tonnes of CO2 into the atmosphere. Currently, approximately 1,000 tonnes of CO2 are released into the atmosphere every second, due to human activity. Greenhouse gases trap incoming solar radiation, warming the atmosphere. When these gases accumulate beyond a certain level - a "tipping point" - global warming will accelerate, potentially beyond control. Faced with circumstances that threaten human civilisation, scientists at least have the sense of humour to term what drives this process as "positive feedback". In climate change, a number of feedback loops amplify warming through physical processes that are either triggered by the initial warming, or the increase in greenhouse gases. One example is the melting of ice sheets. The loss of ice cover reduces the ability of the Earth's surface to reflect heat and, by revealing darker surfaces, increases the amount of heat absorbed. Other dynamics include the decreasing ability of oceans to absorb CO2 due to higher wind strengths, linked to climate change. This has already been observed in the Southern Ocean and North Atlantic, increasing the amount of CO2 in the atmosphere, and adding to climate change. Because of such self-reinforcing feedbacks, once a critical greenhouse concentration threshold is passed, global warming will continue even if we stop releasing greenhouse gases into the atmosphere. If that happens, the Earth's climate will shift into a more volatile state, with different ocean circulation, wind and rainfall patterns, the implications of which are potentially catastrophic for life on Earth. This is often referred to as irreversible climate change. So, how do we arrive at the ticking clock of 100 months?

## Warming Turns War

### We’ll turn any war scenario-climate change will raise the magnitude of all conflicts and initiate the outbreak of others, multiple internal links-storms, drought, resource wars, flooding, disease, economic collapse, border tensions, and U.S. intervention-it’s the consensus of top military experts.

Environmental News Service 7 [Environmental News Service, “Military Panel: Climate Change Threatens U.S. National Security”, April 16, 2007, http://www.ens-newswire.com/ens/apr2007/2007-04-16-05]

Global climate change presents a serious national security threat that could affect Americans at home, impact U.S. military operations, and heighten global tensions, finds a study released today by a blue-ribbon panel of 11 of the most senior retired U.S. admirals and generals. Climate change, national security and energy dependence are a related set of global challenges that will add to tensions even in stable regions of the world, found the panel, known as the Military Advisory Board. "**We will pay for this one way or another**," said retired Marine Corps General Anthony Zinni, former commander of U.S. forces in the Middle East. "We will pay to reduce greenhouse gas emissions today, and we'll have to take an economic hit of some kind. Or, we will pay the price later in military terms. And that will involve human lives. There will be a human toll." "The U.S. should commit to a stronger national and international role to help stabilize climate changes at levels that will avoid significant disruption to global security and stability," the Military Advisory Board recommends. The study, "National Security and the Threat of Climate Change," explores ways in which climate change acts as a "threat multiplier" in already fragile regions of the world, creating the breeding grounds for extremism and terrorism. The CNA Corporation, a nonprofit research and analysis organization, brought together 11 retired four-star and three-star admirals and generals as a Military Advisory Board to provide advice, expertise and perspective on the impact of climate change on national security. CNA writers and researchers compiled the report under the board's direction and review. Members of the Military Advisory Board come from all branches of the armed services. The board includes a former Army chief of staff, commanders-in-chiefs of U.S. forces in global regions, a former shuttle astronaut and NASA administrator, and experts in planning, logistics, underwater operations and oceanography. One member also served as U.S. ambassador to China. "We found that climate instability will lead to instability in geopolitics and impact American military operations around the world," said retired General Gordon Sullivan, chairman of the Military Advisory Board and former Army chief of staff, in releasing the report today at a Washington news conference. "People are saying they want to be perfectly convinced about climate science projections," General Sullivan said. "But speaking as a soldier, we never have 100 percent certainty. If you wait until you have 100 percent certainty, something bad is going to happen on the battlefield." Military Advisory Board members said they remain optimistic that climate change challenges can be managed to reduce future risks. As part of its five specific recommendations for action, the Board said "the path to mitigating the worst security consequences of climate change involves reducing global greenhouse gas emissions." The U.S. Environmental Protection Agency today released the national greenhouse gas inventory, which finds that overall emissions during 2005 increased by 0.8 percent from the previous year. Overall emissions have grown by 16 percent from 1990 to 2005. Retired Navy Vice Admiral Richard Truly, a shuttle astronaut and former NASA administrator, said, "Unlike the challenges that we are used to dealing with, these will come upon us extremely slowly, but come they will, and they will be grinding and inexorable." Truly also notes that "maybe more challenging is that climate change will affect every nation, and all simultaneously. This is why we need to study this issue now, so that we'll be prepared and not overwhelmed by the required scope of our response when the time comes." The Military Advisory Board report recognizes that **unabated climate change could bring an increased frequency of extreme storms, additional drought and flooding, rising sea levels, melting glaciers and the rapid spread of life-threatening disease.** These projected effects are usually viewed as environmental challenges, but now the Military Advisory Board has looked at them from the perspective of national security assessments. They are serious risk factors for massive migrations, increased border tensions, greater demands for rescue and evacuation efforts, and conflicts over essential resources, including food and water, the board said, saying such developments could lead to direct U.S. military involvement. "Climate change can provide the conditions that will extend the war on terror," said retired Admiral T. Joseph Lopez, former commander-in-chief, U.S. Naval Forces Europe and of Allied Forces, Southern Europe. "Rising ocean water levels, droughts, violent weather, ruined national economies-those are the kinds of stresses we'll see more of under climate change," he said. "In the long term, we want to address the underlying conditions that terrorists seek to exploit," Admiral Lopez said. "But climate change will prolong those conditions. It makes them worse."

# Add-Ons

## India 1/2

### After the nuclear deal, the U.S.-Indo alliance has been in stagnation that risks collapse of cooperation, only the plan solves-facilitates technological and industrial interconnectivity, people-to-people contact, bureaucratic familiarity, and perceived lack of the alliance’s utility.

Garretson ‘9, Peter A. Garretson was a Council on Foreign Relations (CFR) International Fellow in India, and a Visiting Fellow at the Institute for Defence Studies and Analyses (IDSA) New Delhi. He is an active duty Air Force officer on sabbatical as an Air Force Fellow. He was previously the Chief of Future Science and Technology Exploration for Headquarters Air Force, Directorate of Strategic Plans and Programs, and is a former DARPA Service Chiefs’ Intern, and former Los Alamos National Laboratory (LANL) Service Academy Research Associate. He is a published author on Space Grand Strategy, and is a recipient of the National Space Society’s (NSS) Space Pioneer Award, Sky’s No Limit: Space Based Solar Power the Next Major Step in the U.S.-Indo Strategic Partnership, http://www.idsa.in/sites/default/files/OP\_SkysNoLimit.pdf

The Indo-US Strategic Partnership is itself a “strategic” topic of security discourse, as it affects many other aspects of both nations’ security, and it is important to actively nurture it. At present, it appears there is a dearth of “big ticket” ideas to continue the momentum post the “123” Indo-US Civil Nuclear Deal. Finding ideas that are relevant to agendas of both nations and help expand the partnership by enhancing cooperation in meaningful ways by linking dual-use technological and industrial bases and people-to-people contact, and familiarity between the respective bureaucracies is itself a meaningful security end. As will be discussed ahead in detail, the SBSP is one of those ideas with a truly “big ticket” potential.

### SBSP is the key internal link to relations.

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This paper sought to evaluate space-based solar power, a highly scalable, revolutionary renewable energy technology, in the context of the Indo-US bilateral strategic partnership, and determine if US and Indian interests and amities were sufficiently aligned to allow forward motion on such a project, and if so, what would be an actionable form for policymakers. It is the conclusion of the researcher that SBSP does appear to be a good fit for the US domestic, Indian domestic and bilateral agendas, and there is adequate political space and precursor agreements to begin a bilateral programme, should policymakers desire it. Given that SBSP appears to fit the articulated Indian criteria for suitability of energy source and to offer a better long-term energy security solution, and that the evaluation of the current energy-climate situation is so unhopeful, with a lack of promising and scalable solutions emerging, a no-regret, due-diligence effort in space-based solar power seems a justified and strategic1 investment. An actionable, three-tiered programme, with threshold criteria/goals, has been proposed, moving from basic technology and capacity building to a multi-lateral demo, and ultimately to an international commercial public-private-partnership entity to supply commercial power in the 2025 timeframe.

India 2/2

### India’s facing a massive energy crisis-growth projections and expert consensus prove-U.S. Space Solar Panels are the only hope.

Dinerman ‘9, Taylor Dinerman, Dinerman is a Space Author and Journalist in New York and a frequent columnist for The Space Review, Should India and the U.S. Cooperate on Space Solar Power, http://www.thespacereview.com/article/1389/1

From India’s standpoint the government does take the energy problem very seriously. While they connect it with the question of climate change, they have made it clear that they are not willing to inflict economic pain on their people in order to appease those in the West who are demanding that they cease their current drive to climb out of mass poverty in the name of the environment. Former External Affairs Minister Pranab Mukherjee made this clear when he spoke at the Asia Society in New York last year and said, “It is therefore completely one sided to target countries like India, whose emissions though modest are rising, but fail to bring to account those who have been responsible for more than 70% of the accumulated emissions in the atmosphere.” Recognizing the potential weakness of a case based strictly on the question of climate change, Mukherjee was wise enough to add that “even if there were no climate change arguments, considerations of energy security alone would require a medium to long term strategy of implementing a strategic shift from fossil fuels to non fossil fuels.” He called for a “major R&D effort to develop applications that that can provide convenient, cost effective large scale applications of solar energy.” Any analysis of the potential of terrestrial solar energy in India or elsewhere runs up against the awesome size of the future demand for power. Photovoltaic panels on rooftops and solar water heaters all make excellent small-scale contributions to the solution, but they cannot by any stretch of the imagination fulfill the requirements of a huge growing economy like India’s. Only SSP, which operates 24 hours a day, 7 days a week, year after year, can hope to meet this need. Fortunately both India and the US have space programs and technologies that could, if developed together and possibly with other interested nations such as Japan, bring SSP systems into service sometime late next decade or the early 2020s.

## AT India Space Program Bad

### It’s been going on for decades and financial motivation means it’ll continue-non-uniques all their offense.

Williams ‘7, Mark Williams was hired as a Senior Academic (CORE) from the Macquarie Center for Cognitive Science at Macquarie University, Technology Review (MIT Publication), India’s Space Ambitions Sore, http://www.technologyreview.com/computing/19115/page1/

While this current spate of activity brings the country greater prominence, India's space program is hardly a new development. In 1975, ISRO launched its first satellite, *Aryabhata*, on a Soviet rocket, and in 1980, India's first home-built launcher, the SLV-3, successfully put a satellite into orbit. ISRO has continued with a series of larger satellites and rockets in the succeeding years. Rather than national prestige, the Indian focus has until recently been on entirely pragmatic applications that gave the most bang for its limited rupees: communications satellites to provide services to far-flung regions of a vast country with little existing communications infrastructure, meteorology packages (often carried on the same geosynchronous satellites that perform communications missions), and remote-sensing satellites to map India's natural resources.

## AT Violates MTCR

### MTCR doesn’t prohibit civilian space cooperation-it’s just being enforced wrong.

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Further, MTCR is not an absolute prohibition. It specifically states that it is not meant to constrain cooperation in civil space programmes.9 In practice, however, it is difficult to find a meaningful distinction between peaceful launch and missile technologies. Even in the case of unambiguously military technologies, countries are at liberty to transfer such technology, provided they receive adequate assurances from the recipient country. One interesting idea that came up in discussion was the idea of a controlled international facility for space-planes, patterned after the IAEA model for controlled international nuclear facilities.

## AT Spending

### The plan costs just over 10 billion-that’s .07% of the deficit.

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In summary, an actionable bilateral policy framework will originate with a joint statement by the respective heads of state announcing and sanctioning the activity and signing the requisite information exchange and project agreement paperwork. An initial five-year, $10-30 million programme, managed in the respective executive, will develop contributing technologies and build a competent work force via the project/initiative and technology mission model, culminating in a roadmap and plan for an international mega-science project 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 retiring all significant technical risk. The final stage will entail the bilateral leadership to set up an international for-profit consortium along the lines of COMSAT/INTELSAT model to provide a scalable green energy system to allow development and address energy security and carbon mitigation concerns.

## \*\*Asteroids 1/2\*\*

### The USFG should incentivize the development and deployment of Space-Based solar power – key to space colonization and asteroid use.

NSSO 7 [National Space Society, October 10, “Space-Based Solar Power as an opportunity for Strategic Security”, Architecture Feasibility Study, the National Security Space Office, http://www.nss.org/settlement/ssp/library/nsso.htm, DeFilippis]

Several major challenges will need to be overcome to make SBSP a reality, including the creation of low-cost space access and a supporting infrastructure system on Earth and in space. Solving these space access and operations challenges for SBSP will in turn also open space for a host of other activities that include space tourism, manufacturing, lunar or asteroid resource utilization, and eventually settlement to extend the human race. Because DoD would not want to own SBSP satellites, but rather just purchase the delivered energy as it currently does via traditional terrestrial utilities, a repeated review finding is that the commercial sector will need Government to accomplish three major tasks to catalyze SBSP development. The first is to retire a major portion of the early technical risks. This can be accomplished via an incremental research and development program that culminates with a space-borne proof-of-concept demonstration in the next decade. A spiral development proposal to field a 10 MW continuous pilot plant en route to gigawatts-class systems is included in Appendix B. The second challenge is to facilitate the policy, regulatory, legal, and organizational instruments that will be necessary to create the partnerships and relationships (commercial-commercial, government-commercial, and government-government) needed for this concept to succeed. The final Government contribution is to become a direct early adopter and to incentivize other early adopters much as is accomplished on a regular basis with other renewable energy systems coming on-line today.

### Space solar power can be the anchor for a system to deflect an asteroid collision that could lead to the extinction of humanity.

Hempsella, 2006 (Mark, professor at University of Bristol, “Space power as a response to global catastrophes,” Acta Astronautica, Volume 59, Issue 7, October 2006, Pages 524-530, EBSCO host, JDC)

Large near-Earth object impacts, while they are comparatively rare compared to calderia volcanoes as a natural initiator of global catastrophes, are of special interest as sufficient space capability would enable deflection of destruction of the incoming object—thus fully preventing the catastrophe. This has been the subject of considerable recent literature and while many different approaches have been proposed all of them require a considerably greater space infrastructure than currently available.  The size of asteroid required to create a global catastrophe is a matter of some debate. Harrison et al. [21] suggest that 1 km size object is just below a threshold where global effects could cause a catastrophe level event. Whereas Rigby et al. [22] argue a 1 km object could have caused the Dark Ages in the 6th Century AD. So a system capable of handling a 1 km object would be the minimum required to deal with potential global catastrophe level events.  The size of system that could deflect a NEO sufficiently to avoid collision with the Earth is also uncertain and is strongly dependent upon the assumptions made on size, orbit and timescale. A small asteroid with centuries until the potential impact may be deflected sufficiently by a single nuclear device (e.g. [23]), which is probably just about possible with the current space infrastructure. However, a large comet with only a year or two warning would require systems well beyond current capability.  There have been proposals for large orbital systems to deflect asteroids for example that outlined by Campbell et al. [24]. To deflect an iron asteroid using a pulsed laser was estimated to need peak powers of 200 GW, which would correspond to a continuous power supply requirement in the order of 20 GW. This is the output of two reference SPS satellites giving a good indication of the size of system required for this technique. One suggested location was a Sun Earth Lagrange point.

\*\*Asteroids 2/2\*\*

### SSP key to stopping inevitable asteroids that cause extinction and civilization collapse.

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## \*\*Tornados 1/2\*\*

### SBSP prevents tornado formation

Eastlund et al, 2006 [Dr. Bernard J.; Lyle M. Jenkins, PH. D. physics Columbia University, Eastlund Scientific Enterprises, <http://ieeexplore.ieee.org/iel5/11012/34697/01656145.pdf?tp=&arnumber=1656145&

isnumber=34697>, 7/10/08]

Tornadoes represent the most dangerous and destructive of storms. A revolutionary concept for disrupting the formation of tornadoes in a thunderstorm is proposed for evaluation. Beamed microwave energy from a satellite could heat cold rainy downdrafts to alter convective forces in the storm cell. Such a satellite is termed a Thunderstorm Solar Power Satellite (TSPS). The TSPS is based on Space Solar Power Program (SSP) concepts and technology.

### Tornadoes kill 62 people yearly.

King 8 [Kate, “2008 could set records for tornado deaths”, CNN, <http://www.cnn.com/2008/TECH/science/05/28/tornado.year/index.html>]

The tornado killed four people in Parkersburg and two in nearby New Hartford that night; another victim died Monday from tornado-related injuries, according to local media. The victims are among at least 110 people killed in the United States by tornadoes this year, putting 2008 on track to be one of the deadliest years in recent history. The average for recent years is 62 tornado fatalities for an entire year. This year's death toll is already the highest since 1998, with seven months left in the year. "It does look like it's going to be a pretty remarkable year," said Greg Carbin, a meteorologist with the Storm Prediction Center of the National Weather Service. Among the victims: a mother who died huddled over her 4-year-old son, protecting him from a tornado in Picher, Oklahoma, the night before Mother's Day; a teenage girl killed when a tree fell on her home in Siloam, Arkansas, as she slept on May 2; and a 2-year-old in Hugo, Minnesota who died Sunday after a tornado hit his home. Watch devastation in Parkersburg, Iowa » The figures for tornado deaths have skyrocketed over the past four years. In 2005, there were 38; in 2006, 67; and last year, 81. But experts caution against reading too much into those statistics.

### Tornadoes will inevitably hit nuclear power plants-they uniquely cause dispersion.

The Ecologist 2003 (Annie Birdsong, NQA, “re: what if the world trade centre had been a nuclear power station?” pg. online @ [www.theecologist.org/forumViewMessage.html?id=72](http://www.theecologist.org/forumViewMessage.html?id=72) //WYO-EF)

Not only do we need to worry about terrorists attacking nuclear power plants, we must also worry about tornados that cross their paths. Imagine what would have happened if the nuclear reactor on campus at the University of Maryland, College Park, had been in the path of the deadly tornado that ripped through the campus April 28, 2002, dashing a car into a dormitory, killing two students; damaging or destroying 12 buildings; damaging 600 cars; and ripping up 30 acres of trees. The tornado, which was the strongest in Maryland's history, came within two miles of the Calvert Cliffs Nuclear Power Plant in Calvert County and destroyed a total of 861 homes, 561 vehicles and 23 businesses in Prince George's and Howard counties.(1a) The Department of Nuclear Engineering's reactor is surrounded by a seven foot concrete wall, but perhaps the powerful winds of the tornado could have dashed it or the control room into a building or rammed a telephone pole into one of them. This could have caused the water that keeps the core cool to leak out, making the uranium fuel turn molten white hot. The intense heat could have caused the steam to build up pressure and explode the containment around the reactor. The core would have melted through the vessel several feet into the ground.(1b) Plumes of radioactivity could have wafted across the surrounding cities spreading cancer to people's bones, leukemia to their blood and poison to their lungs. Radioactive fallout particles, called isotopes, would have fallen in the water. Some particles would have settled on the grass to be eaten by cows and other animals, and made their way up and down the food chain. Radioactivity would then have shown up in the cows milk, as happened after explosions of nuclear bombs during 700 or so weapons tests.(2),(3)

\*\*Tornados 2/2\*\*

### Extinction.

Wasserman 2002 [Harvey, Senior advisor to Greenpeace USA and the Nuclear Information & Resource Service “Nuclear Power and Terrorism,” Earth island Journal Spring 2002 Vol. 17, No.1//]

As at Three Mile Island, where thousands of farm and wild animals died in heaps, natural ecosystems would be permanently and irrevocably destroyed. Spiritually, psychologically, financially and ecologically, our nation would never recover. This is what we missed by a mere 40 miles on September 11. Now that we are at war, this is what could be happening as you read this. There are 103 of these potential Bombs of the Apocalypse operating in the US. They generate a mere 8 percent of our total energy. Since its deregulation crisis, California cut its electric consumption by some 15 percent. Within a year, the US could cheaply replace virtually all the reactors with increased efficiency. Yet, as the terror escalates, Congress is fast-tracking the extension of the Price-Anderson Act, a form of legal immunity that protects reactor operators from liability in case of a meltdown or terrorist attack.      Do we take this war seriously? Are we committed to the survival of our nation? If so, the ticking reactor bombs that could obliterate the very core of our life and of all future generations must be shut down.

## \*\*Nuclear Proliferation\*\*

### SBSP solves nuclear proliferation and conflicts

NSSO 2007 [SPACE-BASED SOLAR POWER AS AN OPPORTUNITY FOR STRATEGY SECURITY, National Security Space Office, <http://www.nss.org/settlement/ssp/library/final-sbsp-interim-assessment-release-01.pdf> , Date Accessed: 7/9/08, TJD]

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….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. SBSP will avoid energy shortages and great power conflict 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.

### Prolif sparks extinction

Utgoff 2, Victor, Deputy fo Strategy, Forces, and Resources Division, Institute for Defense Analysis, 02 (Survival) [http://survival.oupjournals.org](http://survival.oupjournals.org/), DeFilippis]

Widespreadproliferation 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.

## \*\*Natural Disasters\*\*

### SPS can provide quick response to devastating natural disasters.

Business Recorder, 2007 (“Pentagon Examines Use of Solar Panels in Space” December 25, lexis)

But it remains to be seen whether companies are willing to invest in research for space-based solar power because, even if the considerable technical challenges of building and deploying a system can be overcome, profits would remain years - if not decades - away.  Hopkins acknowledges the real technical challenges space-based solar power would face, but said investment is needed now to develop clean and renewable energy. The system would include building kilometre-sized arrays that would float in space and feed energy into a satellite that would beam it back to earth with a laser or microwave. Antennas on the ground would collect it and turn it into electricity.  One of the major challenges would be building a satellite that would have to be many times larger than the International Space Station and launching it into space. The NSSO, in a recent study, concluded that Congress should spend 10 billion dollars over the next 10 years to build a test satellite.  The Pentagon's interest in the system also has simple strategic implications. The NSSO study said fuel in Iraq is expensive and US soldiers lose their lives guarding fuel convoys.  With space-based solar power US bases would simply get the energy they need from space. "This may provide troops abroad in unfriendly or ill-equipped territory with power," the study said. Space-based solar power could also support humanitarian or peacekeeping missions in remote regions of the world, and could respond to areas where power has been knocked out by natural disasters, the NSSO said.  The US government first began exploring generating solar power from arrays in space in the late 1960s, but the idea was abandoned because it was thought to be too expensive and the necessary technology was not available.

### Natural Disasters culminate in extinction

SID-AHMED 2005 (Mohamed, Al-Ahram Online, Jan 6-12, [**http://weekly.ahram.org.eg/2005/724/op3.htm**](http://weekly.ahram.org.eg/2005/724/op3.htm), DeFilippis)

The human species has never been exposed to a natural upheaval of this magnitude within living memory. What happened in South Asia is the ecological equivalent of 9/11. Ecological problems like global warming and climatic disturbances in general threaten to make our natural habitat unfit for human life. The extinction of the species has become a very real possibility, whether by our own hand or as a result of natural disasters of a much greater magnitude than the Indian Ocean earthquake and the killer waves it spawned. Human civilisation has developed in the hope that Man will be able to reach welfare and prosperity on earth for everybody. But now things seem to be moving in the opposite direction, exposing planet Earth to the end of its role as a nurturing place for human life. Today, human conflicts have become less of a threat than the confrontation between [Humanity] Man and Nature. At least they are less likely to bring about the end of the human species. The reactions of Nature as a result of its exposure to the onslaughts of human societies have become more important in determining the fate of the human species than any harm it can inflict on itself. Until recently, the threat Nature represented was perceived as likely to arise only in the long run, related for instance to how global warming would affect life on our planet. Such a threat could take decades, even centuries, to reach a critical level. This perception has changed following the devastating earthquake and tsunamis that hit the coastal regions of South Asia and, less violently, of East Africa, on 26 December. This cataclysmic event has underscored the vulnerability of our world before the wrath of Nature and shaken the sanguine belief that the end of the world is a long way away. Gone are the days when we could comfort ourselves with the notion that the extinction of the human race will not occur before a long-term future that will only materialise after millions of years and not affect us directly in any way. We are now forced to live with the possibility of an imminent demise of humankind.

## \*\*Economy/Environment 1/3\*\*

### Reliance on fossil fuels is one of the greatest threats to the American economy and environment

Neuman, Scott, NPR staff writer, “Gore: Reliance On Fossil Fuels Poses Threat To The US”, July 17, 2008, http://www.npr.org/templates/story/story.php?storyId=92635699

The United States must commit on the scale of the Apollo moon project to end its dependence on carbon-based fuels for electricity and switch to clean, renewable sources in the next decade, former Vice President Al Gore said Thursday. Speaking in Washington, Gore challenged the nation to find a way, within 10 years, to produce all electric power from renewable sources. "The survival of the United States of America as we know it is at risk," Gore said. "The answer is to end our reliance on carbon-based fuels." The Nobel Prize winner acknowledged formidable obstacles to achieving the goal. But referring to the challenge presented by President Kennedy of landing a man on the moon before 1970, Gore said that "many people doubted we could accomplish that goal. "We must now lift our nation to reach another goal that will change history," he said. "Our success depends on our willingness as a people to undertake this journey and to complete it within 10 years. Once again, we have an opportunity to take a giant leap for humankind," he said, citing the famous words uttered by Neil Armstrong as he stepped onto the lunar surface in July 1969. Gore said other American accomplishments, such as the Marshall Plan for rebuilding Europe, Social Security and the interstate highway system should serve as inspiration. He alluded to the White House call for more offshore drilling by condemning "the perverse logic" that the short-term answer to high gasoline prices is to drill for more oil that won't be available for a decade. "When we send money to foreign countries to buy nearly 70 percent of the oil we use every day, they build new skyscrapers and we lose jobs. When we spend that money building solar arrays and windmills, we build competitive industries and gain jobs here at home," he said. Gore said that without dramatic changes to reduce global warming pollution, "our ability to ever recover from this environmental crisis" may be lost. "Of course there are those who will tell us this can't be done," he said. "Some of the voices we hear are the defenders of the status quo — the ones with a vested interest in perpetuating the current system, no matter how high a price the rest of us will have to pay."

### SBSP is very profitable in the long-term, and would significantly improve the US economy.

National Security Space Office 07 (10 October, 2007, “Space‐Based Solar Power As an Opportunity for Strategic Security”, Report to the Director, National Security Space Office)

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 - 35 - 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.

\*\*Economy/Environment 2/3\*\*

### Absent U.S. adoption of Solar-Space power economic collapse and extinction is inevitable.

### **Draiman 2008 [Jay, “Mandatory Renewable Energy: The Energy Evolution”, Energy Consultant and** Energy **Development Specialist with over 20 years experience in energy research, http://environment.newscientist.com/channel/earth/energy-fuels/dn12774-pentagon-backs-plan-to-beam-solar-power-from-space.html, DeFilippis]**

"We strive to meet the needs of the present generation without compromising the ability of future generations to meet their own needs". Today’s energy industry is perhaps the worlds most powerful. Energy is the basis of this entire world wealth, and for perhaps earth entire history, the sun energy has fueled all ecological and economic systems. If early humans did not learn to exploit new sources of energy, humankind would still be living in the tropical forests. Without the continual exploitation of new energy sources, there would have been no civilization, no Industrial Revolution and no looming global catastrophe. In order to insure energy and economic independence as well as better economic growth without being blackmailed by foreign countries, our country, the United States of America utilization of energy sources must change. "Energy drives our entire economy. We must protect it. "Let's face it, without energy the whole economy and economic society we have set up would come to a halt. So you want to have control over such an important resource that you need for your society and your economy." The American way of life is not negotiable. Our continued dependence on fossil fuels could and will lead to catastrophic consequences.

### U.S. leadership is key in any SBSP project and SBSP is key to economy and freedom of action.

Berger, Brian, space writer for “Space News”, “Report Urges U.S. to Pursue Space-Based Solar Power”, 12 October 2007, http://www.space.com/4478-report-urges-pursue-space-based-solar-power.html

WASHINGTON – A Pentagon-chartered report urges the United States to take the lead in developing space platforms capable of capturing sunlight and beaming electrical power to Earth. Space-based solar power, according to the report, has the potential to help the United States stave off climate change and avoid future conflicts over oil by harnessing the Sun's power to provide an essentially inexhaustible supply of clean energy. The report, "Space-Based Solar Power as an Opportunity for Strategic Security," was undertaken by the Pentagon's National Security Space Office this spring as a collaborative effort that relied heavily on Internet discussions by more than 170 scientific, legal, and business experts around the world. The Space Frontier Foundation, an activist organization normally critical of government-led space programs, hosted the website used to collect input for the report. Speaking at a press conference held here Oct. 10 to unveil the report, U.S. Marine Corps Lt. Col. Paul Damphousse of the National Space Security Space Office said the six-month study, while "done on the cheap," produced some very positive findings about the feasibility of space-based solar power and its potential to strengthen U.S. national security. "One of the major findings was that space-based solar power does present strategic opportunity for us in the 21st century," Damphousse said. "It can advance our U.S. and partner security capability and freedom of action and merits significant additional study and demonstration on the part of the United States so we can help either the United State s develop this, or allow the commercial sector to step up."

\*\*Economy/Environment 3/3\*\*

### U.S. India cooperation on SPS solves the economy for two reasons-reverses the trade deficit and solves jobs and minimal start-up costs.

**Alex ’10**, Dr. T. K. Alex is the Director of the Indian Space Research Organization (ISRO) Satellite Centre, Bangalore.  He led the Chandrayaan-1 project, the first Indian mission to the Moon, which resulted in the discovery of water on the Moon’s surface.  Now he is guiding and directing the development of Chandrayaan-2 and sixteen new Indian satellites.  John Mankins, who will also be available, is a 25-year NASA veteran who ran NASA’s most recent multi-million dollar study of space solar power, National Space Society Announces the Kalman-NSS Space Initiative, http://blog.nss.org/?p=2214=1

Space solar power has the potential to reverse America’s half a trillion dollar a year balance of payments deficit and to generate a new generation of American jobs.  Why?  Space solar power is a source whose basic technology is already here.  The United States has been harvesting solar power in space and transmitting it to Earth since 1962, when Telstar, the first commercial satellite, went up.  That satellite, Telstar, looked like a beach ball encrusted with square medallions.  The medallions were photovoltaic panels.  And India has been harvesting solar energy in space since 1975, when its first satellite, Aryabhata A, went into orbit. Every square centimeter of Aryabhata’s exterior was tiled with solar panels.  Today harvesting energy in space and transmitting it to Earth is a quarter of a trillion dollar industry…the commercial satellite business.  You use solar energy harvested in space when you watch soccer games from other continents, when you tune into satellite TV or satellite radio, when you use the Global Positioning System (GPS), when you consult the pictures in Google Earth, and when you use your cell phone.

## \*\*Water Wars 1/2\*\*

### SSP solves water shortages, the brink is now.

W. Kent Tobiska, ’10, President and Chief Scientist Space Environment Technologies, Winter 2010, (Online Journal of Space Communication, Vision for Producing Fresh Water Using Space Power, Issue No. 16: Solar Power Satellites, <http://spacejournal.ohio.edu/issue16/tobiska.html>)

An escalating climate crisis is stressing the Earth's environment. One significantly affected area is the global water infrastructure that includes hydropower, flood defense, drainage, and irrigation systems. The effect of adverse climate change on freshwater systems aggravates population growth and weakens economic conditions. In the western U.S., for example, reduced water supplies plus increased demand are likely to provoke more interstate and urban-rural competition for over-allocated water resources. Seawater desalination has existed for decades as a proven technology for supplying water in coastal areas; however, desalination processes are energy intensive and this has reduced their widespread use. It is noted that California offshore oil and gas platforms already use seawater desalination to produce fresh water for platform personnel and equipment. It is proposed that as California coastal oil and gas platforms come to the end of their productive lives, they be re-commissioned for use as large-scale fresh water production facilities. Solar arrays, mounted on the platforms, are able to provide some of the power needed for seawater desalination during the daytime. However, for efficient fresh water production, a facility must be operated 24 hours a day. The use of solar power transmitted from orbiting satellites (Solar Power Satellites - SPS) to substantially augment the solar array power generated from natural sunlight is a feasible concept. We discuss the architecture of using a SPS in geosynchronous orbit (GEO) to enable 24 hours a day operations for fresh water production through seawater desalination. Production of industrial quantities of fresh water on re-commissioned oil and gas platforms, using energy transmitted from solar power satellites, is a breakthrough concept for addressing the pressing climate, water, and economic issues of the 21st Century using space assets.

\*\*Water Wars 2/2\*\*

### Impact is extinction.

NASCA, 2004, National Association for Scientific and Cultural Appreciation, 2004, “Water shortages - Only a matter of time,” <http://www.nasca.org.uk/Strange_relics_/water/water.html>

Water Shortage According to the latest estimates nearly 70% of the Earth’s population will struggle to find an adequate water supply by the year 2025. Many authorities now believe that tension over water consumption will be the major catalyst for the wars of the future. Water shortage. It’s just around the corner. Water is one of the prime essentials for life as we know it. The plain fact is - no water, no life! This becomes all the more worrying when we realise that the worlds supply of drinkable water will soon diminish quite rapidly. In fact a recent report commissioned by the United Nations has emphasised that by the year 2025 at least 66% of the worlds population will be without an adequate water supply. Incalculable damage. As a disaster in the making water shortage ranks in the top category. Without water we are finished, and it is thus imperative that we protect the mechanism through which we derive our supply of this life giving fluid. Unfortunately the exact opposite is the case. We are doing incalculable damage to the planets capacity to generate water and this will have far ranging consequences for the not too distant future. Bleak future The United Nations has warned that burning of fossil fuels is the prime cause of water shortage. While there may be other reasons such as increased solar activity it is clear that this is a situation over which we can exert a great deal of control. If not then the future will be very bleak indeed! Already the warning signs are there. Drought conditions. The last year has seen devastating heatwaves in many parts of the world including the USA where the state of Texas experienced its worst drought on record. Elsewhere in the United States forest fires raged out of control, while other regions of the globe experienced drought conditions that were even more severe. Parts of Iran, Afgahnistan, China and other neighbouring countries experienced their worst droughts on record. These conditions also extended throughout many parts of Africa and it is clear that if circumstances remain unchanged we are facing a disaster of epic proportions. Moreover it will be one for which there is no easy answer. Dangers. The spectre of a world water shortage evokes a truly frightening scenario. In fact the United Nations warns that disputes over water will become the prime source of conflict in the not too distant future. Where these shortages become ever more acute it could forseeably lead to the brink of nuclear conflict. On a lesser scale water, and the price of it, will acquire an importance somewhat like the current value placed on oil. The difference of course is that while oil is not vital for life, water most certainly is! Power shift. It seems clear then that in future years countries rich in water will enjoy an importance that perhaps they do not have today. In these circumstances power shifts are inevitable, and this will undoubtedly create its own strife and tension. Nightmare situation. In the long term the implications do not look encouraging. It is a two edged sword. First the shortage of water, and then the increased stresses this will impose upon an already stressed world of politics. It means that answers need to be found immediately. Answers that will both ameliorate the damage to the environment, and also find new sources of water for future consumption. If not, and the problem is left unresolved there will eventually come the day when we shall find ourselves with a nightmare situation for which there will be no obvious answer.

## \*\*Colonization\*\*

### SPS shows economic benefits of space-incentivizes colonization.

Space Future 6 [2006-06-02,Space Future- “The Space Power Business”, <http://www.spacefuture.com/power/business.shtml>, DeFilippis]

In order to get a feel for why using solar energy delivered from space is a good idea it helps if you use a little imagination and envisage where it will lead - the world humans will live in when SPS is a major energy source. Then it's easier to understand why it would obviously be a good direction for technological development to aim at today - instead of being almost completely ignored! Where will the energy come from? As said elsewhere, a simple way to think of the energy problem (or at least a large part of it - electricity) is that we have roughly 1 kW of electricity generation capacity per head in the rich countries. So it's easy to calculate what happens if everyone in the world plans to reach this level. Electricity demand is still growing, even in the richest countries, despite their efforts to save energy. But the poorer countries are industrializing fast, and the world population is also due to double over the next 50-100 years to about 10,000 million people. So total electricity capacity will grow to around 10,000 Gigawatts - about 10 times today's level. (In addition, of course, today's electricity plants only last a few decades, so the existing 1000 GW of capacity will all have to be replaced too.) So in round figures this means that we'll have to build about 100 GW of CLEAN electricity plant per year on average through the next century. This is THE major challenge facing humans over the next century, since we don't yet know how to provide such vast amounts of electricity without destroying the environment. So all promising ideas need to be investigated. . Solar energy is certain to provide a growing portion of this energy. Despite minimal government funding to date - in total, perhaps 1/1000 of the funding given to nuclear power - the use of solar energy in many different forms continues to spread. Among others, the production and use of photo-voltaics (solar cells) also continues to spread as the technology improves year by year - faster than official energy departments ever predict(!) But of course solar energy is diffuse, intermittent, and unreliable in many parts of the world. It's an old idea So back in 1968 the American engineer, Peter Glaser, explained the potential advantages of an additional way of using solar energy - collecting it in space and transmitting it to Earth as microwaves: it's more intense, it shines 24 hours a day, and could be delivered more or less anywhere - even when cloudy. So in the 1970s (yes, THAT long ago) the US Department of Energy ( DOE) spent about $20 million on some studies of " SPS" (short for Solar Power Satellites, Satellite Solar Power Stations and various other phrases). They designed a "Reference System" 5 km-by-10 km rectangular satellite using solar cells to generate DC, and 2.45 GHz microwave beams to transmit it to Earth. The US DOE concluded that SPS would indeed be feasible - after all it's only what satellites do today, though on a scale a million times larger; it would be environmentally clean - converting microwaves to DC is highly efficient; but they calculated that it was much too expensive. So almost all work in the USA and Europe stopped. NASA even gave away their whole SPS archive! That was a mistake! It was like asking the Wright brothers to design an aeroplane to carry 300 passengers across the Atlantic - and then giving up aviation research because their design looks too expensive to compete with ships! Why SPS? In 1910 the Wright brothers couldn't design a Boeing 747. Likewise, today we can't know what power-satellites will look like decades in the future. Particularly at a time when, as we all know, engineering capabilities are advancing faster than ever before. However, we do know a number of things for certain: Photovoltaic cells are getting cheaper and more efficient all the time - they're part of the semi-conductor industry, the fastest-moving field of engineering. And just as the use of solar cells is growing continually on Earth, despite the huge subsidies given to other forms of energy, so the prospects of using solar cells in space for energy supply to Earth are getting better literally every day. […,] In addition to these 3 reasons, there is a 4th reason why developing power from space will be beneficial. This is because building and operating SPS units in Earth orbit will lead on spontaneously, through purely commercial evolution, to a range of further developments in space - to our space future, in fact. It's easy to see this by considering the ways in which business typically grows - which is much easier to predict than political decisions. Selling electricity from space to Earth will provide commercial companies with both the finance and the incentive to develop and use extra-terrestrial materials.

### It’s space colonization or extinction from nuclear war, terrorism, disease, biological warfare, and asteroids.

Engdahl, ‘07 [Sylvia Engdahl, science teacher and space advocate, “Space and Human Survival: My Views on the Importance of Colonizing Space,” 10-07, www.sylviaengdahl.com/space/survival.htm]

A more urgent cause for concern is the need not to “put all our eggs in one basket,” in case the worst happens and we blow up our own planet, or make it uninhabitable by means of nuclear disaster or perhaps biological warfare. We would all like to believe this won’t happen, yet some people are seriously afraid that it will—it’s hardly an irrational fear. Peace with Russia may have drawn attention from it, yet there are other potential troublemakers, even terrorists; the nuclear peril is not mere history. Furthermore, there is the small but all-too-real possibility that Earth might be struck by an asteroid. We all hope and believe our homes won’t burn down, and yet we buy fire insurance. Does not our species as a whole need an insurance policy? Even Carl Sagan, a long-time opponent of using manned spacecraft where robots can serve, came out in support of space colonization near the end of his life, for this reason; see his book Pale Blue Dot. And in an interview with Britain’s newspaper Daily Telegraph, eminent cosmologist Stephen Hawking said, “I don’t think that the human race will survive the next thousand years unless we spread into space. There are too many accidents that can befall life on a single planet.” Hawking is more worried about the possibility of our creating a virus that destroys us than about nuclear disaster. However, he said, “I’m an optimist. We will reach out to the stars.”

## \*\*Allied Credibility\*\*

### SSP key to allied credibility.

NSS 7 [National Space Society, October 10, “Space-Based Solar Power as an opportunity for Strategic Security”, Architecture Feasibility Study, the National Security Space Office, http://www.nss.org/settlement/ssp/library/nsso.htm]

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 [themselves]. 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.

### Solves extinction.

Ross ‘99 (Winter, Douglas – professor of political science at Simon Fraser University, Canada’s functional isolationism and the future of weapons of mass destruction, International Journal, p. lexis)

Thus, an easily accessible tax base has long been available for spending much more on international security than recent governments have been willing to contemplate. Negotiating the landmines ban, discouraging trade in small arms, promoting the United Nations arms register are all worthwhile, popular activities that polish the national self-image. But they should all be supplements to, not substitutes for, a proportionately equitable commitment of resources tothe management andprevention of international conflict – andthus thecontainment oftheWMDthreat. Future American governments will not ‘police the world’ alone**.** For almost fifty years the Soviet threat compelled disproportionate military expenditures and sacrifice by the United States. That world is gone**.** Only by enmeshing the capabilities of the United Statesand other leading powers in a co-operative security management regime where the burdens are widely shared does the world community have any plausible hope of avoidingwarfare involving nuclear or other WMD.

## \*\*Clean Technology 1/2\*\*

### SSP is key to U.S. clean tech leadership.

NSS 7 [National Space Society, October, “Space Solar Power—Limitless clean energy from space”, http://www.nss.org/settlement/ssp/index.htm]

The United States and the world need to find new sources of clean energy. Space Solar Power gathers energy from sunlight in space and transmits it wirelessly to Earth. Space solar power can solve our energy and greenhouse gas emissions problems. Not just help, not just take a step in the right direction, but solve. Space solar power can provide large quantities of energy to each and every person on Earth with very little environmental impact. The solar energy available in space is literally billions of times greater than we use today. The lifetime of the sun is an estimated 4-5 billion years, making space solar power a truly long-term energy solution. As Earth receives only one part in 2.3 billion of the Sun's output, space solar power is by far the largest potential energy source available, dwarfing all others combined. Solar energy is routinely used on nearly all spacecraft today. This technology on a larger scale, combined with already demonstrated wireless power transmission (see 2-minute video of demo), can supply nearly all the electrical needs of our planet. Another need is to move away from fossil fuels for our transportation system. While electricity powers few vehicles today, hybrids will soon evolve into plug-in hybrids which can use electric energy from the grid. As batteries, super-capacitors, and fuel cells improve, the gasoline engine will gradually play a smaller and smaller role in transportation — but only if we can generate the enormous quantities of electrical energy we need. It doesn't help to remove fossil fuels from vehicles if you just turn around and use fossil fuels again to generate the electricity to power those vehicles. Space solar power can provide the needed clean power for any future electric transportation system. While all viable energy options should be pursued with vigor, space solar power has a number of substantial advantages over other energy sources. Advantages of Space Solar Power (also known as Space-Based Solar Power, or SBSP) Unlike oil, gas, ethanol, and coal plants, space solar power does not emit greenhouse gases. Unlike coal and nuclear plants, space solar power does not compete for or depend upon increasingly scarce fresh water resources. Unlike bio-ethanol or bio-diesel, space solar power does not compete for increasingly valuable farm land or depend on natural-gas-derived fertilizer. Food can continue to be a major export instead of a fuel provider. Unlike nuclear power plants, space solar power will not produce hazardous waste, which needs to be stored and guarded for hundreds of years. Unlike terrestrial solar and wind power plants, space solar power is available 24 hours a day, 7 days a week, in huge quantities. It works regardless of cloud cover, daylight, or wind speed. Unlike nuclear power plants, space solar power does not provide easy targets for terrorists. Unlike coal and nuclear fuels, space solar power does not require environmentally problematic mining operations. eliminating a major Space solar power will provide true energy independence for the nations that develop it, source of national competition for limited Earth-based energy resources. Space solar power will not require dependence on unstable or hostile foreign oil providers to meet energy needs, enabling us to expend resources in other ways. Space solar power can be exported to virtually any place in the world, and its energy can be converted for local needs — such as manufacture of methanol for use in places like rural India where there are no electric power grids. Space solar power can also be used for desalination of sea water. Space solar power can take advantage of our current and historic investment in aerospace expertise to expand employment opportunities in solving the difficult problems of energy security and climate change. Space solar power can provide a market large enough to develop the low-cost space transportation system that is required for its deployment. This, in turn, will also bring the resources of the solar system within economic reach.

\*\*Clean Technology 2/2\*\*

### Clean tech deters Chinese and Russian aggression-impact is great power war.

Klarevas 9 (Louis, Professor at the Center for Global Affairs – New York University, “[Securing American Primacy While Tackling Climate Change: Toward a National Strategy of Greengemony](http://www.huffingtonpost.com/louis-klarevas/securing-american-primacy_b_393223.html)”, Huffington Post, 12-15, http://www.huffingtonpost.com/louis-klarevas/securing-american-primacy\_b\_393223.html)

By not addressing climate change more aggressively and creatively, the United States is squandering an opportunity to secure its global primacy for the next few generations to come. To do this, though, the U.S. must rely on innovation to help the world escape the coming environmental meltdown. Developing the key technologies that will save the planet from global warming will allow the U.S. to outmaneuver potential great power rivals seeking to replace it as the international system's hegemon. But the greening of American strategy must occur soon. The U.S., however, seems to be stuck in time, unable to move beyond oil-centric geo-politics in any meaningful way. Often, the gridlock is portrayed as a partisan difference, with Republicans resisting action and Democrats pleading for action. This, though, is an unfair characterization as there are numerous proactive Republicans and quite a few reticent Democrats. The real divide is instead one between realists and liberals. Students of realpolitik, which still heavily guides American foreign policy, largely discount environmental issues as they are not seen as advancing national interests in a way that generates relative power advantages vis-à-vis the other major powers in the system: Russia, China, Japan, India, and the European Union. Liberals, on the other hand, have recognized that global warming might very well become the greatest challenge ever faced by mankind. As such, their thinking often eschews narrowly defined national interests for the greater global good. This, though, ruffles elected officials whose sworn obligation is, above all, to protect and promote American national interests. What both sides need to understand is that by becoming a lean, mean, green fighting machine, the U.S. can actually bring together liberals and realists to advance a collective interest which benefits every nation, while at the same time, securing America's global primacy well into the future. To do so, the U.S. must re-invent itself as not just your traditional hegemon, but as history's first ever green hegemon. Hegemons are countries that dominate the international system - bailing out other countries in times of global crisis, establishing and maintaining the most important international institutions, and covering the costs that result from free-riding and cheating global obligations. Since 1945, that role has been the purview of the United States. Immediately after World War II, Europe and Asia laid in ruin, the global economy required resuscitation, the countries of the free world needed security guarantees, and the entire system longed for a multilateral forum where global concerns could be addressed. The U.S., emerging the least scathed by the systemic crisis of fascism's rise, stepped up to the challenge and established the postwar (and current) liberal order. But don't let the world "liberal" fool you. While many nations benefited from America's new-found hegemony, the U.S. was driven largely by "realist" selfish national interests. The liberal order first and foremost benefited the U.S. With the U.S. becoming bogged down in places like Afghanistan and Iraq, running a record national debt, and failing to shore up the dollar, the future of American hegemony now seems to be facing a serious contest: potential rivals - acting like sharks smelling blood in the water - wish to challenge the U.S. on a variety of fronts. This has led numerous commentators to forecast the U.S.'s imminent fall from grace. Not all hope is lost however. With the impending systemic crisis of global warming on the horizon, the U.S. again finds itself in a position to address a transnational problem in a way that will benefit both the international community collectively and the U.S. selfishly. The current problem is two-fold. First, the competition for oil is fueling animosities between the major powers. The geopolitics of oil has already emboldened Russia in its 'near abroad' and China in far-off places like Africa and Latin America. As oil is a limited natural resource, a nasty zero-sum contest could be looming on the horizon for the U.S. and its major power rivals - a contest which threatens American primacy and global stability. Second, converting fossil fuels like oil to run national economies is producing irreversible harm in the form of carbon dioxide emissions. So long as the global economy remains oil-dependent, greenhouse gases will continue to rise. Experts are predicting as much as a 60% increase in carbon dioxide emissions in the next twenty-five years. That likely means more devastating water shortages, droughts, forest fires, floods, and storms. In other words, if global competition for access to energy resources does not undermine international security, global warming will. And in either case, oil will be a culprit for the instability. Oil arguably has been the most precious energy resource of the last half-century. But "black gold" is so 20th century. The key resource for this century will be green gold - clean, environmentally-friendly energy like wind, solar, and hydrogen power. Climate change leaves no alternative. And the sooner we realize this, the better off we will be. What Washington must do in order to avoid the traps of petropolitics is to convert the U.S. into the world's first-ever green hegemon. For starters, the federal government must drastically increase investment in energy and environmental research and development (E&E R&D). This will require a serious sacrifice, committing upwards of $40 billion annually to E&E R&D - a far cry from the few billion dollars currently being spent. By promoting a new national project, the U.S. could develop new technologies that will assure it does not drown in a pool of oil. Some solutions are already well known, such as raising fuel standards for automobiles; improving public transportation networks; and expanding nuclear and wind power sources. Others, however, have not progressed much beyond the drawing board: batteries that can store massive amounts of solar (and possibly even wind) power; efficient and cost-effective photovoltaic cells, crop-fuels, and hydrogen-based fuels; and even fusion. Such innovations will not only provide alternatives to oil, they will also give the U.S. an edge in the global competition for hegemony. If the U.S. is able to produce technologies that allow modern, globalized societies to escape the oil trap, those nations will eventually have no choice but to adopt such technologies. And this will give the U.S. a tremendous economic boom, while simultaneously providing it with means of leverage that can be employed to keep potential foes in check.

# Solvency

## Demonstrations Spill Over 1/3

### The private sector has lost interest in Space Solar tech but NASA still has the capability to advance SSP- Lacking is the USFG push and funding

Sheila Bailey' and Ryne Raffaelle 2010

lNASA Glenn Research Center at Lewis Field, of Energy, National Center for Photovoitaics “SPACE SOLAR CELLS AND APPLICATIONS” 2010 John Wiley and Sons, Inc.

While the production capability of terrestrial photovoltaics has risen dramati­cally over the past few years, the demand in the space world has been essentially stable, averaging -27 GEO satellites per year. The high-performance III—V cells used for space can easily be adapted to lerrestrial concentrator uses, and the leading producers of these cells are looking toward a growing terrestrial market. The his­toric focus in the space world of increasingly higher-efficiency cells still has merit in the terrestrial market, particularly for concentrators, but cost (dollar per watt) plays a larger role in determining the future of 111 V cells in that market. There are several potential things that could change the current status quo and could open the playing field to players emerging to serve new niche markets. The argument about spacecraft flying low-efficiency thin-film cells is well documented in numer­ous trade studies [1]. In 1994, when GaAs/Ge cells sold for -S644 per watt com­pared to $432 per wait for Si cells, it was not cost effective to consider thin-film cells unless the cells were at least 13%, AMO, efficient, and there were low-cost space-qualified array designs as well. We now have thin-film cells approaching that efficiency. A recent mass and cost comparison of lightweight and rigid array structures showed that there could certainly be an advantage in cost and mass savings particularly in high-radiation orbits for thin-film cells |2|. The Boeing 11 PSA concept was used in this study and was compared to a Boeing 702 rigid array structure. It should be noted that here, the cost comparison was $750 per watt at the array level for a standard 28% MJ rigid array with an array performance at 83 W/kg and S400 per watt for the baseline HPSA array up to 30 kW with a 13% CIGS cell at 180 W/kg. There has been limited investment in producing higher-efficiency thin-film space cells or the infrastructure to support them. NASA ceased most research funding several years ago and AFRL has provided only limited support. There is a true lack of research funding resulting in very few choices to be made with regard to array structures. There are several space applications in which one could envision a lightweight, low-cost array would be a major advan­tage. If as a matter of national security we would want a space-based solar utility capable of supplying power to targeted terrestrial sites, then there would be con­siderably more interest in high-efficiency, low-cost, thin-film cells. Looking at the possibilities for the future, there are some interesting emerging technologies. A selection of the highest confirmed cells can be seen in Table 18.1 [3].

Demonstrations Spill Over 2/3

### SBSP is a viable option to provide green energy, but requires a government funded proof-of-concept demonstration to spark interest.

Jenkins, ’09. Issues in development of space-based solar power, L.M. Jenkins, 10/17/09

Space-Based Solar Power - (SBSP) is a concept that has considerable potential to provide clean renewable energy. Increased population coupled with reduced natural resources represent a challenge to national and world security. The SBSP concept is to collect energy from the Sun in Earth orbit. The electrical energy is converted to microwave frequency for transmission to the surface of the Earth. There it is converted back in to electricity for use. Possible usages are base-load power, fuel conversion or direct delivery to consumers in isolated locations. The available potential of solar energy is greater than energy in petroleum reserves. The primary issue is defining the path to development of SBSP capability. A critical parameter is the cost of delivery of components to orbit. There are a variety of concepts with the potential to reduce cost of payload in orbit. It is important to make a commitment to the development of a capability with cost efficiency as the prime objective. Current technology supports viability of the SBSP. A government-supported proof of concept demonstration would focus initial efforts. There are a number of ideas to be described that fit the demonstration objectives. Analysis of SBSP has defined certain key questions. Can the SBSP system be designed to be environmentally safe? Can clear targets for economic viability in markets of interest be identified? Are there technical development goals and a roadmap for reducing risk? Selection of design trades could enable the best options. The government is expected to take the lead in initial action. The transition to commercial application requires a defined vision. This goal needs to be funded with a focus on development of this solution to energy security.

Demonstrations Spill Over 3/3

### The Private sector will not enter the SBSP industry without the USFG leading the way

Feng Hsu, Ph.D. and Ken Cox, Ph.D. 2009

 NASA GSFC Sr. Fellow, Aerospace Technology Working Group and Founder & Director

Aerospace Technology Working Group, respectively. “Sustainable Space Exploration and Space Development ••• A Unified Strategic Vision” Aerospace Technology Working group.

So while some might argue that RLV or SBSP are too expensive or too difficult to realize, we must not forget that what makes a nation and its people thrive and prosper are not what they do for easy or short-term gain, but what they accomplish that others dare not do or cannot do. How many of history’s great endeavors have brought profound benefits to humanity across the economic, scientific and social fronts? It is precisely such an opportunity that lies before us today. Hence, we recommend the new paradigm of a strategic vision for space development (VSD) be considered by the new administration, consisting of the following key strategic elements, as a roadmap for propelling America and humanity’s outward expansion into space-based economic and commercial frontiers: 1. Set the goal of a low-cost, reliable space transportation infrastructure development within the Earth-moon system as the highest priority to be implemented by the proposed new Department of Space. The U.S. should build strong support and invite global participation from the entire international community. In this effort to achieve the proposed VSD, the U.S. and its international partners In this effort to achieve the proposed VSD, the U.S. and its international partners should focus heavily on the development of RLVs, such as crew & cargo transport and launch vehicle systems with top-level requirements of low-cost, low system complexity, and aircraft-like reliability, maintainability and operability. 3. We should develop and establish an international Fuel-Depot and Orbital Staging or Service point (station) in the LEO environment to support and service commercial space-transportation traffic, including space tourism, Lunar and Earth orbital transfers, and commercial satellite services. 4. We should also promote and support the establishment and construction of spaceport infrastructure in several strategic locations within the U.S. and around the globe, which will meet the emerging demand for increased commercial launch and spacetransport economic activities. 5. We must develop enabling space infrastructure observation and tracking capabilities for planetary defense. In particular, develop ground and orbital systems, in close collaboration with international partners, for monitoring, tracking and deflecting asteroids, comets, and other cosmic objects in near-Earth orbit, which threaten the safety of our home planet.And we must invest in projects with multiple benefits such as space-based solar power (SBSP) research and development, which would be developed by first funding a series of space-to-space or space-to-Earth SBSP demonstration projects. Technology demonstrations, such as wireless power transmission (WPT), highefficiency microwave beam generation and control, system safety and reliability, onorbit robotic assembly technology, and deployment of large-scale orbital solar structures would also be advisable to help reduce risks, thus triggering large-scale investments by private industries. The upside potential, if successful, would ultimately lead to the capacity to harness solar energy from space to alleviate Earth’s dependence on fossil fuels, thereby addressing global climate-change concerns.

## ISS Demonstration Good

### The ISS can be used as an effective test zone for SSP

 O. GLENN SMITH: July 23, 2008 “Harvest the Sun — From Space” The New York Times www.nytimes.com/2008/07/23/opinion/23smith.html

Still, because building the first operational space solar power system will be very costly, a practical first step would be to conduct a test using the International Space Station as a “construction shack” to house the astronauts and equipment. The station’s existing solar panels could be used for the demonstration project, and its robotic manipulator arms could assemble the large transmitting antenna. While the station’s location in orbit would permit only intermittent transmission of power back to Earth, a successful test would serve as what scientists call “proof of concept.”

## ISS Demonstration Spills Over 1/4

### The ISS fits the bill for demonstrating microwave beaming tech.

Lyle M. Jenkins. April 11, 2011. “Concepts for Demonstration of Wireless Power Transfer for Space-Based Solar Power” Jenkins Enterprises

The International Space Station(ISS) is a potential platform for demonstrating power beaming shown in Figure 2. An initial test could be a transmitting antenna on the Earth’s surface with the receiving rectenna on the ISS. A large phased array about 2280 meters in diameter could transmit 10kw of radiated power at 35 Ghz. The flat rectenna on ISS could be 4m in diameter and expected to collect 5kw power. The microwave frequency was selected to take advantage of a dip in the atmospheric absorption and to minimize the flight hardware. The next level of demonstration of wireless power transfer is to transmit from ISS to the Earth’s surface shown in Figure 3. The ISS installation would include an energy storage module weighing 10,000 Kg. It could be powered from outlets built into the space station for experimentation. The antenna is a 40x60m crossed beam. The system is transmitting up to 100Kw in 1 minute bursts. The 152 m rectenna can receive the bursts converting about 50Kw. This is intensity within the 5 mw/cm2 safety standard. The 35 Ghz planned for this demonstration is higher frequency than the communications and control bands on the ISS. Antenna and rectenna sizing is based on the following Formula.The demonstration of wireless power transmission is one of the initial elements of an evolutionary development of SBSP. It also represents a key factor in the feasibility of generation of plasma patterns for weather research. As such, other research activities in the weather modification process may be integrated in to the development materials needed for their particular poster session, such as a display table, white board, etc. by February 1, 2011. There may be a charge for some items.

ISS Demonstration Spills Over 2/4

### Small scale demonstrations are key to SBSP program success and the ISS is a key component.

Lyle M. Jenkins. April 11, 2011. “Concepts for Demonstration of Wireless Power Transfer for Space-Based Solar Power” Jenkins Enterprises

Solar energy as an alternative to fossil fuel reduces stress on the Earth’s environmental system. Cost of solar power, particularly from space, is not currently competitive with prices of fossil fuels. Collecting the energy in space provides significant advantages in continuity of supply over terrestrial solar, but there is large initial cost prior to getting a return on the investment. Studies indicate that concepts needing less investment in an operational system may be feasible. Resources are needed to develop technology and to demonstrate practicality. Initially, studies should concentrate on technology issues required to implement the space-based power system. The government is expected to take the lead in initial action. The transition to commercial application requires a defined vision. This goal needs to be funded with a focus on development of this solution to energy security. Intergration of the International Space Station into the wireless power transmission demonstration is a key element in development of SBSP. Successful demonstration of power transfer will benefit the program.

ISS Demonstration Spills Over 3/4

### The ISS is equipped for the beaming test and will serve as a proof of concept for market viability

Lyle M. Jenkins. April 11, 2011. “Concepts for Demonstration of Wireless Power Transfer for Space-Based Solar Power” Jenkins Enterprises

A critical parameter is the transfer of power from orbit. There are a variety of concepts with the potential to demonstrate wireless transfer. One important requirement is clear results from the test. Efficiency of power transfer is a parameter to be defined. Analysis of SBSP has defined certain key questions. Can the SBSP system be designed to be environmentally safe? Can clear targets for economic viability in markets of interest be identified? Are there technical development goals and a roadmap for reducing risk? Selection of demonstration concepts should consider these factors in evaluation of the best options. Involvement of the International Space Station(ISS) is a key resource in defining the wireless power transfer demonstration. Transmitter or reciever could be placed on the ISS. Power and sensors can be provided on the ISS. Operation at a 34GHz takes advantage of a reduction in atmospheric absorption to reduce the size of the transmitter and reciever. TA

ISS Demonstration Spills Over 4/4

### The ISS is critical to gathering investors- its similar to commercial satellite tech

Ralph H. Nansen, President Solar Space Industries 2000 Before the Subcommittee on Space and Aeronautics, United States House of Representatives Committee on Science.

The International Space Station is one of the key infrastructure elements needed for the development of solar power satellites. The basic technology for the power generation and transmission will be developed and validated by a Ground Test Program, but this program does not address the issues unique to the space environment. These can only be tested in space. The Space Station is ideally suit to this task. Solar Power Satellites is a commercial program that will provide very large economic returns for the investment and by using the Space Station as the in-space test base will give the Space Station a commercial base to pay for its cost of operation. A preliminary list of the research and development tasks and tests required for the development of solar power satellites, that could utilize the unique capabilities of the International Space Station, is shown in the following:

## ISS Demonstration Possible

### The ISS already has sufficient solar capabilities to do the project

Pete Harding June 14th, 2011 “ Tech Demos: NASA preparing for full ISS utilization in post-Shuttle era” NASAspaceflight.com http://www.nasaspaceflight.com/2011/06/nasa-preparing-full-iss-utilisation-post-shuttle/

According to notes on L2, NASA managers are also discussing the prospect of a beam energy transfer demonstration on the ISS, whereby the ISS would wirelessly transfer electrical energy from itself to an orbiting Falcon satellite.The ISS is particularly useful for this application due to the large amounts of solar power available via its large solar arrays, which will mean that a beam energy payload can be developed and flown without its own set of large solar arrays, thus reducing the cost and development time of the payload.

## ISS Demonstrations Good

### Using the ISS has the added benefits of cost efficiency and the ability to transport energy to rural areas in need

 Jeremy Hsu: 02 December 2009, senior writer on staff with TechMediaNetwork. Special to SPACE.com http://www.space.com/7617-controversy-flares-space-based-solar-power-plans.html

Hoffert still believes strongly in the promise of space solar power, and has calculated that it can even prove as cost-effective as ground-based solar panels. That's because solar farms on Earth must build expensive storage systems to hold energy reserves during cloudy days or nighttime ? although Hoffert still sees solar farms as an ideal complement to space solar power. Space solar power has to deal mainly with expensive launch costs of about $15,000 per kilogram, as well as the huge capital costs of building ground arrays if RF technology is involved. Hoffert has pushed for the laser beaming approach as newly effective cost-cutting measure, and even submitted a proposal with his son to ARPA-E, the U.S. Department of Energy's new agency. "The cost to first power doesn't have to be in the hundreds of billions," Hoffert said. His proposal includes laser transmission tests on the ground in an NYU lab, and then a space experiment launched to the International Space Station. Such beaming tests could even provide temporary power to isolated places on Earth along the space station's ground track, although a true solar space power station would sit in geostationary orbit.

## Demonstration Spills Over/Safe

### A beam test demonstration is vital to SBSP development, and completely safe- less dangerous than a cell phone.

Edward M. Henderson March 2009 NASA/Johnson Space Center “Space based solar power flight demonstration concept” http://ieeexplore.ieee.org/xpls/abs\_all.jsp?arnumber=4839572&tag=1

Another objective is to demonstrate that power can be beamed down and safely received on the ground. To support the validation of models needed for planning future power transmissions, the beam characteristics need to be measured and analyzed. The amount of power received may be small, but this will be a breakthrough demonstration. The safety aspects will be addressed in a number of ways: First, the transmission frequencies used and power densities received will conform to standards so as to not, in any way have a potential for any harmful effects, and second, control of the transmission beam will be such that transmission can only be conducted when it is pointed at the safe location. The power received on the ground for this initial demo will only be about one-half the relative power density FCC limit required for cell phones. Additionally, it will demonstrate the accuracy and beam control that will be needed for larger power levels.

## Demonstrations Spill Over 1/4

### USFG proof of concept stimulates SBSP development- overcomes the private sectors doubts in existing technology

National Security Space Office 10 October 2007 “ Space‐Based Solar Power As an Opportunity for Strategic Security” http://science.ksc.nasa.gov/shuttle/nexgen/Nexgen\_Downloads/SBSPInterimAssesment0.1.pdf

The SBSP Study Group concluded that space‐based solar power does present a strategic opportunity that could significantly advance US and partner security, capability, and freedom of action and merits significant further attention on the part of both the US Government and the private sector. • The SBSP Study Group concluded that while significant technical challenges remain, Space‐Based Solar Power is more technically executable than ever before and current technological vectors promise to further improve its viability. A government‐led proof‐of‐concept demonstration could serve to catalyze commercial sector development. • The SBSP Study Group concluded that SBSP requires a coordinated national program with high‐level leadership and resourcing commensurate with its promise, but at least on the level of fusion energy research or International Space Station construction and operations.

Demonstrations Spill Over 2/4

### USFG proof of concept will encourage private sector development- exposes the business opportunity

National Security Space Office 10 October 2007 “ Space‐Based Solar Power As an Opportunity for Strategic Security” http://science.ksc.nasa.gov/shuttle/nexgen/Nexgen\_Downloads/SBSPInterimAssesment0.1.pdf

A demonstration or proof of concept is a key priority. The Urgent Need scenario will likely follow quickly upon successful completion of a reasonable scale demonstration. Commercial Baseload because of the larger scale involved may need further research on some of the drivers behind the business case (such as launch cost/RLV technology). Just the awareness of quantifying these issues may make them easier to overcome once the confidence in the concept exists. Focus then can be on reducing the cost of the key factors until the business case is undeniable. There may then be competition to build SBSP systems worldwide.

Demonstrations Spill Over 3/4

### The federal government must demonstrate the beaming tech to stimulate private sector interest

National Security Space Office 10 October 2007 “ Space‐Based Solar Power As an Opportunity for Strategic Security” http://science.ksc.nasa.gov/shuttle/nexgen/Nexgen\_Downloads/SBSPInterimAssesment0.1.pdf

The SBSP Study Group found that a small amount of entry capital by the US Government is likely to catalyze substantially more investment by the private sector. This opinion was expressed many times over from energy and aerospace companies alike. Indeed, there is anecdotal evidence that even the activity of this interim study has already provoked significant activity by at least three major aerospace companies. Should the United States put some dollars in for a study or demonstration, it is likely to catalyze significant amounts of internal research and development. Study leaders likewise heard that the DoD could have a catalytic role by sponsoring prizes or signaling its willingness to become the anchor customer for the product. These findings are consistent with the findings of the recent President’s Council of Advisors on Science and Technology (PCAST) report which recommended the federal government “expand its role as an early adopter in order to demonstrate commercial feasibility of advanced energy technologies.” 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 - 35 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.

Demonstrations Spill Over 4/4

### Proof-of-concept demonstrations are necessary to stimulate private-sector interest in SBSP- it decreases the risk of investment.

Berger 07 (Brian, 12 October 2007, “Report Urges U.S. to Pursue Space-Based Solar Power”, Space News, http://www.space.com/4478-report-urges-pursue-space-based-solar-power.html)

Specifically, the report calls for the U.S. government to underwrite the development of space-based solar power by funding a progressively bigger and more expensive technology demonstrations that would culminate with building a platform in geosynchronous orbit bigger than the international space station and capable of beaming 5-10 megawatts of power to a receiving station on the ground. Nearer term, the U.S. government should fund in depth studies and some initial proof-of-concept demonstrations to show that space-based solar power is a technically and economically viable to solution to the world's growing energy needs. Aside from its potential to defuse future energy wars and mitigate global warming, Damphousse said beaming power down from space could also enable the U.S. military to operate forward bases in far flung, hostile regions such as Iraq without relying on vulnerable convoys to truck in fossil fuels to run the electrical generators needed to keep the lights on. As the report puts it, "beamed energy from space in quantities greater than 5 megawatts has the potential to be a disruptive game changer on the battlefield. [Space-based solar power] and its enabling wireless power transmission technology could facilitate extremely flexible 'energy on demand' for combat units and installations across and entire theater, while significantly reducing dependence on over-land fuel deliveries." Although the U.S. military would reap tremendous benefits from space-based solar power, Damphousse said the Pentagon is unlikely to fund development and demonstration of the technology. That role, he said, would be more appropriate for NASA or the Department of Energy, both of which have studied space-based solar power in the past. The Pentagon would, however, be a willing early adopter of the new technology, Damphousse said, and provide a potentially robust market for firms trying to build a business around space-based solar power. "While challenges do remain and the business case does not necessarily close at this time from a financial sense, space-based solar power is closer than ever," he said. "We are the day after next from being able to actually do this." Damphousse, however, cautioned that the private sector will not invest in space-based solar power until the United States buys down some of the risk through a technology development and demonstration effort at least on par with what the government spends on nuclear fusion research and perhaps as much as it is spending to construct and operate the international space station. "Demonstrations are key here," he said. "If we can demonstrate this, the business case will close rapidly." Charles Miller, one of the Space Frontier Foundation's directors, agreed public funding is vital to getting space-based solar power off the ground. Miller told reporters here that the space-based solar power industry could take off within 10 years if the White House and Congress embrace the report's recommendations by funding a robust demonstration program and provide the same kind of incentives it offers the nuclear power industry.

## ISS Demonstration Spills Over 1/4

### The first step for SBSP is to launch energy beaming technology onto the ISS; this will demonstrate the feasibility and safety of SBSP.

Henderson 9 (Edward, Aerospace conference, 2009 IEEE, Issue Date: 7-14 March 2009, page(s): 1 – 7, http://ieeexplore.ieee.org/xpls/abs\_all.jsp?arnumber=4839572&tag=1)

Considerable progress has been made over the past thirty years since the initial space solar power studies concluded that SBSP was not an economically feasible source of energy. Launch systems, power transmission efficiencies and space robotics have all made significant improvements. This along with the increasing demand on dwindling oil supplies and increased global warming concerns make SBSP a more attractive energy alternative today. Yet technology advances are still required to make SBSP a significant contributor for meeting the world’s energy needs.2 However, the need is there and the sooner SBSP can get started the sooner the likelihood will occur for resolving those challenges. This paper recommends starting SBSP demonstrations by 2010 using the space shuttle and the space station. The demonstrations would be a starting point for the demonstration of beam control and validation of fundamental aspects of WPT engineering, needed for future applications. The initial demo would likely be a microwave transmission from the International Space Station (ISS) to the ground. The concept would be to launch the experiment, on the space shuttle vehicle, and then transfer and mount it on the ISS. The demo would be powered by batteries and could be moved to minimize any interference with the station and pointed using the station’s Remote Manipulator System (SRMS) when beaming power to the ground (fig. 1). Compatible ground sites would lock on to the experiment with a retrograde beam during an over flight to receive the wireless power transmission. Several sites may be used over a period of some months of beaming opportunities to evaluate the beam control and characterize the beam properties under various site and atmospheric conditions. This data could then be used to validate models needed for future SBSP testing. More importantly the beam control would provide confidence needed to help mitigate public safety concerns. There are many eventual uses for space solar power systems including beaming power down to troops in the field, providing power during recovery from natural disasters, mining shale oil and tar sands more efficiently, beaming power to the lunar surface to support exploration, and even potentially altering trajectories of threatening asteroids. Therefore additional SBSP demonstrations should be conducted at different transmission frequencies and power levels to different locations, including space-to-space, to support these diverse utilizations. Finally, a roadmap is needed for advancing the SBSP capabilities for the future. The next big challenge is to get out of low Earth orbit and place a SBSP demo into geostationary orbit where longer and more powerful demonstrations can be performed. Not only would this 3 provide power beaming to a fixed ground site 24 hours a day, seven days a week, it would better facilitate the use of an energy generation system or systems. This interim goal would be to position a satellite with sufficient capability in orbit and provide an operational capability to beam useful power amounts (KWs). Improved systems could be added that further increase power to the ground while maturing new launch capabilities that will be required to implement the large space solar power systems of the future

ISS Demonstration Spills Over 2/4

### In order to kickstart SBSP R & D, energy beaming has to be demonstrated as soon as possible; after this, private companies will be willing to invest in the technology.

Henderson 9 (Edward, “Space based solar power flight demonstration concept”, Aerospace conference, 2009 IEEE, Issue Date: 7-14 March 2009, page(s): 1 – 7, http://ieeexplore.ieee.org/xpls/abs\_all.jsp?arnumber=4839572&tag=1)

The primary objective for the initial SBSP demonstration is to conduct a meaningful experiment while the space shuttle opportunities still exist. Beaming power from space has been “kicked around” for more than thirty years; what has been needed is to fly a SBSP demonstration mission. Beaming power from space has such potentially significant implications for the future that it needs to gain some realworld impetus and exposure soon. Once the capability has been initially demonstrated and shown to be safe, the flood gates will open up and more demonstrations and applications will be identified, funded and flown. Another objective is to demonstrate that power can be beamed down and safely received on the ground. To support the validation of models needed for planning future power transmissions, the beam characteristics need to be measured and analyzed. The amount of power received may be small, but this will be a breakthrough demonstration. The safety aspects will be addressed in a number of ways: First, the transmission frequencies used and power densities received will conform to standards so as to not, in any way have a potential for any harmful effects, and second, control of the transmission beam will be such that transmission can only be conducted when it is pointed at the safe location. The power received on the ground for this initial demo will only be about one-half the relative power density FCC limit required for cell phones. Additionally, it will demonstrate the accuracy and beam control that will be needed for larger power levels. V. SBSP ROADMAP The initial SBSP demo is just a start with more demos to follow. Eventually an implementation of an operational space-based solar power system that can meet real-world needs will be achieved. The next step would be the growth of these systems to meet larger needs and to provide a substantial piece of the national power requirement. Therefore a roadmap to chart the path to the future is needed. The roadmap is predicated on not only what can be done, but on the business case that supports its utility. A large variety of customers exist that cover exploration for NASA, security for national defense, industry for commercial applications and secure energy for the nation. The roadmap (fig. 5) covers necessary space demos starting in low Earth orbit (LEO) and moving out to GEO. The initial demos will evaluate different frequencies and applications and will be powered by batteries and/or station. The next demo series would add power generation capabilities including photovoltaic and solar dynamic systems. Once a practical system or systems have been deemed feasible, then an initial operational system can be put in GEO. The objective would be to deploy a system with significant amounts of power (KWs) that could be beamed down 24 hours a day, 365 days a year. While collecting data, this power could be beamed down to Earth for useful interim applications. The space shuttle can possibly provide transport for early demos to LEO, other launch systems will be required after the shuttle retires. There are several launch systems that will be available including the HTV, ATV, COTS, EELV’s and Russian and European launch systems. However, to get the large SBSP satellites needed in GEO to return viable power, a heavy-lift launch vehicle will be needed. The quickest and lowest cost capability could be a shuttle-derived launch vehicle (ref. 2) that would have the capability to get more than 30 metric tons of payload to GEO as early as 2015-16. This system could populate GEO with a fleet of power satellites providing megawatts of power to the ground. Eventually to make a significant contribution to this nation’s and world power needs, an advanced, fully reusable launch system would need to be developed to make launch costs for power from space more economical. A practical long range goal could be to provide 10 percent or more of the nation’s energy needs by 2050 with space based solar power

ISS Demonstration Spills Over 3/4

### The ISS would be a perfect platform to demonstrate energy beaming, which would prove the feasibility of SBSP; using a 35 GHz microwave would ensure no interference between the ISS and the energy beaming.

Jenkin 11 (Lyle, January 11, 2011, Concepts for Demonstration of Wireless Power Transfer for Space-Based Solar Power, http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=05747305)

Involvement of the International Space Station(ISS) is a key resource in defining the wireless power transfer demonstration. Transmitter or reciever could be placed on the ISS. Power and sensors can be provided on the ISS. Operation at a 34GHz takes advantage of a reduction in atmospheric absorption to reduce the size of the transmitter and reciever. The ultimate goal is to enable development of Space-Based Solar Power. A key element in the concept is wireless power transmission [9]. The International Space Station(ISS) is a potential platform for demonstrating power beaming. An initial test could be a transmitting antenna on the Earth’s surface with the receiving rectenna on the ISS. A large phased array about 2280 meters in diameter could transmit 10kw of radiated power at 35 GHz. The flat rectenna on ISS could be 4m in diameter and expected to collect 5kw power. The microwave frequency was selected to take advantage of a dip in the atmospheric absorption and to minimize the flight hardware. The next level of demonstration of wireless power transfer is to transmit from ISS to the Earth’s surface. The ISS installation would include an energy storage module weighing 10,000 Kg. It could be powered from outlets built into the space station for experimentation. The antenna is a 40x60m crossed beam. The system is transmitting up to 100Kw in one minute bursts. The 152 m rectenna can receive the bursts converting about 50Kw. This is intensity within the 5mw/cm safety standard. The 35 GHz planned for this demonstration is higher frequency than the communications and control bands on the ISS This corresponds to a reduction zone in atmospheric absorptions.

ISS Demonstration Spills Over 4/4

### The ISS is key to spurring interest from the private sector

Hauser, Marly 2009 ((Marty Hauser is the VP of Research and Analysis of the Space Foundation ('The International Space Station Decision 2015" Space Foundation (2009): 9) JA

how the ISS can contribute to technological innovation The space program is one of the most well-known sources of advanced technological research in the country In the process of researching and designing . ei, :omp ex space systems, advances are made that have benefits outside the space program The NASA Innovative Partnerships Program (IPP) helps transition these advances into the private sector, benefiting global competition and the economy Research associated with the development of the ISS. in particular, has contributed greatiy to this phenomenon. For example, technology developed to recycle wastewater on the ISS has led to the creation of a filtration system with the ability to purify water from the most challenging water sources This could have important impacts in remote areas where well water is heavily contaminated by bacteria and it is already being used to purify the water supplies of hospitals in the developing world and dental practices in developed nations Other technologies derived from work on the ISS include air purifiers, biosensors, and advanced fire alarms iSS-inspired technology can be found in the most unlikely places: wireless sensors developed for the program can now be found monitoring the structural integrity of three tunnels in the Netherlands The companies associated witft 9^9"ces are gn;en partnered with NASA as pan of *\he* agency's Small Business Innovation Research (SBiRl program The success of small businesses is essential to innovation and growth in the economy Moreover, although some of these companies are based in states such as Texas. Florida, and California, which are often associated with the space program others reside in a wide variety of states, including New York. Oregon. Virginia, Montana. Pennsylvania. Arizona. Georgia. Connecticut, Michigan. Colorado. Massachusetts. New Mexico. Maryland. Nevada, and New Hampshire The ISS has already proven to be an efficient engine for the creation of new. advanced technologies The longer the program continues, the greater the likelihood that even more technologies will be developed to benefit the United States and people worldwide

# A2

## AT Spending

### The plan costs just over 1 billion annually-that’s .007% of the deficit.

Garretson ‘9, Peter A. Garretson was a Council on Foreign Relations (CFR) International Fellow in India, and a Visiting Fellow at the Institute for Defence Studies and Analyses (IDSA) New Delhi. He is an active duty Air Force officer on sabbatical as an Air Force Fellow. He was previously the Chief of Future Science and Technology Exploration for Headquarters Air Force, Directorate of Strategic Plans and Programs, and is a former DARPA Service Chiefs’ Intern, and former Los Alamos National Laboratory (LANL) Service Academy Research Associate. He is a published author on Space Grand Strategy, and is a recipient of the National Space Society’s (NSS) Space Pioneer Award, Sky’s No Limit: Space Based Solar Power the Next Major Step in the U.S.-Indo Strategic Partnership, http://www.idsa.in/sites/default/files/OP\_SkysNoLimit.pdf

In summary, an actionable bilateral policy framework will originate with a joint statement by the respective heads of state announcing and sanctioning the activity and signing the requisite information exchange and project agreement paperwork. An initial five-year, $10-30 million programme, managed in the respective executive, will develop contributing technologies and build a competent work force via the project/initiative and technology mission model, culminating in a roadmap and plan for an international mega-science project 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 retiring all significant technical risk. The final stage will entail the bilateral leadership to set up an international for-profit consortium along the lines of COMSAT/INTELSAT model to provide a scalable green energy system to allow development and address energy security and carbon mitigation concerns.

## A2: Everything

### The logic of environmental destruction is the root of all war.

Murray Bookchin, co-founder of the Institute of Social Ecology, 1987 ("An Appeal For Social and Psychological Sanity," The Modern Crisis, Published by Black Rose Books Ltd., ISBN 0920057624, p. 106-108)

Industrially and technologically, we are moving at an ever-accelerating pace toward a yawning chasm with our eyes completely blindfolded. From the 1950s onward, we have placed ecological burdens upon our planet that have no precedent in human history. Our impact on our environment has been nothing less than appalling. The problems raised by acid rain alone are striking examples of [end page 106] innumerable problems that appear everywhere on our planet. The concrete-like clay layers, impervious to almost any kind of plant growth, replacing dynamic soils that once supported lush rain forests remain stark witness to a massive erosion of soil in all regions north and south of our equatorial belt. The equator—a cradle not only of our weather like the ice caps but a highly complex network of animal and plant life—is being denuded to a point where vast areas of the region look like a barren moonscape. We no longer "cut" our forests—that celebrated "renewable resource" for fuel, timber, and paper. We sweep them up like dust with a rapidity and "efficiency" that renders any claims to restorative action mere media-hype. Our entire planet is thus becoming simplified, not only polluted. Its soil is turning into sand. Its stately forests are rapidly being replaced by tangled weeds and scrub, that is, where vegetation in any complex form can be sustained at all. Its wildlife ebbs and flows on the edge of extinction, dependent largely on whether one or two nations—or governmental administrations—agree that certain sea and land mammals, bird species, or, for that matter, magnificent trees are "worth" rescuing as lucrative items on corporate balance sheets. With each such loss, humanity, too, loses a portion of its own character structure: its sensitivity toward life as such, including human life, and its rich wealth of sensibility. If we can learn to ignore the destiny of whales and condors—indeed, turn their fate into chic cliches—we can learn to ignore the destiny of Cambodians in Asia, Salvadorans in Central America, [end page 107] and, finally, the human beings who people our communities. If we reach this degree of degradation, we will then become so spiritually denuded that we will be capable of ignoring the terrors of thermonuclear war. Like the biotic ecosystems we have simplified with our lumbering and slaughtering technologies, we will have simplified the psychic ecosystems that give each of us our personal uniqueness. We will have rendered our internal mileau as homogenized and lifeless as our external milieu—and a biocidal war will merely externalize the deep sleep that will have already claimed our spiritual and moral integrity. The process of simplification, even more significantly than pollution, threatens to destroy the restorative powers of nature and humanity—their common ability to efface the forces of destruction and reclaim the planet for life and fecundity. A humanity disempowered of its capacity to change a misbegotten "civilization," ultimately divested of its power to resist, reflects a natural world disempowered of its capacity to reproduce a green and living world.

## SBSP Popular

### Energy crisis and massive public support make the plan popular.

Jenkins ‘7, Lyle Jenkins is currently a consultant on development of the tornado-taming project. He retired from NASA after 38 years, Issues in Development of Space Based Solar Power, http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=04839313&tag=1

Space solar power has been advocated on the basis of its value as a solution to the World’s energy problems. This approach does not appear to be effective. Fossil fuels are sufficient to meet most of the needs in the immediate future, hence the lack of support from policy makers for an expensive and complex program. SBSP development as a sustainable energy source with benefit to the environment provides a basis for the initial investment and a transition to a profit making commercial enterprise. The potential for clean renewable energy may induce the policy makers to assign resources to the technology development and demonstration. Then, when investment risk is reduced, the burden of funding by the government may be replaced by private sources. The definition of space solar power concepts that can be implemented with less initial investment also aids in the transition from government to private industry funding[2].Through an emphasis on potential environmental change impacts, political commitment to SBSP support will be put into a context that most stakeholders, the general public, can understand and embrace [3]. Supporters of space-based solar power have been presenting the concepts as a means to help meet world energy needs.

### Perceived economic benefits mean massive governmental support.

Jenkins ‘7, Lyle Jenkins is currently a consultant on development of the tornado-taming project. He retired from NASA after 38 years, Issues in Development of Space Based Solar Power, http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=04839313&tag=1

The prosperity of future generations is dependent on a stable global environment. To ensure environmental stability, a continued effort to understand the effect of human activities must be a priority. The complex relationships of greenhouse gases, wind circulation, ocean currents and atmospheric water vapor make the analysis extremely challenging. It is undisputed that carbon dioxide in the atmosphere has increased by over thirty percent since the beginning of the industrial age. Fossil fuels are certainly a major contributor to that increase. By replacing fossil fuel use, SBSP could reduce the buildup of CO2 in the atmosphere and the consequent climate changes from an enhanced greenhouse effect. There are economic returns from a space-based power source that will lead to commercial management and operation of the system. There will continue to be an element of the political community that is committed to the short-term view because of the immediate economic impact. This reality is a factor that will have to be dealt with through facts and risk assessment for the long-term view. The anticipated benefit to the Earth's environment is the overarching objective that may provide support for technology development and demonstration toward space-based solar power for use on Earth.

### We outweigh their links-support for SPS statistically outweighs opposition.

Preble, ‘6 – Darel, systems analyst, physicist and chair of the Space Solar Power Workshop (http://www.sspi.gatech.edu/sunsatcorpfaq.pdf)

According to repeated surveys, public perception of America’s Space Goals places SSP construction clearly as America’s top space priority1: 2002 2005 What should be America’s Goal in Space? 32% 35% Build satellites in Earth orbit to collect solar energy to beam to utilities on Earth 23% 17% Develop the technology to deflect asteroids or comets that might destroy the Earth 13% 10% No Opinion 4% 10% Send humans to Mars 2% 7% Search for life on other planets 6% 7% Build a human colony in space 3% 6% Develop a passenger rocket to send tourists into space 5% 4% Build a base on the moon for humans to use for moon exploration 11% 2% None of the above, we should stop spending money on space

## Needed Now 1/2

### SBSP is needed right now- oil, coal, and natural gas production are going to peak within the next decade, and we will experience a drastic drop in fuel after that.

Fan et al June 6, 2011 (William Fan, Harold Martin, James Wu, Brian Mok, “SPACE BASED SOLAR POWER”, http://www.pickar.caltech.edu/e103/Final%20Exams/Space%20Based%20Solar%20Power.pdf)

Recent studies regarding “peak oil,” the time when the world oil supply reaches its highest volume before it declines, suggest a time frame between now and 2016, and multiple scenarios predict a 10% reduction in production by 2030 [8]. Oil makes up 29% of the current energy supply [9]. While these numbers suggest that oil will decrease at 0.005% per year, its actual decrease will not be gradual, but instead be a sudden precipitous drop over the course of only a few years [8], not giving the market enough time to develop a suitable alternative without having a destructive effect on the global economy. Coal, also makes up 29% of the current energy supply. “Peak coal” is estimated by academic sources to be reached in the next few years, and have been reduced to 50% of peak values by 2047 [10], though significant technological improvement in mining and refining low quality coal may reduce some of the effects. Producing 25% of the world’s sources of energy, natural gas is the only resource that is not expected to peak until 2020[11]. However, natural gas is not commonly shipped over ocean lanes, leading to a natural gas crisis currently in North America, as domestic (US and Canadian) production is not enough to meet demand, even with the use of environmentally destructive “shale gas” and other unconventional natural gas resources. North American peak natural gas could occur as early as 2013 [12]. Including the widespread use of environmentally destructive practices, North American gas production will only increase by 5% by 2025 [13].

Needed Now 2/2

### Now is the key time to develop SBSP systems, the situation will be critical in the next 10 years + Provides huge market opportunities.

Ralph H. Nansen, President Solar Space Industries 2000 Before the Subcommittee on Space and Aeronautics, United States House of Representatives Committee on Science.

Energy demand continues to grow as our population expands. The electronic age is totally reliant on electric power and is creating a new need for electric power. Many areas of the nation are experiencing energy shortages and significantly increased costs. United States electricity use is projected to increase by 32% in the next twenty years while worldwide electric energy use will grow by 75% in the same period. Worldwide oil production is projected to peak in the 2010 to 2015 time period with a precipitous decrease after that due to depletion of world reserves. Natural gas prices in the United States have doubled in the last year as the demand has grown for gas fired electrical generation plants. Global warming and the need for reduction of CO2 emissions calls for the replacement of fossil fuel power plants with renewable nonpolluting energy sources. Even with increased use of today's knowledge of renewable energy sources carbon emissions are expected to rise 62% worldwide by 2020. If we have any hope for a reversal of global warming we must dramatically reduce our use of fossil fuels. Solar power satellite development would reduce and eventually eliminate United States dependence on foreign oil imports. They would help reduce the international trade imbalance. Electric energy from solar power satellites can be delivered to any nation on the earth. The United States could become a major energy exporter. The market for electric energy will be enormous. Most important of all is the fact that whatever nation develops and controls the next major energy source will dominate the economy of the world.

## No Space Debris

### SBSP satellites are safe from debris

Powersat 2010 ((international SBSP cooperation) <http://www.powersat.com/faq.html>) JA

Collision with space junk is unlikely for a number of reasons. First, PowerSat reside in a geosynchronous orbit which is much higher than the low earth orbit debris band. Second, the surface area of the powersat is thin-film solar cells. Thus, a piece of space junk would go right through the thin film and would affect only a fraction of the output of that module, as there are many solar cells within a module. We could conceivably lose a module if a piece of junk collided with the core control system for that module, but the output of one module is only 1/300th the output of the entire satellite and can be easily replaced.

## USFG Key

### SBSP will not be funded in the status quo without a USFG facilitated demo- Other nations and Private sector groups show interest but will not act before Demo.

W. Neil Johnson October 23, 2009 High-energy Space Environment Branch Space Science Division Naval Research Laboratory Washington, DC 20375-5320 “Space-based Solar Power: Possible Defense Applications and Opportunities for NRL Contributions” pg. 76

The National Aeronautics and Space Administration (NASA) NASA has funded significant SBSP studies and research in the 1970s, 1990s, and 2000s. NRL has performed work for NASA under SBSP-related programs, and some of the technologies described in this report were developed in part with such funding. 6.2 The U.S. Department of Energy (DOE) The DOE together with NASA funded the comprehensive 1970s study of SBSP. With continued increases in energy costs, DOE may again be in a position to fund SBSP studies and research. 6.3 The U.S. Department of Defense (DoD) If sufficient priority is placed on reducing dependence on foreign energy sources and increasing selfsustainability of military installations, DoD may fund SBSP work. The Air Force, Office of Naval Research, DARPA, National Reconnaissance Office (NRO), and other DoD entities have funded science and technology development pertinent to SBSP. 6.4 International Partners India, Japan, and European countries have expressed explicit interest in further spurring and extending SBSP technologies and system development. They comprise another possible source of funding, especially if incentivized by like contributions from U.S. sources. 6.5 The U.S. Department of State or United Nations Office for Outer Space Affairs (UNOOSA) SBSP offers possible political and humanitarian benefits. Though these agencies might not fund SBSP development directly, they might be employed in mustering political will to fund such activities. 6.6 Corporate Partners Space and energy industry corporations will likely be hesitant to fund the development of system until the concept has been successfully demonstrated and has a solid business case. Component technologies may be funded by corporate internal research if they also have applicability elsewhere.

## Have the Tech 1/2

### We posses the technology to deploy a small SBSP as soon as necessary

W. Neil Johnson October 23, 2009 High-energy Space Environment Branch Space Science Division Naval Research Laboratory Washington, DC 20375-5320 “Space-based Solar Power: Possible Defense Applications and Opportunities for NRL Contributions” pg.78

It is possible now to build a low-power LEO system experiment or series of experiments that would not require breakthrough technologies and that could be launched on a single launch vehicle. This would likely speed closure of some of the outstanding technical questions for SBSP and enable iteration toward optimum designs for defense and civilian SBSP systems. Though more challenging, it is possible even without the knowledge gleaned from flight experiments to create today a detailed design of a MW-sized system that would require us to identify technologies that require development. This would help focus hardware development work in advanced technologies required by large SBSP systems, technologies which are likely to have other useful applications as well.

Have the Tech 2/2

### While a functioning SBSP program would be complicated, we have all of the necessary technology to build one.

National Security Space Office 07 (10 October, 2007, “Space‐Based Solar Power As an Opportunity for Strategic Security”, Report to the Director, National Security Space Office)

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.

## SBSP > Terrestrial Solar Panels 1/3

### SBSP is superior to other alternatives- it doesn’t take up space on Earth, releases almost no pollution, and is almost always able to produce energy.

Fan et al June 6, 2011 (William Fan, Harold Martin, James Wu, Brian Mok, “SPACE BASED SOLAR POWER”, http://www.pickar.caltech.edu/e103/Final%20Exams/Space%20Based%20Solar%20Power.pdf)

Space solar power is thought to have several advantages over other forms of alternative energy, particularly over terrestrial implementation of solar power. The chief general advantage is that the SBSP satellite is that it is relatively isolated, neither taking up space on Earth nor being vulnerable to degradation from nature. As will be addressed in following sections, deploying SBSP satellites do release small amounts of pollution, and the effect of beaming large amounts of energy through the ionosphere is not yet adequately documented. However, these effects are generally agreed[3] to be overshadowed by the potential benefits, including the risk of hydroelectric damming, petroleum storage, coal mining, and nuclear waste. SBSP is thought to be especially attractive against terrestrial solar power for the reason of persistence. Land based solar panels are illuminated for only the daytime, subject to seasonal variation in daylight, as well as the filtering of a large amount of solar energy through the atmosphere by the time it reaches the land based panel no matter its efficiency. By contrast, an SBSP satellite is illuminated for 99% of the day on most days, and 95% of the day even on seasonal equinoxes[2]. Furthermore, SBSP satellites receive 450% [2]additional solar energy than terrestrial solar panels, which couples particularly well with recent advances in metamorphic solar cells that exceed the theoretical limit of conversion efficiency from solar power.

SBSP > Terrestrial Solar Panels 2/3

### Space-based solar power is much more environment-friendly than traditional solar power because it requires less solar panels to produce the same amount of electricity, and the rectennas will take up much less space on Earth than a solar panel array would.

National Security Space Office 07 (10 October, 2007, “Space‐Based Solar Power As an Opportunity for Strategic Security”, Report to the Director, National Security Space Office)

If solar is considered “green” energy, then SBSP could be considered the ultimate green energy. SBSP, if manufactured on Earth (and not in‐space using lunar or asteroidal material), will of course have very similar manufacturing/pollution impacts as ground solar—except that per unit of delivered energy, much less residual pollution needs to be produced because much less solar collection area (and therefore solar collector materials) is required with SBSP. While the advantages of a distributed grid of ground solar are clear, especially for peak power during the middle of the day, space solar has several distinct advantages over ground solar, such as its appropriateness for base‐load power (the minimum power required by the grid at all times). • SBSP’s primary environmental benefit is in the form of nearly carbon‐free, renewable energy. o Recommendation: The SBSP Study Group recommends engagement with representatives of several well‐established national environmental organizations to determine general support levels for SBSP. • Geostationary SBSP experiences nearly continuous sunlight and therefore is available more than 99% of the time and so does not incur the same difficulties of storage for terrestrial solar, which requires a corresponding increase in overcapacity. - 28 - • Even considering the energy cost of launch, SBSP systems do payback the energy to construct and launch. In fact, SBSP systems have net energy payback times (<1 year except for very small 0.5 GW plants) well within their multi‐decade operational lifetimes. Payback times are equivalent and perhaps faster than terrestrial solar thermal power (Zerta et al, 2004). The reason for this is that an equivalent area in space receives 8‐10 times the energy flux for the annual average, and as much as 30‐40 times the energy flux in a given week than the same area located on a favorable place on the ground after considering day/night, summer/winter, and dust/weather cycles. Prior analyses suggest that the resulting energy payback (time to recover the energy used in deploying a power system) for SBSP is equivalent to or less than (perhaps as little as ½) comparable ground solar baseload power systems (which includes energy storage capacity for 24/7 usage, and pay back in 1.6‐1.7 years). • Even after losses in wireless power transmission, the reduced need for overcapacity and storage to make up for periods of low illumination translates into a much lower land usage vs. terrestrial solar for an equivalent amount of delivered energy. • Unlike terrestrial solar facilities, microwave receiving rectennas allow greater than 90% of ambient light to pass through, but absorb almost all of the beamed energy, generating less waste heat than terrestrial solar systems because of greater coupling efficiency. This means that the area underneath the rectenna can continue to be used for agricultural or pastoral purposes. To deliver any reasonably significant amount of base‐load power, ground solar would need to cover huge regions of land with solar cells, which are major sources of waste heat. As a result, these ground solar farms would produce significant environmental impacts to their regions. The simultaneous major increases to the regional temperature, plus the blockage of sunlight from the ground, will likely kill off local plants, animals and insects that might inhabit the ground below or around these ground solar farms. This means that that a SBSP rectenna has - 29 - less impact on the albedo or reflectivity of the Earth than a terrestrial solar plant of equivalent generating capacity. Moreover, the energy provided could facilitate water purification and irrigation, prevent frosts, extend growing seasons (if a little of the energy were used locally) etc. In the plains of the U.S. (e.g., South Dakota, etc), in sub‐ Saharan Africa, etc. etc. there are vast areas of arable land that could be both productive farm land and sites for SBSP rectennas. • The final global effect is not obvious, but also important. While it may seem intuitively obvious that SBSP introduces heat into the biosphere by beaming more energy in, the net effect is quite the opposite. All energy put into the electrical grid will eventually be spent as heat, but the methods of generating electricity are of significant impact for determining which approach produces the least total global warming effect. Fossil fuel burning emits large amounts of waste heat and greenhouse gases, while terrestrial solar and wind power also emit significant amounts of waste heat via inefficient conversion. Likewise, SBSP also has solar conversion inefficiencies that produce waste heat, but the key difference is that the most of this waste heat creation occurs outside the biosphere to be radiated into space. The losses in the atmosphere are very small, on the order of a couple percent for the wavelengths considered. Because SBSP is not a greenhouse gas emitter (with the exception of initial manufacturing and launch fuel emissions), it does not contribute to the trapping action and retention of heat in the biosphere.

SBSP > Terrestrial Solar Panels 3/3

### Reasons to invest in SBSP

Powersat 2010 ((international SBSP cooperation) <http://www.powersat.com/faq.html>) ja

Energy from the sun is 5 times more powerful when collected in orbit than it is by the time it reaches even the brightest desert on Earth. Our atmosphere filters out over 50% of the sunlight it receives, and that doesn’t even factor in the potential for cloud cover. In addition, nighttime darkness greatly reduces the capacity of Earth-based PV systems. The biggest advantage for powersats over earth-based solar power is that powersats receive sunlight 24/7, allowing them to operate at 100% capacity all of the time, receiving over 25 times more power than a ground-based system of the same size.

## A2: Other Renewables

### SBSP is good, laundry list:

 National Space Society Jun 3, 2011. “ Space Solar Power Limitless clean energy from space” http://www.nss.org/settlement/ssp/

Unlike oil, gas, ethanol, and coal plants, space solar power does not emit greenhouse gases. Unlike coal and nuclear plants, space solar power does not compete for or depend upon increasingly scarce fresh water resources. Unlike bio-ethanol or bio-diesel, space solar power does not compete for increasingly valuable farm land or depend on natural-gas-derived fertilizer. Food can continue to be a major export instead of a fuel provider. Unlike nuclear power plants, space solar power will not produce hazardous waste, which needs to be stored and guarded for hundreds of years. Unlike terrestrial solar and wind power plants, space solar power is available 24 hours a day, 7 days a week, in huge quantities. It works regardless of cloud cover, daylight, or wind speed. Unlike nuclear power plants, space solar power does not provide easy targets for terrorists. Unlike coal and nuclear fuels, space solar power does not require environmentally problematic mining operations. Space solar power will provide true energy independence for the nations that develop it, eliminating a major source of national competition for limited Earth-based energy resources. Space solar power will not require dependence on unstable or hostile foreign oil providers to meet energy needs, enabling us to expend resources in other ways. Space solar power can be exported to virtually any place in the world, and its energy can be converted for local needs — such as manufacture of methanol for use in places like rural India where there are no electric power grids. Space solar power can also be used for desalination of sea water. Space solar power can take advantage of our current and historic investment in aerospace expertise to expand employment opportunities in solving the difficult problems of energy security and climate change. Space solar power can provide a market large enough to develop the low-cost space transportation system that is required for its deployment. This, in turn, will also bring the resources of the solar system within economic reach.

## Hydropower Bad 1/2

### Dams lead to accumulated sediment, not only harming the body of water but also the hydrollic system itself.

McCully, Patrick, “Silenced rivers the ecology and politics of large dams”, International Rivers, London, 1996, http://www.internationalrivers.org/en/node/1476

All rivers contain sediments: a river, in effect, can be considered a body of flowing sediments as much as one of flowing water. When a river is stilled behind a dam, the sediments it contains sink to the bottom of the reservoir. The proportion of a river’s total sediment load captured by a dam – known as its "trap efficiency" – approaches 100 per cent for many projects, especially those with large reservoirs. As the sediments accumulate in the reservoir, so the dam gradually loses its ability to store water for the purposes for which it was built. Every reservoir loses storage to sedimentation although the rate at which this happens varies widely. Despite more than six decades of research, sedimentation is still probably the most serious technical problem faced by the dam industry. Professor K. Mahmood of George Washington University in Washington, DC, "roughly estimated" for a 1987 World Bank study that around 50 cubic kilometres of sediment – nearly one per cent of global reservoir storage capacity – is trapped behind the world’s dams every year. In total, calculated Mahmood, by 1986 around 1,100 cubic kilometres of sediment had accumulated in the world’s reservoirs, consuming almost one–fifth of global storage capacity. The rate of reservoir sedimentation depends mainly on the size of a reservoir relative to the amount of sediment flowing into it: a small reservoir on an extremely muddy river will rapidly lose capacity; a large reservoir on a very clear river may take centuries to lose an appreciable amount of storage. Large reservoirs in the US lose storage capacity at an average rate of around 0.2 per cent per year, with regional variations ranging from 0.5 per cent per year in the Pacific states to just 0.1 per cent in reservoirs in the northeast. Major reservoirs in China lose capacity at an annual rate of 2.3 per cent. Apart from rapidly filling their reservoirs, sediment–filled rivers also cause headaches for dam operators due to the abrasion of turbines and other dam components. The efficiency of a turbine is largely dependent upon the hydraulic properties of its blades, just as an aeroplane depends on the aerodynamic properties of its wings. The erosion and cracking of the tips of turbine blades by water–borne sand and silt considerably reduces their generating efficiency and can require expensive repairs.

Hydropower Bad 2/2

### Dams can still effect air quality and often damage water habitats as well as not working everywhere.

DOE, http://www.epa.gov/cleanenergy/energy-and-you/affect/hydro.html

Hydropower is mostly dependent upon precipitation and elevation changes; high precipitation levels and large elevation changes are necessary to generate significant quantities of electricity. Therefore, an area such as the mountainous Pacific Northwest has more productive hydropower plants than an area such as the Gulf Coast, which might have large amounts of precipitation but is comparatively flat. Environmental Impacts Although hydropower has no air quality impacts, construction and operation of hydropower dams can significantly affect natural river systems as well as fish and wildlife populations. Assessment of the environmental impacts of a specific hydropower facility requires case-by-case review. Although power plants are regulated by federal and state laws to protect human health and the environment, there is a wide variation of environmental impacts associated with power generation technologies. The purpose of the following section is to give consumers a better idea of the specific ecological impacts associated with hydropower. Air Emissions Hydropower's air emissions are negligible because no fuels are burned. However, if a large amount of vegetation is growing along the riverbed when a dam is built, it can decay in the lake that is created, causing the buildup and release of methane, a potent greenhouse gas. Water Resource Use Hydropower often requires the use of dams, which can greatly affect the flow of rivers, altering ecosystems and affecting the wildlife and people who depend on those waters. Often, water at the bottom of the lake created by a dam is inhospitable to fish because it is much colder and oxygen-poor compared with water at the top. When this colder, oxygen-poor water is released into the river, it can kill fish living downstream that are accustomed to warmer, oxygen-rich water. In addition, some dams withhold water and then release it all at once, causing the river downstream to suddenly flood. This action can disrupt plant and wildlife habitats and affect drinking water supplies.

## Other Energies Fail 1/3

### In order to meet the earth’s projected energy needs by 2100, current energy sources fall short

Snead, James Michael, lead for agile combat support in the AFRL, “The End Of Easy Energy And What To Do About It”, November 19, 2008, http://mikesnead.net/resources/spacefaring/white\_paper\_the\_end\_of\_easy\_energy\_and\_what\_to\_do\_about\_it.pdf

4. To transform the world to primarily sustainable energy by 2100 to replace oil, coal, and natural gas, current sustainable energy sources must be scaled up from today by a factor of 24. By the end of the century—perhaps decades earlier—the world will need to obtain almost all of its energy from sustainable energy sources: nuclear and renewables. Today, the equivalent of about 11 billion BOE comes from sustainable energy sources. By 2100, the world must increase the production capacity of sustainable energy sources by a factor of about 24 to provide the equivalent of 280 billion BOE. The two primary sources of sustainable energy today are nuclear and hydroelectric. Today, the world has the sustainable energy equivalent of about 350 1-GWe (gigawatt- electric) nuclear power plants and 375 2-GWe Hoover Dams. To meet the world’s 2100 need for 280 billion BOE of energy production, every four years through the end of the century, the world must add this amount of sustainable energy production in the form of nuclear, hydroelectric, geothermal, wind, solar, and biomass.

Other Energies Fail 2/3

### Earth based renewable energy cannot possibly solve—we would need millions of square miles of just wind turbines.

Snead, James Michael, lead for agile combat support in the AFRL, “The End Of Easy Energy And What To Do About It”, November 19, 2008, http://mikesnead.net/resources/spacefaring/white\_paper\_the\_end\_of\_easy\_energy\_and\_what\_to\_do\_about\_it.pdf

5. Terrestrial sources of sustainable dispatchable electrical power generation will fall significantly short of U.S. and world needs by 2100 and, even, current U.S. needs. Energy is supplied in two primary forms: dispatchable electrical power to meet consumer needs for electricity and modern fuels to power transportation and other systems operating off the electrical power grid. By 2100, the world will need about 18,000 GWe of dispatchable electrical power generation capacity, compared with about 4,000 GW today, with almost all generated by sustainable sources.\* To assess the potential of nuclear fission and terrestrial renewables for meeting this world need, the addition of 1,400 1-GWe conventional nuclear fission reactors , the construction of the equivalent of 1,400 2- GWe Hoover Dams for added hydroelectric power generation, the addition of 1,900 GWe of geothermal electric power generation, and the expansion of wind-generated electrical power to 11 million commercial wind turbines, covering 1.74 million sq. mi., would only be able to supply about 47% of the world’s 2100 need for dispatchable electrical power generation capacity.‡ For the United States, only about 30% of the needed 2100 dispatchable electrical power generation capacity could be provided by these sustainable sources. By 2100, the U.S. and the world would be left with a dispatchable electrical power generation shortfall of 70% and 53%, respectively, with respect to this paper’s projection of the 2100 needs. Further, for the United States, the projected 2100 sustainable generation capacity would only provide about one-half of the current installed generation capacity that relies substantially on non- renewable coal and natural gas.

Other Energies Fail 3/3

### Hydrogen, Alcohol, biomethane and biosoilds also can never solve—they would use all the earth’s resources before even putting a dent in our projected need

Snead, James Michael, lead for agile combat support in the AFRL, “The End Of Easy Energy And What To Do About It”, November 19, 2008, http://mikesnead.net/resources/spacefaring/white\_paper\_the\_end\_of\_easy\_energy\_and\_what\_to\_do\_about\_it.pdf

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 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.

### **And, SBSP can solve all of that.**

Snead, James Michael, lead for agile combat support in the AFRL, “The End Of Easy Energy And What To Do About It”, November 19, 2008, http://mikesnead.net/resources/spacefaring/white\_paper\_the\_end\_of\_easy\_energy\_and\_what\_to\_do\_about\_it.pdf

7. Closing the U.S.’s and the world’s significant shortfalls in dispatchable electrical power will require substantial additional generation capacity that can only be addressed through the use of space solar power. Because of the substantial shortfall in needed 2100 fuels production, producing even more sustainable fuels to burn as a replacement for oil, coal, and natural gas to generate the needed additional electrical power is not practical. As a result, additional baseload electrical power generation capacity must be developed. The remaining potential sources of dispatchable electrical power generation are advanced nuclear energy and space solar power. While advanced nuclear energy certainly holds the promise to help fill this gap, fulfilling its promise has significant challenges to first overcome. Demonstrated safety; waste disposal; nuclear proliferation; fuel availability; and, for fusion and some fission approaches, required further technology development limit the ability to project significant growth in advanced nuclear electrical power generation. Space solar power (SSP)—involving the use of extremely large space platforms (20,000 or more tons each) in geostationary orbit (GEO) to convert sunlight into electrical power and transmit this power to large ground receivers—provides the remaining large-scale baseload alternative. Relying on SSP would require 1,854 5-GWe SSP systems to eliminate the world’s shortfall in needed 2100 dispatchable electrical power generation capacity. Of these, 244 SSP systems would be used to eliminate the U.S. shortfall in needed 2100 dispatchable electrical power generation capacity. The following two charts summarize this paper’s projection of the potential contribution of SSP in meeting the U.S.’s and the world’s dispatchable electrical power generation needs in 2100.

## AT: Earth-Based Solar Power

### Earth based solar power can never solve as well as the case, three reasons:

### 1) Dependent on the availability of sunlight—if you don’t have sun you don’t have power, whereas SBSP is exposed to 24 hour sunlight

### 2) Earth based solar power wastes money unnecessarily

Jones and Malloy, V. Rory & Steve, “WARNING to homeowners: Roof solar panels could be a really bad move if they’re not thought through! “, November 2009, http://www.youtilbill.com/images/youtilbill-Paper-Solar-100117b.pdf

Thinking about putting some sleek solar panels on your roof? Well – STOP – and do some quick evaluations before a slick salesman talks you into doing something you may regret. Since the California Legislature passed Bill 811 (“AB811”) in July 2008, allowing local governments to lend money to homeowners for energy-savings investments, solar panel installations have become the rage across Sonoma County – one of the first Counties to offer an AB811 lending program. The trouble is, homeowners are rushing into excessive and unnecessary hikes in their property assessments, while others are taking on leases that actually cause their annual overall energy-related spending to increase! While everyone is concerned about the impact of their energy consumption on the planet, there is now ample evidence that over-doing a solar implementation actually impacts the planet much more negatively than it does good. Much better to do some energy-savings measures first, then size the solar solution to what’s needed. Not only does the planet avoid the costs of making and installing too much photo-voltaic solar equipment, but a small amount of thinking can actually save the homeowner loads of money too! So, what’s needed? It turns out that most US homes waste an appalling amount of energy – on average, about 40%. These losses manifest themselves as lost air mass through cracks and leaks, after much is expended in heating or cooling air; inefficient energy conversion in refrigerators, water heaters and the like; and always-on equipment that doesn’t need to be always on (like phone chargers and computer peripheral equipment). If these issues aren’t addressed before you commit to a PV solar generation installation, you’re likely to end up with 40% too much – and the associated costs of borrowing or leasing such an excessive amount.

### 3) Earth-based solar power takes up valuable land, which SBSP won’t.

## **Wind Power Fails 1/2**

### Wind power kills thousand of bird every year due to inappropriate regulatory guidelines—some of them endangered species

American Bird Conservancy, Letter to the U.S. fish and wildlife Service, May 19, 2011, http://www.abcbirds.org/Wind\_Guidelines\_Comment\_Letter.pdf

Thank you for the opportunity to comment on the U.S. Fish and Wildlife Service’s Draft Voluntary Wind Guidelines. We offer them on behalf of American Bird Conservancy, American Birding Association, Bird Refuge of York County, Center for Native Ecosystems, Chesapeake Wildlife Heritage, Desert Cities Bird Club, Endangered Habitats League, Environmental Protection Information Center, Friends of Dyke Marsh, The Lands Council, Lehigh Gap Nature Center, Long Point Waterfowl, Madison Audubon Society, North Fork Audubon Society, Oregon Wild, St. Louis Audubon Society, Salem Audubon Society, Saving Birds Thru Habitat, The Trumpeter Swan Society, Western Nebraska Resources Council and Wisconsin Audubon Council. Brief descriptions of these groups appear at the end of this letter. Although wind power can be an important part of the solution to global climate change, wind farms can impact birds—including eagles, songbirds, and endangered species—through collisions with turbines and associated power lines, and through loss of habitat. By 2030, there are expected to be more than 100,000 wind turbines in the U.S., and these are expected to kill at least one million birds each year—probably significantly more. Wind farms are also expected to impact almost 20,000 square miles of bird habitat, and another 4,000 square miles of marine habitat, some of it critical to threatened species.

### Wind turbines are erected in areas without adequate consideration to what kinds of species live there—including endangered species.

Sorentrue, Jennifer, “PB Country considers 30-story Wind Turbines for Glades Sugarfield”, The everglades foundation, http://www.evergladesfoundation.org/news/entry/PB-County-considers-30-story-wind-turbines-for-Glades-sugar-fields/

Environmentalists say they are concerned spinning turbines could harm birds and bats. "There are a lot of questions that remain to be answered, before we jump on the wind energy bus," said Joanne Davis, a community planner with 1000 Friends of Florida. One fear: that migratory birds flying through the region could be struck by the fast-moving blades. The endangered snail kite, for one, could be devastated if even a few were killed, environmentalists say. They point a wind farm located just east of San Francisco where thousands of birds have been hit by the spinning blades - a project Wind Capital officials said uses outdated technology. "When you talk about birds like the snail kite, we can't afford to have any mortality," said Drew Martin, conservation chairman for the Sierra Club's Loxahatchee Group. Wind Capital sat with environmental groups before this last week's meeting with county planners, to discuss the groups' concerns. The company is working with a consulting firm to study bird flight patterns near Lake Okeechobee. Company officials also have met with various government agencies and elected officials to discuss the project. "We are trying to be as transparent as we can," Saiz said.

Wind Power Fails 2/2

### Wind turbines kill 4-5 million birds each year, by conservative estimates.

Manville, Albert M., “TOWERS, TURBINES, POWER LINES, AND BUILDINGS—STEPS BEING TAKEN BY THE U.S. FISH AND WILDLIFE SERVICE TO AVOID OR MINIMIZE TAKE OF MIGRATORY BIRDS AT THESE STRUCTURES “, 2009, http://www.publicradio.org/columns/marketplace/sustainability-answers/Manville\_PIF09.pdf

Direct impacts of communication towers to migratory birds come from two sources, colli- sions and possibly from radiation exposure. Collisions represent a primary source of mor- tality and have been well documented since the late 1940s in the U.S. (Aronoff 1949, Kemper 1996, Manville 2005 and 2007a). From a collision perspective alone, 4–5 million birds are conser- vatively estimated to die each year in tower and guy-wire collisions—with high-end estimates at 40–50 million birds (Manville 2005). These ﬁgures are admittedly “guesstimates,” but still based on the best available scientiﬁ c evidence. Like all structural mortality estimates, not until scientiﬁ cally valid, cumulative impact analyses are conducted will we clearly understand the level of impact each structure is having on bird populations. However, until impacts are better under- stood—including the likelihood of additive mortality effects to some populations—the Service will continue to address impacts using the precautionary approach (UNEP 2002). The precautionary approach—also known as the precautionary principle—has its origin in European law. However, the precautionary approach was reﬁ ned, based on the develop- ment and application of international law in light of scientiﬁ c uncertainty, at the 1992 Earth Summit in Rio de Janeiro, most notably through Rio Principle 15. It states that, “Where there are threats of serious or irreversible damage, lack of full scientiﬁ c certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.” Simply Documented bird collisions continue to be a problem. While C. Kemper documented the record for a one-night avian-tower collision of more than 12 000 birds retrieved and identiﬁ ed in 1963 at a Wisconsin television tower (Kemper 1996), spikes in tower collision numbers have recently been noted. For example, in continuing studies conducted by A. Clark over 29 years at three television towers in Buffalo, NY (Morris et al. 2003), Clark noted a gradual decrease in the number of birds killed at the towers he stud- ied—ranging from a high of 4787 in 1982 to a low of 6 in 1992. The authors hypothesized the decline in the rate of mortality was due to 4 pos- sible factors: (1) an overall decrease in migra- tory bird populations, (2) change in weather and wind patterns, (3) increases in predation and scavenging around tower bases, and (4) changes in migration patterns. However, during the fall 2005 migration season, Clark (2006 pers. comm.) documented the largest annual kill at his study towers since 1982. In 2005, he retrieved 1223 birds at the bases of those same three New York towers (878 whole carcasses and 345 “parts thereof” repre- senting 55 species). This included more than 200 Golden-crowned (Regulus satrapa) and Ruby- crowned Kinglets (R. calendula). Also during the fall 2005 migration season, additional troubling reports of large bird kills at both tall and short communication towers also surfaced, particularly kills that occurred dur- ing a week-long inclement weather event that coincided in the East with the songbird migra- tion in October. W. Evans (2005 pers. comm.)

## Microwaves Safe 1/2

### SBSP would meet FCC regulations for microwave beams at the edges of rectennas, and restricting the airspace above them would ensure that no one would be harmed by microwaves.

Shiner 08 (Linda, July 1, 2008, “Where the Sun Does Shine- Will space solar power ever be practical?”, Air & Space Magazine, http://www.airspacemag.com/space-exploration/Sun\_Does\_Shine.html?c=y&page=3)

Perhaps the biggest hurdle facing space solar power is public concern about how low-level microwave beams will affect animals and humans. Never mind that the fear remains unfounded. Because of the widespread use of microwaves for communication, the Federal Communications Commission has established a safety standard for human exposure. In all proposed space power systems, the expected power density at the edges of the receiving antenna, where people are most likely to be affected, meets the standard. But explaining this to the public, which hears “microwave” and thinks “oven,” might require a large and costly education campaign. Another worry, that microwave beams could scramble a passing airliner’s avionics or harm passengers, could be addressed by restricting the airspace around the beams, just as the Federal Aviation Administration restricts the airspace over nuclear power plants. Space power advocates may find it instructive to study the political struggles of the nuclear power industry. At the October press conference, speakers pointed out that the inevitable pursuit of higher standards of living will increase competition for energy, and that by mid-century, the global population will have increased from six to nine billion. It’s not much of a reach to apocalyptic visions of clashes over diminishing fuel. Can the sunsat believers make the case that space solar power is one way to help meet the growing demand for clean, inexhaustible energy? And if so, will they find a branch of the government that can support and coordinate the necessary research? We want to believe.

Microwaves Safe 2/2

### Microwave energy beaming is safe and can’t be weaponized- low energy densities.

Jenkins 09 (Lyle, December 20, “Development of Space-Based Solar Power”, Renewable Energy, http://www.intechopen.com/source/pdfs/9321/InTech-Development\_of\_space\_based\_solar\_power.pdf)

Microwave beams arc constant and conversion efficiencies high. They can be beamed at densities substantially lower than that of sunlight. This delivers more energy per area than terrestrial solar energy. The peak density of the beam can be significantly less than noon sunlight, and at the edge of the rectenna equivalent to the leakage of a microwave oven. This low energy density and choice of wavelength also means that biological effects arc likely to be low. The safety of wild life wandering into the beam is not expected to be an issue. The physics of electromagnetic energy beaming is uncompromising. The size of the antenna makes microwave beaming unsuitable as a "secret" weapon. The distance from the geostationary belt is so great that beams diverge beyond the coherence and power concentration needed for a weapon. The beam is likely to be designed to require a pilot beam transmitted from the rectenna site. Absent the pilot signal, the system can bo programmed to go into an incoherent mode. Concerns may also be addressed through an inspection regime. The likelihood of the beam wandering over a city is extremely low. Even if it occurred, it would not be a hazard.

## Energy Beaming Safe

### The technology is safe

Powersat 2010 ((international SBSP cooperation) <http://www.powersat.com/faq.html>) JA

The powersat energy beam is incredibly safe and secure. Overall, the radio frequency radiation in the beam has less of an effect than an ordinary cell phone. The beams are directed only at the receiving stations and do not pass through the collectors. It is physically improbable that a human would be exposed to the path of the beam, as it would require being above the receiving stations, which are elevated 25 feet above the ground. Airplanes are able to safely cross the path of the beam without any kind of problem because the beam bounces off of the aluminum of the plane. Today, thousands of communication satellites, GPS and DirectTV transmit energy from space. Powersats utilize similiar technology.

## Lasers Work 1/2

### Using lasers to power machines is possible- NASA demonstrations prove.

NASA 5/7/2008 (National Air and Space association) <http://www.nasa.gov/centers/dryden/news/FactSheets/FS-087-DFRC.html>) JA

Flights of the lightweight, radio-controlled model airplane inside a large building at NASA Marshall are believed to be the first time that an aircraft has been powered only by laser energy. The demonstration was a key step toward the capability to beam power to an aircraft, allowing it to stay in flight indefinitely — a concept with potential for the scientific community as well as the remote sensing and telecommunications industries.

Lasers Work 2/2

### Applications for beaming technology

NASA 5/7/2008 ((National Air and Space association) <http://www.nasa.gov/centers/dryden/news/FactSheets/FS-087-DFRC.html>) JA

Another possible solution would be to beam the power down from a laser power station in space that can always see the aircraft above the clouds. Other Potential Applications High-altitude airships: Beaming power to high-altitude airships for the same role as high-altitude, long endurance unscrewed airplanes has also been proposed, although the technology to allow a dirigible or blimp fly at high altitude has yet to be demonstrated. Extra-terrestrial robotic rovers and aircraft: Laser power-beaming could energize ground-based robotic rovers on the moon and Mars or power a small airplane in the Martian atmosphere, with electricity beamed from an orbiting satellite. Small or swarming unmanned aircraft: Small, low-altitude scout aircraft that could fly guard duty over a military combat area, or fly in front of a convoy to warn against an ambush could be periodically recharged with a laser beam so they could stay aloft as long as needed. Power transmission: In locations where it is not practical to run power transmission lines, power beaming could "close the gap" by beaming the energy across the open distance. Power could even be beamed to a special aircraft or satellite that would then send the energy back to Earth a great distance away. Space applications: Power beaming has been proposed to transmit power from the ground to satellites to provide more energy than they could absorb from solar panels alone. Space-based solar farms could beam power directly to Earth, the moon or other planets. Other suggestions include using specially tuned high-power lasers to "rejuvenate" damaged solar panels on satellites to extend their life, and development of "power farms" (satellites with very large solar panels) to beam energy to another satellite that required periodic high amounts of energy.

## SBSP Cheap

### **The projected costs of SBSP would be about 5 billion dollars, or about the same as that of a nuclear power plant; technological advances will make them cheaper.**

Mardon 12 June 2011- Austin Mardon received an honourary doctorate of laws from the University of Alberta on Friday. He is a member of the Order of Canada and is a full member of the International Academy of Astronautics (Austin Mardon, “Solar Satellites Key to Green Energy”, Edmonton Journal, http://www.edmontonjournal.com/technology/Solar+satellites+green+energy/4933251/story.html)

With gas prices on the rise, the race is on for cheap alternative fuel sources, including solar power, but amid a wash of criticism, the solar industry may not even be in the running. The major criticisms against solarpower facilities, such as wind farms, are unreliability and inefficiency. Solar power depends on environmental factors beyond human control and that makes investors anxious. These facilities also require areas with high amounts of sunlight, usually hundreds if not thousands of acres of valuable farmland and all for relatively little power production. This is why, in the 1960s, scientists proposed solar-powered satellites (SPSs). SPSs have about the most favourable conditions imaginable for solar energy production, short of a platform on the sun. Earth's orbit sees 144 per cent of the maximum solar energy found on the planet's surface and takes up next to no space in comparison to land-based facilities. Satellites would be able to gather energy 24 hours a day, rather than the tenuous 12-hour maximum that land-based plants have, and direct the transmitted energy to different locations, depending on where power was needed most. So, with so many points in its favour, why hasn't anyone built one yet? Obviously, putting anything into outer space takes a lot of money. Many governments claim there simply isn't any money in the budget for launching satellites into space, but in 2010, amid an economic crisis, the United States managed to find $426 million for nuclear fusion research and $18.7 billion for NASA, a five-per-cent increase from 2009. The most recent projections, made in the 1980s, put the cost of launching an SPS at $5 billion, or around 8-10 cents/ kWh. Nuclear power plants cost a minimum of $3 billion to $6 billion, not including cost overruns, which can make a plant cost as much as $15 billion. In the U.S., nuclear power costs about 4.9 cents/kWh, making SPS power supply only slightly more expensive. But these estimates are over two decades old and the numbers likely need to be re-examined. The idea for space-based solar energy has been around since the '60s; given the technological advancements since then, surely governments would have invested in making an SPS power supply more budget-friendly. That is not the case. Governments and investors are rarely willing to devote funding to something that doesn't have quick cash returns. The projected cost of launching these satellites once ranged from $11 billion to $320 billion. These figures have been adjusted for inflation, but the original estimates were made back in the 1970s, when solar technology was in its infancy, and may have since become grossly inaccurate. How long an SPS would survive in orbit is anybody's guess, given the maintenance due to possible damage to solar panels from solar winds and radiation. As for adding to the ever-expanding satellite graveyard in Earth's orbit, most solutions to satellite pollution remain theoretical. Still, these satellites should not be so largely dismissed. There is a significant design flaw keeping these satellites from production. One of the major shortfalls in the design of SPSs is simply in getting the power from point A to point B. This remains the most controversial aspect of SPSs: the use of microwaves to transmit power from high orbit to the ground. Critics often cite the dangers of microwave radiation to humans and wildlife, however, the strength of the radiation from these beams would be equal to the leakage from a standard microwave oven, which is only slightly more than a cellphone. A NASA report from 1980 reveals that the major concern with solarpowered satellites was problems with the amplifier on the satellite itself. Several workable solutions were proposed in that same report. The report also recommended that NASA develop and invest in SPS technology, so that by the 2000s, these satellites would be a viable alternative fuel source. This recommendation was ignored. We should already have the technology and the infrastructure in place for green energy, but we don't. Instead, we are engaged in a mad dash for the quickest, cheapest alternative to oil and that may be the source of our downfall. For the sake of the future, expediency must take a back seat to longevity and longevity may just be found in outer space.

## SBSP Efficient

### SSP is an incredibly efficient source of energy

McLinko, Ryan M., and Basant V. Sagar. 2010 “Space-based solar power generation using a distributed network of satellites and methods for efficient space power transmission.” International Conference on Space Information Technology 2009. Ed. Xingrui Ma, Baohua Yang, & Ming Li. Beijing, China: SPIE, 2009. 76513P-7.©2010 SPIE--The International Society for Optical Engineering.

The efficiency for power transmission through free-space has been shown to approach 100% and its dependence on various factors can be characterized by the following dimensionless quantityThis result is derived by treating electromagnetic beams as Gaussian beams, [9], [10]. Experimental results, in [2], about the relationship of efficiency with X/2, clearly support the theoretical predictions of the Gaussian beam model. The Gaussian beam used in this design will have a power tapering (ratio of power density at the center of transmitting antenna to that at the edge) of 10-15 db. The area of the rectenna arrays in space and on the ground will be optimized according to this relation. In this design, the total transmitter aperture in space is ~0.8 km2 and the rectenna array occupies ~1.5 km2 on earth. The main beamers have huge transmitter antenna arrays, which span the overall geometry of the satellite network. The 2.45 GHz frequency range has been widely studied for the purpose of space solar power transmission. This frequency is thought to be optimal both in terms of efficiency and transmission. A power conversion efficiency of up to 85% has been obtained by rectennas operating at 2.45 GHz. [5] This region of the electromagnetic spectrum is also free from the effects of attenuation in the atmosphere, thereby making the SSP system immune from the effects of weather. Attenuation begins to affect transmission after 3GHz and spikes afterward, making the 2.45 GHz region our best choice for SSP. [6]. Studies by [7] have shown that power loss in the atmosphere is less than 1% for this frequency. A rectenna array on the ground converts the microwave energy into DC power, which can then be converted into AC and fed to the power grid infrastructure on Earth.

## USFG Key

### The USFG has the funds, tech, and political support to make SSP a long term solution to global energy problems

Peter J. Schubert 2011 “Materials Selection and Processing for Lunar Based Space Solar Power” Materials challenges in Alternative and Renewable Energy. 2011 by The American Ceramic Society.

With the technology outlined herein, and the materials identified to make them technically feasible, mankind is capable of meeting future growth in power demands for an indefinite period of time, and sufficient for the entirety of human enterprise. Economic studies of this cislunar architecture show achievable cost parity with mega-nuclear installations'^'19, assuming projected costs by private launch services. Studies of SSP are diverse and poorly-coordinated. However, there has been a recent focus on SSP in international conferences in 2009 and 2010. Certain Members of the US Congress arc aware of SSP, as is the Office of Science and Technology Policy of the Executive Office of the President. An outline for achieving commercial SSP has been developed recently14. All that is required is the awareness of the potential for this technology, the political will to fund its development, and the cooperation and coordination of the many talented scientists and engineers who can bring about this ultimate answer to electric power. As an additional bonus, mankind will have a permanent base on another planetary body - a stepping stone for further exploration and exploitation of the many riches available to us in outer space.

## SBSP Possible

### It’s possible- they’ve done tests in Japan.

Shimbun, Yomiuri, Daily Newspaper in Japan, January 22, 2011,

Jan. 22–A team of scientists from several organizations will begin tests this spring on a space-based power generation technology using satellites, it was learned Saturday. The technology would start by generating electricity from sunlight in space, convert the power into microwaves and then send it to Earth, the team said. The planned test will attempt to convert a strong electric current into microwaves and transmit them 10 meters away in a simulated outer space environment at Kyoto University. The group comprises scientists from the Japan Aerospace Exploration Agency, Mitsubishi Electric Corp., Mitsubishi Heavy Industries Ltd., IHI Corp. and Kyoto University. 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.

## SBSP Viable

### SBSP is now a viable energy option- we’re right on the cusp, we just need to prove it!

OFFICE OF SPACE COMMERCIALIZATION U.S. Department Of Commerce April 2010 http://www.space.commerce.gov/power/

The NSSO study found that SBSP does present a strategic opportunity that could significantly advance U.S. and partner security, capability, and freedom of action, and the concept merits significant further attention on the part of the U.S. Government and the private sector. While significant technical challenges remain, SBSP is more technically executable than ever before, and current technological vectors promise to further improve its viability. A government-led proof-of-concept demonstration could serve to catalyze commercial sector development.