

Renewable Energy and the Nevada Test and Training Range

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Abstract

A team of graduate students at the College of William & Mary's Thomas Jefferson Program in Public Policy examine the issue of encroachment due to renewable energy infrastructure development at the Nevada Test and Training Range. Nevada has a comparative advantage in producing solar power, and both the nation in general and the Department of Defense have ever-increasing renewable energy goals. However, proposals for the development of 116 renewable energy infrastructures around the Nevada Test and Training Range would significantly impede the critical training and munitions testing that occur there. The student team identifies several mitigation options and provides a list of policy options, as well as supplementary recommendations, that aim to both preserve Air Force capabilities and advance renewable energy technology in the United States. Many are based on a variety of land acquisition methods, but they offer solutions merely on a case-by-case basis, and only with regard to solar power in Nevada. More broad policy resolutions are necessary, potentially at the national level. This initial analysis should provide a basic framework for addressing encroachment from like sources at other Air Force bases, as well as those of the other branches of the Armed Services. Finally, the team inventories further considerations including the political environment, economic and environmental impacts, tribal concerns, and mineral rights.

I. Introduction

As its name indicates, the Nevada Test and Training Range (NTTR), an Air Force installation in the state of Nevada, north of Nellis and Creech Air Force Bases, serves a dual training and testing mission. In fact, every aircraft and all munitions in the Air Force's inventory are tested and trained upon at this site, and it is the centerpiece of the Air Warfare Center's mission. For this reason, NTTR has been described as the "crown jewel of Air Force training resources."

¹ The testing portion of NTTR's mission takes place on the range itself, while the training component takes place in the air above the range as well as in military operating areas (MOA)—airspace above land that the military does not actually own but is still permitted to use.

At its heart, the policy challenge that this briefing addresses is an issue of competing land use. In its most general sense, competing land use refers to the contest between two or more stakeholders for use of specific or scarce land for differing purposes—a concept to which the U.S. military is no stranger. More specifically, at NTTR, renewable energy and military readiness compete for use of the land and the air above it. Both utilizing renewable energy resources and maintaining optimum military testing and training levels are present national priorities. Therefore, our concern is whether the Air Force can work to accommodate both near NTTR and, if so, how best to do so.

Our methodology consists of identifying three hypothetical sites at which renewable energy infrastructures would have differing impacts on NTTR operations. There are over 116 proposed sites for a variety of renewable energy infrastructures near NTTR. So, for ease of comparability, rather than evaluate multiple technologies at multiple sites, we chose one renewable technology and one proposal as a baseline for analysis—the highly-publicized Coyote Springs. Already under development, Coyote Springs is the front-runner in terms of progress; also, it uses concentrated solar power tower technology, which is particularly obstructive to NTTR operations.

We chose our three hypothetical sites with the aid of the Air Combat Command and the Applied Physics Lab at Johns Hopkins University.² With their guidance, the first site we chose is located underneath a portion of the MOA airspace called Sally Corridor, a critical flight path in many training operations, particularly the highly-valued Red Flag exercise. The second site we chose is also located underneath MOA airspace. It is under a section called Charlie Caliente, where many aircraft refuel during their training exercises. We chose our third hypothetical site to be in Nye County. It is not under airspace used for training purposes, but it is located near the munitions testing portion of the range, though not on the range itself.

Rather than produce a single recommendation to the Air Force for such a nuanced issue, we provide a framework for addressing this and similar challenges moving forward. To this end, our team consulted with multiple experts to identify a menu of potential options to mitigate any negative impacts from renewable energy infrastructures near NTTR. To evaluate these options, we gauged the political environment at the federal, state, and local levels, as well as assessed potential economic impacts on communities in the vicinity who have a long history of partnership with NTTR. We also examined other considerations that require attention, particularly in the Southwest, such as impacts on the environment, minimizing detriment to sites of cultural or historical significance, reflecting the rights and interests of tribal groups in the region, and the ownership of mineral rights. From this evaluation of the potential mitigation options, we produced some interim supplementary recommendations moving forward.

II. Encroachment at NTTR

The Air Force faces encroachment on their bases and other installations due to a variety of sources. Noise abatement, suburban sprawl, and numerous forms land development for commercial or residential purposes are just a few. The construction of renewable energy infrastructures is but one of many issues that are actively shrinking the Air Force's testing and training space. This occurs, however, while the Air Force's capabilities are rapidly expanding, causing concern that the Air Force will outgrow its testing and training areas.³

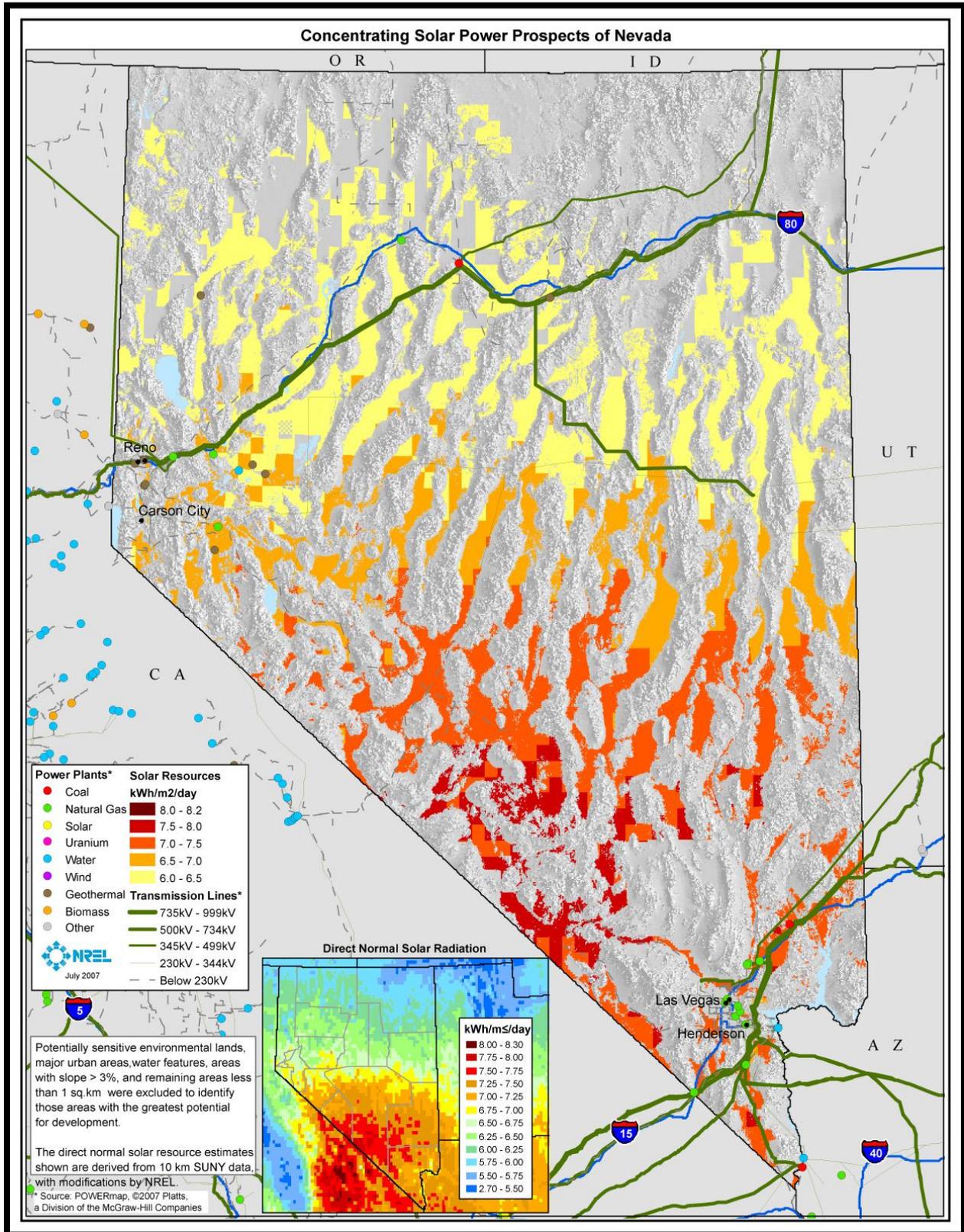
Current levels of encroachment and future predictions are difficult to assess. Specific measurements of present and future encroachment are protected and, considering that widely publishing such data would reveal potential weaknesses in defense, it comes as no surprise that the Air Force is adverse to do so. To provide an illustration, however, one unspecified aircraft in the Air Force's inventory required over 4,600 hours in order to maximize training capacity as of 2007, but was only able to utilize slightly more than 3,000 hours, meaning that this particular defense platform was operating at roughly 68% of where the Air Force would like it to be. That same year, nearby Nellis AFB was able to utilize its schedule training airspace with only 88% effectiveness due to a variety of encroachment impediments.⁴

A key component of the opposition between solar power towers and Air Force testing and training levels is that both have been known to have some level of adverse impact upon each other. For instance, the glare from the solar mirrors has the potential to blind pilots for up to one minute, which is especially problematic when operating high-speed aircraft. The heat retained by solar towers also produces an infrared glow that can disrupt infrared targeting systems used by many pilots.⁵ Also the height of the towers constrains altitudes at which the Air Force can fly, as pilots are required to a minimum altitude above ground structures. Such high towers severely limit the Air Force's ability to conduct low-altitude awareness training. On the other hand, when aircraft travel at high speeds, they produce pressure waves that have the potential to fracture the mirrors that this form of solar technology uses to gather sunlight. This damage to solar mirrors has long been an observed problem for renewable energy development sites in nearby Lincoln County.⁶

III. Renewable Energy Technology

NTTR is, in fact, the ACC's most encroached installation, due to a myriad of sources; a problem that will only be made worse by renewable energy developments that congest the airspace and have adverse affects on aircraft instruments.⁷ However, Nevada, and the southwest part of the state in particular, has a comparative advantage in producing solar energy. Additionally, the National Renewable Energy Laboratory (NREL) reports that this area is one of "the most economically suitable lands available for deploying of large-scale concentrating solar power plants in the southwestern United States," accounting for land availability.⁸ See Figure 1 for an illustration of solar resources in Nevada.⁹ Consequently, renewable energy development has the support of local and state officials as well as the general public for its ability to bring jobs, revenues, and clean and reliable energy to the state and the surrounding region.

Figure 1: Solar Resources in Nevada



The mission at NTTR is potentially compromised by upwards of 116 renewable energy development proposals in progress around the range and under the MOA airspace. The front runner and our baseline regarding the specifications and footprint of solar thermal energy plants is the Coyote Springs development in Lincoln County, just north of Las Vegas and approximately 60 miles from Nellis AFB. Coyote Springs uses solar power towers—a concentrated solar power (CSP) technology. The developer, the Coyote Springs Land Company, broke ground in January 2010 and plans to begin production by January 2012.¹⁰ The development will consist of two 200 MW capacity towers—a large output, considering that only 31 MW of CSP tower technology had been installed around the world as of 2008.¹¹ Approximately 100,000 mirrors, or heliostats, on the ground reflect sunlight to a boiler atop an 850 foot tower, heating steam to run a conventional turbine and generate clean electricity.

Solar power towers are a preferred CSP technology because, on such a large scale, they are highly efficient and, thus, cost-effective. Current technology permits 6 hours of thermal storage at the base of the tower—associated with a capacity factor of approximately 40%, and increases in storage only improve efficiency.¹² Furthermore, heliostats using two-axis tracking with nearly a 1,500 concentration ratio allow for high operating temperatures and lower water cooling needs, making power towers less susceptible to efficiency losses.¹³ The heliostats themselves also contribute to cost-effectiveness: the highly accurate small, flat mirrors “are more efficient, simpler to manufacture, and cost less to install than parabolic mirrors used in solar troughs;” additionally, they require little to no maintenance and have longevity of 35 years.¹⁴

We apply these assumptions to Sandia National Laboratories’ (hereafter “Sandia”) estimates of land and water requirements to determine the footprint of a solar power development. Sandia reports that CSP plants require an average of 5 acres per MW of capacity.¹⁵ Based on the Coyote Springs proposal, this amounts to a 2,000 acre or 3.125 square mile project. In their unadulterated form, power towers use 500-750 gallons of water per MWh.¹⁶ However, power towers –especially large-scale plants—can use dry or air and hybrid cooling techniques with less penalty than other technologies and may eliminate 80-90% of the requirement of water conventional systems, for both cycle makeup and mirror washing.¹⁷

The technology that will be used at Coyote Springs employs dry cooling and, purportedly, uses 90% less water than a wet cooling system. Therefore, in a worst case scenario, operating at a maximum capacity of 400MW, using 75 gallons of water per MWh, a development like Coyote Springs would use approximately 30,000 gallons of water per hour—this is 20 times less than an Olympic swimming pool contains. Furthermore, power towers are closed systems (they recycle/reuse water), and the Coyote Springs development may be able to use reclaimed water from nearby homes, golf courses, and businesses.¹⁸ See Table 1 for a sensitivity analysis.

Table 1: CSP Tower Water Requirement Scenarios

	Water requirement	Full capacity=400MW	40% capacity=160MW
750 gal/MWh	90% savings=75 gal/MWh	30,000 gal/h	12,000 gal/h
	80% savings=150 gal/MWh	60,000 gal/h	24,000 gal/h
500 gal/MWh	90% savings=50 gal/MWh	20,000 gal/h	8,000 gal/h
	80% savings=100 gal/MWh	40,000 gal/h	16,000 gal/h

IV. Renewable Energy Goals

a. Federal Goals

All federal agencies have an incentive to encourage renewable energy development due to requirements placed upon them to use an increasing amount of renewable energy. Federal directives currently call for all federal agencies to meet certain energy goals by the year 2025, with interim goals every few years by which to measure progress. Furthermore, the Department of Defense (DoD) has specific mandated goals it is required to meet and to report on annually, and the Air Force has established benchmarks of its own.

There are three directives that are especially important in establishing energy goals for DoD and for calculating how these goals may be met. First, an overall renewable energy goal is set by: Title 10 USC §2911 (e), *Energy Performance Goals and Plan for Department of Defense* requires DoD “to produce or procure” no less than 25 percent of its total facility energy consumption during fiscal year 2025, and each fiscal year thereafter, from renewable energy sources. This statute has been interpreted to include the procurement of renewable energy, which allows DoD to get credit for both renewable energy credits (RECs) and energy purchased off-site.

Second, encouraging the development of new renewable energy sources: Executive Order 13423, *Strengthening Federal Environmental, Energy, & Transportation Management* requires that, in each fiscal year, an amount of renewable energy equal to at least half of the statutorily required renewable energy that is consumed by a federal agency must come from new renewable sources placed into service after January 1, 1999.

Third, a caveat to calculation that promotes renewable energy development on federally owned land: 42 USC §13201, the *Energy Policy Act of 2005* defines means for calculating renewable energy goal compliance. Among its directives, it establishes that to determine compliance with energy requirements, the amount of renewable energy counted towards the goal is doubled if:

- (1) *The renewable energy is produced and used on-site at a Federal facility;*
- (2) *the renewable energy is produced on Federal lands and used at a Federal facility; or*
- (3) *the renewable energy is produced on Indian lands and used at a Federal facility.*

In summary, these directives require DoD use 25 percent renewable energy by 2025, allow DoD to procure this energy from off-site sources, stipulates that at least half of the requirement is fulfilled by using “new” renewable energy sources, and incentivizes DoD to partner with other federal landowners to encourage possible energy development on their lands or to produce renewable energy on its own property.

While the end goal is for federal agencies’ energy usage to be 25 percent renewable by 2025, *Table 2* outlines the interim goals that are used in order to hold agencies accountable for their progress.

Table 2: Energy Policy Act Interim Goals

Year	Target
FY 2007-2009	3%
FY 2010-2012	5%
FY 13+	7.5%
By 2025	25%

b. Current AF and DOD Progress in Meeting Federal Goals

In February of 2010, the Deputy Under Secretary of Defense for Installations and Environment issued a statement before the House Armed Services Committee's Subcommittee on Readiness, that DoD is "not even close to meeting the interim target" established for the goal to produce or procure no less than 25 percent of its total facility energy consumption from renewable energy sources by FY 2025.

The Air Force is already not only DoD's largest renewable energy power purchaser, but the largest renewable energy power purchaser in the U.S. and the third largest in the world. Were it to be separated from DoD as a whole in order to meet the 25 percent federal goal, the Air Force would be on track and is currently meeting interim target percentages of renewable energy usage. The Air Force moves toward meeting its own 25 percent base-by-base renewable energy goal in two ways: by either purchasing renewable energy directly or by purchasing renewable energy credits (RECs) from power producers. According to the 2009 DoD Annual Energy Report, 39 percent of Air Force renewable energy requirements are met by energy purchases, while the majority of the requirement, 61 percent, is met by REC purchases. As DoD's largest consumer of energy, the Air Force has an opportunity to contribute to DoD as a whole in establishing its mandated energy goals.

c. State and Local Goals

While federal agencies are attempting to reach federal energy goals, Nevada state and its localities are striving to achieve their own energy and other goals. While the state and its individual counties have the same energy goals in so far as they promote renewable energy development, they have the added incentive to promote growth in the renewable energy industry in order to encourage general economic development in their region.

Like most states, Nevada has implemented a Renewable Portfolio Standard (RPS).¹⁹ RPS requires increased production of energy from renewable energy sources, placing an obligation on electricity supply companies to produce 25 percent of their electricity from renewable energy sources.²⁰ Nevada's RPS also includes a solar set aside, which stipulates that 5 percent of the renewable energy requirement to be produced by solar technology. Concurrent with federal energy goals, Nevada's RPS requires that the state and its energy companies increase renewable energy production. This may be used as an opportunity to partner with energy companies to jointly achieve goals, but also represents the importance to Nevada of encouraging renewable energy developments within the state.

Counties do not have their own energy mandates, but like the state as a whole, also have incentives to increase renewable energy projects in their localities based on the current availability of federal grants. In 2009, the Nevada State Office of Energy ("NSOE") Program and the State Energy Program ("SEP") received \$34,714,000 in American Recovery and Reinvestment Act (ARRA) funding. Of this amount, \$3,724,316 was allotted to Nevada cities and \$2,104,161 to Nevada counties in the form of Energy Efficiency & Conservation Block Grants (EECBG).²¹ EECBG funds may be used for the development of energy efficiency and energy conservation projects, as well as development of renewable energy systems. In addition, the 10 largest counties and 10 largest cities in Nevada, by population, were awarded funding directly by the DOE, independent from any NSOE grants, directly to federal agencies (the DOE and the Government Accountability Office). With such a significant amount of funding available for the purpose of renewable energy development, localities, of course, have great incentive to use as much of what it has available to invest in development that will benefit their communities.

In summary, state and local goals both include the pursuit of renewable energy development in Nevada. While their goals are not contrary to federal goals, when weighing mitigation options concerning certain developments and land use policy, maintaining the state's ability to attract investment in renewable energy technology (private or federal) will be an important consideration.

V. The Political Environment

Any mitigation option that the Air Force or DoD considers regarding renewable energy developments and land use must take into account the local political environment in order to help determine the policy's feasibility.

a. State-Level Political Representation

Political representatives in Nevada are elected to represent the interests of the state and its citizens. As such, most of Nevada's representatives have similar goals focused on Nevada's economic development, of which encouraging renewable energy development is an important factor. However, some representatives have expressed different political focal points in their campaigns or in their dialogue with the public which could give clues as to their level of support for certain mitigation options. These focal points should be considered when proposing mitigation options or when partnering to implement solutions to NTTR's current issues.

Nevada's Governor, Brian Sandoval, is a newly elected (as of 2010) Republican who ran on a platform that promised to maintain Nevada's business-friendly environment and to fight proposals for a corporate income tax in the state. This indicates that in the beginning of his political career Sandoval will be very supportive of businesses and development in Nevada. He is also a former U.S. District Judge and strongly supportive of the 10th Amendment, favoring a strict interpretation of states' rights, which may suggest that his leadership will be sensitive to issues that can be interpreted as federal encroachment upon those rights.

At the Senate-level, Harry Reid (D) and John Ensign (R) represent Nevada. Harry Reid, the current Senate Majority Leader, is renowned for his support of renewable energy initiatives in Nevada. Most recently, Sen. Reid has promoted extensions of the solar investment tax credit, hosted the National Clean Energy Project forum, promoted legislation that will require the President to designate renewable energy zones with significant clean energy generating potentials, and is very involved in promoting the construction of energy transmission lines to serve rural areas. Sen. Reid is also known to have strong family connections with a key renewable energy developer in the area. His strong political and personal stakes in renewable energy development suggest that he will be sensitive to mitigation options that might preclude any developments proposed by the renewable energy industry. However, these ties and his history of renewable energy development also indicate that Sen. Reid would be an important partner in helping DoD fulfill its energy mandates through increased renewable energy procurement.

Senator John Ensign, is also a proponent of renewable energy development, promoted extensions of the solar investment tax credit and worked to streamline the permitting process for renewable energy developments on public land. Sen. Ensign has also been vocal about supporting military needs in Nevada, suggesting in the case of NTTR's congestion issues, that the Armed Services

should work with developers to give them alternative suggestions to their proposals when they may be sited where interference with operations occur. Because he is strongly supportive of both energy and military issues, Sen. Ensign could be a valuable partner in promoting legislation that would suggest alternative siting for energy developments.

b. Nevada's Congressional Districts

State representatives, even more so than senate-level political representatives, have direct accountability to their congressional districts and constituent opinions. Though it is the 7th largest state in size, Nevada remains one of the most sparsely populated states, and therefore consists of only three congressional districts.²² Nevada's three House Representatives are: Shelley Berkley ((D), District 1), Dean Heller ((R), District 2), and Joe Heck ((R), District 3). Nevada's District 1 includes Las Vegas, most of North Las Vegas, and unincorporated areas of Clark County; District 2 occupies all of Nevada outside of Clark County, and some parts of Clark County; and District 3 occupies the suburbs of Las Vegas, parts of North Las Vegas, Summerlin, and much of unincorporated Clark County.

Though NTTR operations, primarily those that fly from Nellis AFB to NTTR, may affect a small portion of airspace over parts of Districts 1 and 3, the range is surrounded by and the airspace is above District 2 for the most part. This means that the political environment in District 2 should be of primary concern for NTTR officials. Representative Heller, of District 2, represents a population that is about 78 percent urban and 22 percent rural. Most of the district's population is concentrated in the city of Reno or other parts of Washoe County, with Washoe County residents casting about 70 percent of the district's votes. However, since such a large area of the district, that which surrounds NTTR, is rural, there is significant emphasis put on rural issues in the district. Therefore, Rep. Heller is especially concerned with issues in counties with a large percentage of federal land ownership, loss of taxable land to the federal government, and making sure localities receive compensatory payments or royalties in those areas so that they may fund basic services. When interacting with surrounding communities or proposing mitigation options which will affect them, especially in District 2, NTTR should consider the rural concerns that pervade the political environment there.

c. Nevada as a leader in renewable energy development

Due to its ideal terrain, abundant natural resources, business-friendly environment, and aggressive RPS, Nevada is a recognized leader in renewable energy production. According to the Nevada Commission on Economic Development, clean energy is the fastest-growing industry in the state.²³ Nevada, its businesses, and property owners therefore have a high incentive to use their comparative advantage to promote investment in their state's renewable energy sector. This propensity toward the renewable energy sector will affect the feasibility of mitigation options by leaning toward greater partnership with this industry and hesitation in putting any demands upon it which might discourage investment in the area.

d. Military presence in Nevada

The U.S. Armed Forces have a particularly strong presence in the state of Nevada. Nellis AFB and Creech AFB are two major installations, in addition to the Tonopah Test Range Airfield and the Fallon Naval Air Station. The state is home to 14,235 military personnel, 7,721 of whom serve on active duty and 6,514 of whom serve within Reserve or National Guard commands. The Air Force by far supplies the largest amount of Armed Services personnel in the state. In fact, 6,627 of the total 7,721 active duty

personnel in the state serve in the Air Force's ranks. This dwarfs Nevada's 1,003 Navy / Marine Corps and 91 Army personnel.²⁴

VI. Mitigation Options

a. Case-by-Case Solutions

Considering the dichotomy of the nature of NTTR operations and the growing importance of renewable energy technology, we identify a series of policy options that maintain the integrity of the mission and either promote or do not significantly impede renewable energy development. The most basic, low-cost option is to negotiate with energy developers on the type of renewable technology they will use. That is, depending on the resources and energy needs local to the proposed site, another CSP or thermal technology may be appropriate. If the energy needs of the local community can be met by a capacity lower than that of a development like Coyote Springs, smaller scale CSP plants using solar troughs or photovoltaic panels could be installed. Recall, CSP tower technology is the most suitable for Coyote Springs because of its large maximum generating capacity. Alternatively, there may be room for negotiation on the height and number of CSP towers in the development. Finally, Nevada is a favorable location for geothermal resources; and, though geothermal systems command significant start-up costs, they derive efficiency from low operating costs and high capacity factors.²⁵

Another option, though less politically feasible, is to merely preclude development at a specific site by means of land acquisition or restriction of development rights. In the former case, DoD can either purchase or condemn private or public non-federal land, as an individual agency or jointly with other federal entities and non-governmental organizations (NGOs). When purchasing land, DoD must reach an agreement with landowners; however, it is unclear how much above and beyond the energy developer's offer DoD will have to pay. Furthermore, questions have been raised about a "slippery slope" to abuse of this policy and exploitation of federal payment procedures. With respect to condemnation, DoD must initiate judicial proceedings to justify the acquisition; the court will then determine an appropriate easement. In the latter case, the government could theoretically pay just compensation to place a restriction on the development rights alone (effectively condemning the airspace while the landowner maintains possession), but since there is no private market for airspace, the method of valuation of said compensation is unknown.

b. Craft Broader Policy

The issue of land use compatibility with military operations is one that is being faced all over the country, by each of the Armed Services and DoD as a whole. By implementing case-by-case mitigation options, solutions or compromises may be made regarding land use surrounding individual installations (like NRRT in this case). However, those options will not address similar issues being faced elsewhere. In addition to considering air space encroachment by renewable energy development at the installation-level, a broader national policy would address the problem of duplication—spending resources solving similar issues each time they arise. There are two ways in which this issue may be addressed at the national level: through federal legislation or direct engagement with the National Security Council (NSC) and the White House. Federal legislation pertaining to airspace protection in some way is needed; however, political factors will determine the strength of the legislation proposed and the restrictions it might impose on development in certain areas, if any.

One option is to adopt legislation that would require developers within a certain radius of military bases or underneath MOA airspace to report their proposals to base officials. This legislation could also potentially establish a formal office within the Armed Services which analyzes proposals and a more formal process for dealing with those proposals. While this legislation would not necessarily restrict development in critical areas, it would involve the Armed Services in the process from the very beginning, allowing more time for impact assessments of the projects and for negotiation with developers. This legislation would also, ideally, establish for DoD a voice and a formal role in the permitting process.

Another more difficult option, which could be more feasible as subsequent legislation, would be to develop federal regulations that would restrict certain types of development affecting critical airspace. This would have the benefit of applying to all of the Armed Services and would set uniform guidelines by which all development proposals would be measured. However, this type of legislation would only be feasible if critical airspaces are defined, with more comprehensive surveys of those areas, and with definitive information on the impacts of various technologies to airspace and flight technology. Additionally, in the current political environment, the intentions of the legislation would need to be clearly stated to be both to promote renewable energy development as a form of national security and military readiness as an important factor in national security.

To achieve quicker results in this critical time, while developments remain in the proposal stage, and to institute a high-level push that would bring the concerns we have examined to the attention of politicians and to the public, DoD should appeal to NSC and the White House. The issue of the importance of critical airspace may not currently be a high priority for many officials, due to a lack of information or communication with the Armed Services. Through collaboration, the NSC and the President would have the political power to issue an Executive Order concerning the protection of critical airspace or to encourage the introduction of other legislation, which could quickly bring about a broad national policy to protect airspace.

c. Establishing a Compatible-Use Corridor

Another option is to identify an area near NTTR suitable for compatible use—where renewable energy developments would not congest NTTR airspace, and to which energy developers would voluntarily move the site of their proposals. This Compatible-Use Corridor can be established simply by designation, or DoD can acquire the land to create this “yes area.” The two approaches have both unique and overlapping incentives to developers and the Air Force/DoD.

Both approaches appeal to energy developers in three ways. First, building in the Compatible-Use Corridor ensures that proposals are acceptable to and garner no opposition from the Air Force—time-consuming objections are prevented and developers are ensured that their plans go unhindered by NTTR officials. Second, DoD can offer to make Purchase Power Agreements, guaranteeing the purchase of energy or renewable energy credits (maybe at a competitive price). Third, the Compatible-Use Corridor may offer synergies in critical new supporting infrastructure, like access roads and water and transmission lines. The strength of the first approach, designation only, is that it comes at little cost to DoD. However, it does not guarantee that energy developers will, in fact, choose to relocate.

The second approach, acquiring the land, provides four additional incentives and, thus, a higher chance of success. First, developers could be guaranteed leases and development rights that might be more difficult to obtain from a private or non-federal public landowner. Second, DoD can offer

competitive lease rates; and, third, since DoD has already assessed the land, there is a high likelihood that of a favorable environmental impact study outcome. Finally, this government backing is particularly attractive to private investors. Furthermore, by owning the Compatible-Use Corridor land, DoD would gain the additional benefits of double credit toward meeting mandated renewable energy goals, and revenue from the leases. Acquiring this land would, of course, come at the cost of the land purchase or easement fees, or political capital. DoD can acquire the land by means of purchase—individually or jointly with other federal agencies, or even NGOs under the Readiness and Environmental Protection Initiative Program (REPI). Or, DoD can even acquire land from another federal agency, through transfer, which may require an outlay of political capital instead or in addition to a financial one.

d. Crucial factors in achieving the three mitigation options

Interagency cooperation at the federal level is crucial to any of the proposed mitigation options. Collaborations provide means of partnering to acquire land for joint purposes, coming to mutual agreements concerning restrictions on development on federal land that would affect critical airspace, and to implementing more uniform policies regarding land use in general. DoD should especially focus on its relationships with environmental, energy, land management, and aviation-concerned agencies—such as EPA, DOE, DOI, and FAA—proposing memorandums of understanding regarding NTTR airspace or critical airspace elsewhere when appropriate. In addition, intra-agency cooperation within DoD, among the Armed Services, should be increased in regard to airspace needs. Whereas airspace encroachment issues are currently dealt with base-by-base or according to service, information sharing on proposed solutions or best practices could be helpful. Furthermore, the Armed Services could move toward more uniform policies across branches to ease the implementation of policies and in order for developers to more easily understand military needs, requirements or restrictions.

VII. Local Impacts

a. Environmental Impacts

NTTR operations, particularly low-level flying at supersonic speeds and the associated noise, have the potential to affect wildlife.²⁶ However, observation of current target areas suggests that they do not, in fact, support sensitive wildlife species.²⁷ Should operations be modified to accommodate congestion due to renewable energy infrastructure, new studies must be done. In 2007, the Air Force completed an environmental assessment of NTTR in order to analyze the impact of a proposed natural resources management plan; the results indicated that the action would have no significant impacts on neither natural nor cultural resources in the area.²⁸ Currently, the Air Force engages in “pro-active natural resource management...[aimed at preventing the] degradation of the range vegetation and wetlands, riparian plant communities, and plant communities associated with seeps and springs.”²⁹ Given the numerous, widespread resources native (in some cases, exclusively) to Nevada, the same kind of analyses must be done for up to 116⁺ proposed individual sites and/or in the Compatible-Use Corridor.

In addition to land, both individual development sites and/or the Compatible-Use Corridor will require new supporting infrastructure including roads and water and transmission lines; in turn, the impact of a “proposed action” includes the impact associated with all supporting infrastructure and activity. Furthermore, it is unclear whether the Compatible-Use Corridor would provide synergies regarding environmental impacts. A development like Coyote Springs requires 2,000 acres or just over

three square miles and, while it is possible that multiple sites can be contiguous, there is also potential for land requirements to be greater for development in the Compatible-Use Corridor (i.e. sites require a buffer). It is probable that developers can share access roads, and that fewer transmissions lines will be needed than if developments were scattered around the region. Conversely, it is likely that the surface and groundwater resources in the desert may not be sufficient for both the multiple developments in the Compatible-Use Corridor and the existing population.

The US Fish and Wildlife Service (FWS) reports that 39 threatened and endangered species occur in the state of Nevada—so, the potential for their habitat coinciding with one of the proposed development sites or in the Compatible-Use Corridor is high.³⁰ To all appearances, based on FWS maps, 10 threatened and 11 endangered plant and animal species are in or near the proposed site of the Compatible-Use Corridor (see Appendix III for an inventory).³¹ Many of the animals are species of fish, further complicating the issue of water requirements, and many habitats are in the Ash Meadows area, in Armagosa Valley, near the proposed site of the Compatible-Use Corridor. Indeed, the Ash Meadows National Wildlife Refuge has “a greater concentration of endemic life than any other local area in the United States and the second greatest in all of North America.”³² Recall, however, that REPI legislation allows the Air Force to acquire land in partnership with EPA in an effort preserve habitat and the purpose of conservation. Finally, modified operations and/or renewable energy development should be mindful of approximately twenty species of bats potentially occurring in the area, as well as many migratory birds (though transient and small in number).³³

b. Economic Impacts

The establishment of renewable energy infrastructures has significant potential to create jobs, both temporary and permanent, for Nevadans. Solar contractors estimate that approximately 800 temporary construction jobs could result per tower, as well as between 80 and 100 permanent jobs per tower. This would, of course, would have to be balanced with any potential job loss at Nellis AFB, Creech AFB, and NTTR that may result. Presently, however, these losses are projected to be minimal.

Some mitigation options, such as land acquisition or restricting renewable energy developments in certain areas would have community impacts at both the county and individual levels. Increased federal land acquisition would result in a diminishing of a county’s tax base. Since the majority of Nevada’s land is already controlled by the federal government³⁴ and, thus, exempt from local property taxes, the creation of more federal land in Nevada would result in less property tax revenues collected by its counties.³⁵ In the case of rural localities like those which surround NTTR, which have small tax bases to begin with, this could have a significant impact on the municipal services provided in those areas.

Other mitigation options might have impacts on individuals as well. For example, restrictions imposed on renewable energy development could cause individual property and business owners to forego tax credits and other incentives that are available to them if they place certain renewable energy technologies on their properties. In Nevada, these incentives come in the form of not only federal tax credits, but state-offered abatements of property and sales and use taxes, and rebates for certain energy technologies that are purchased.

Additionally, if any mitigation options happen to impede or delay renewable energy development they, in turn, hinder energy independence. Nevada utilities estimate that the state’s demand for baseload energy “is expected to grow by more than 3,400 megawatts over the next 20

years, and average annual load growth of 2.2 percent [and u]tility forecasters also predict that summer peak electricity demand in Nevada will increase by 1,400 megawatts between now and 2014, a jump of more than 16 percent.”³⁶ Nevada as well as the surrounding region will obviously need a consistent—in terms of affordability and availability—and clean energy source in the near future, and restricting or precluding renewable energy development may prevent them from achieving self-sufficiency.

c. Other Considerations

Aside from environmental and economic impacts, there are several considerations for localities near NTTR that must be examined in assessing the impact of potential mitigation options. These other considerations are mainly the preservation of nearby historic or cultural sites, protecting the rights and reflecting the interests of Nevada’s tribal groups, and the ownership of mineral rights. In terms of sites of history and culture, Nevada is home to twelve major sites of archaeological or historical significance. Fortunately, slightly less than two percent of NTTR’s land is significant in this capacity. The same, however, would need to be verified for any newly acquired lands. Development on or near such lands would also be subject to the Archaeological Resources Protection Act of 1979 (ARPA), which recognizes the increasing threat to such sites because of their commercial attractiveness and secures the protection of archaeological resources and sites on public lands and Indian lands.³⁷

Aside from historic sites, the rights and interests of tribal groups in Nevada also requires attention. Nevada has twenty-five federally-recognized Indian tribes – most of them branches of the Shoshone and Paiute tribes. These tribes hold much social and political sway in the region. Their needs must be taken into consideration when making decisions. For instance, by avoiding negative impact to sacred lands or habitats of species whose existence fulfills a sacred purpose for tribes. Fortunately, the tribes have historically proven to be strong partners in land preservation, and this positive relationship must be maintained for any mitigation efforts to succeed.

The ownership of mineral rights is a major concern in the Southwest. Nevada is home to twelve major minerals with significant commercial use and countless others that may one day become commercially lucrative. Success will require accounting for the existence of resources – both at the surface and below it – on any land acquired. Purchasing land and mineral rights do not necessarily go hand in hand, though they can. Sometimes land is purchased with mineral rights, and sometimes without them. Conversely, mineral rights are sometimes purchased with land, sometimes without it.³⁸ For the Air Force to maintain the sway to protect its training operations, any purchased lands would need to be procured with mineral rights to prevent development. This will require frequent interface with multiple state and local mineral authorities to broker the land and mineral deals.

VIII. Summary and Supplemental Recommendations

The team has also produced three supplementary recommendations that we feel must be pursued in order to achieve any of the aforementioned mitigation options or to legitimize any related policy decisions. First, the Air Force must continue to identify and interface with local, state, and federal partners in resolving encroachment issues that arise. The same is true for private stakeholders as well. Such positive relationships will be central to future success in this arena. Second, it is imperative that the Air Force pursue resolution as early in the life of a renewable energy development proposal as possible. As with most obstacles, early resolution is far preferable to later resolution. Third, the Air Force must add to its focus obtaining more data supporting potential mitigation options.

To this end, the Air Force should examine efforts to survey the entire airspace in question. A potential means of achieving this is the Air Installation Compatible Use Zone (AICUZ) program.³⁹ Using the AICUZ program would come at a cost to the Air Force of conducting the survey over a large area, but would have the advantage of pinpointing areas where mission and developments may affect one another and provide support for protecting airspace in those areas. Additionally, it should pursue the generation of more comprehensive mapping that overlays multiple lines of information. For instance, such mapping should include different types of land ownership (DOD, federal non-DOD, state-owned, private, etc.), federal and state congressional districts, floral and faunal habitats, historic and cultural sites, surface and subsurface natural resource deposits, etc. for the purposes of comparison.

In summary, policies for mitigating encroachment of NTTR due to renewable energy development will have to consider a host of issues, political, economic, scientific, and social in nature. The mission at NTTR is crucial, but Nevada is ideal for solar energy and the federal government, DoD and Air Force need to increase renewables as a proportion of their energy portfolios. State and local goals to do necessarily conflict with federal ones, but they are key in terms of attracting investors to specific regions as well as the state of Nevada as a whole. Some mitigation options face more political barriers than others, and they will all require some level of intra- or inter-agency collaboration. The economics of mitigating encroachment is a sensitive matter, as are the environmental and cultural impacts. It seems as though a broad national policy could effectively mitigate encroachment for both the Air Force and the other Armed Forces, but the federal government should be reticent to encroach on state's rights and local interests. Some combination of policies will probably be employed, but it is certain that one or more is necessary because the NTTR and the nation as a whole will have to accommodate renewable energy development in the foreseeable future.

IX. Appendix I: Inventory of Stakeholders

Federal Entities

1. U.S. Department of Defense
 - a. Legislative Affairs
 - b. Public Affairs
 - c. Armed Services
 - i. Office of the Secretary of the Air Force
 - ii. Office of the Secretary of the Navy
 - iii. Office of the Secretary of the Army
2. U.S. Department of the Interior
 - a. Assistant Secretary of Land and Minerals Management
 - i. Bureau of Land Management
 - ii. Office of Surface Mining, Reclamation, and Enforcement
 - b. Special Trustee for American Indians
 - c. Assistant Secretary for Indian Affairs
3. U.S. Department of Energy
 - a. Energy Information Administration
 - b. Office of the Under Secretary
 - i. Assistant Secretary for Energy Efficiency and Renewable Energy
 - ii. Assistant Secretary for Electricity Deliverability and Energy Reliability
 - iii. Assistant Secretary for Environmental Management
 - c. Southwestern Power Administration
4. U.S. Environmental Protection Agency
 - a. Office of Environmental Information
 - b. Office of International and Tribal Affairs
 - c. Region 8 (Denver) Regional Office

Nevada State Entities

1. Office of Governor Brian Sandoval (R)
2. U.S. Senators
 - a. Harry Reid (D)
 - b. John Ensign (R)
3. State Congressional Delegation
 - a. District 1—Shelley Berkeley (D)
 - b. District 2—Dean Heller (R)
 - c. District 3—Joe Heck (R)

Localities

1. Lincoln County Board of Supervisors
2. Nye County Board of Supervisors
3. Clark County Board of Supervisors

Private Landowners

Commercial Land Developers

Solar Energy Associations

1. American Solar Energy Society
2. Solar Energy Industries Association
3. Solar Energy Association
4. Nevada Institute for Renewable Energy Commercialization
5. American Wind Energy Association
6. International Solar Energy Society
7. Northern California Solar Energy Association

Other Renewable Energy Associations

1. American Council on Renewable Energy
2. Environmental and Energy Study Institute
3. European Renewable Energy Council
4. International Network for Sustainable Energy
5. International Renewable Energy Agency
6. International Renewable Energy Alliance
7. Presidential Forum on Renewable Energy
8. Renewable and Appropriate Energy Laboratory
9. Renewable Energy and Energy Efficiency Partnership
10. Rocky Mountain Institute
11. World Council for Renewable Energy

Prominent Nevada Solar Developers

1. 4Evergreen Consulting
2. Absolute Green Technologies, LLC
3. Advanced Green Builders
4. Alternative Energy Solutions
5. American Patriot Solar Community
6. American Sun and Solar
7. Anthony Solar
8. Avery Atlantic, LLC
9. BrightSource
10. Bristlecone Energy
11. Commercial Solar Services
12. Creative Energy Solutions
13. Ecolife Development Corporation
14. EnergyCo
15. EnergySource / Dynamic Engineering
16. GaiaSol Energy Partners
17. Green Energy Inc. (DBA Hybrid Solar)
18. Joint Forces, LLC
19. Kimley-Horn and Associates
20. Life with Solar

21. Meadows Renewable Energy
22. Nevada Solar Authority, Ltd.
23. NewCo Renewables
24. PacificWest Energy Solutions Inc.
25. Premier Power
26. Prometheus Energy Inc.
27. RA ENERGIE Inc.
28. Renewable Energy Associates
29. Renewable Energy Systems Consulting
30. Sierra Solar Systems
31. Silver State Renewables Inc.
32. Smart Energy Systems
33. Sol NV | Solectric NV, Inc.
34. Solar Independence
35. Solar Solutions Unlimited
36. Solar Unlimited of Nevada LLC
37. State Renewable Energy
38. Sun Powered Systems LLC
39. Sunburst Energy Solutions
40. Sunlight Solar Energy Inc.
41. Synergy Companies
42. Tahoe Solar Designs
43. The Free Energy Store
44. The Solar Store
45. TWC Construction
46. United Solar Energy Inc.

X. Appendix II: Inventory of Key Political Offices and Points of Contact

Congressional Delegation

a. Senate

- i. Harry Reid (D)
- ii. John Ensign (R)

b. House

- i. Shelley Berkeley (D), District 1
- ii. Dean Heller (R), District 2
- iii. Joe Heck (R), District 3

Governor Brian Sandoval (R)

State Delegation

- a. Senate Majority Leader Steven Horsford (D), Clark District 4
- b. Senator Minority Leader Mike McGinness (R), Central Nevada Senatorial District

Lincoln County

- a. Director of Planning Cory Lytle
- b. Commission Chair Paul Mathews, Panaca Area
- c. Commissioner George T. Rowe, Caliente Area
- d. Commissioner Ronda Hornbeck, Northern Lincoln Co. Area
- e. Commissioner Ed Higbee, Southern Lincoln Co. Area
- f. Commissioner Bill Lloyd, Pioche Area

Nye County

- a. Director of Planning Steve Osborne
- b. Commission Chair Gary Hollis
- c. Commission Vice-Chair Andre Borasky
- d. Commissioner Lorinda Wichman
- e. Commissioner Joni Eastley
- f. Commissioner Fely Quitevis

Clark County

- a. Director of Planning Nancy Lipski
- b. Commission Chair Rory Reid, District G
- c. Commission Vice-Chair Susan Brager, District F
- d. Commissioner Steve Sisolak, District A
- e. Commissioner Tom Collins, District B
- f. Commissioner Larry Brown, District C
- g. Commissioner Lawrence Weekly, District D
- h. Commissioner Chris Giunchigliani, District E

XI. Appendix III: Inventory of Endangered and Threatened Species

Status	Species
	ANIMALS
E	Chub, bonytail entire (<i>Gila elegans</i>)
E	Chub, Virgin River (<i>Gila seminuda</i> (=robusta))
E	Dace, Ash Meadows speckled (<i>Rhinichthys osculus nevadensis</i>)
E	Dace, Moapa (<i>Moapa coriacea</i>)
T	Naucorid, Ash Meadows (<i>Ambrysus amargosus</i>)
E	Poolfish, Pahrump (<i>Empetrichthys latos</i>)
E	Pupfish, Ash Meadows Amargosa (<i>Cyprinodon nevadensis mionectes</i>)
E	Pupfish, Devils Hole (<i>Cyprinodon diabolis</i>)
E	Pupfish, Warm Springs (<i>Cyprinodon nevadensis pectoralis</i>)
E	Spinedace, White River (<i>Lepidomeda albivallis</i>)
T	Springfish, Railroad Valley (<i>Crenichthys nevadae</i>)
E	Sucker, razorback entire (<i>Xyrauchen texanus</i>)
T	Tortoise, desert U.S.A., except in Sonoran Desert (<i>Gopherus agassizii</i>)
T	Trout, Lahontan cutthroat (<i>Oncorhynchus clarki henshawi</i>)
	PLANTS
T	Blazingstar, Ash Meadows (<i>Mentzelia leucophylla</i>)
T	Centaury, spring-loving (<i>Centaurium namophilum</i>)
T	Gumplant, Ash Meadows (<i>Grindelia fraxino-pratensis</i>)
T	Ivesia, Ash Meadows (<i>Ivesia kingii</i> var. <i>eremica</i>)
T	Milk-vetch, Ash meadows (<i>Astragalus phoenix</i>)
E	Niterwort, Amargosa (<i>Nitrophila mohavensis</i>)
T	Sunray, Ash Meadows (<i>Enceliopsis nudicaulis</i> var. <i>corrugata</i>)

Note: these species are potentially occurring in the proposed site of the Compatible-Use Corridor⁴⁰

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- ¹ Anthony, Major Damon A. "The Nevada Test and Training Range (NTR) Crunch: Expanding Airpower Capabilities are Shrinking Training Airspaces and Ranges." Air Command and Staff College. April 2008.
- ² Thanks to Doug Clark, Jeff Dixon, Greg Williams, Alan Zimm at Johns Hopkins University; and Eric Nelson, Sam Nelson, and Kristine Smith at the Air Combat Command
- ³ Damon
- ⁴ *Ibid*
- ⁵ Rogers, Keith. "Green Power Turning Air Force Blue."
- ⁶ CSP Today. "Analysis of US Concentrated Solar Power Market." Las Vegas Review-Journal. April 24, 2010.
- ⁷ The affects of the towers on aircrafts and vice versa have been documented by the Applied Physics Lab at Johns Hopkins University. See/contact Greg Williams or Doug Clark for details.
- ⁸ National Renewable Energy Laboratory (NREL), "Concentrating Solar Power Research: Concentrating Solar Power Resource Maps," <http://www.nrel.gov/csp/maps.html>
- ⁹ That is, controlling for potentially sensitive environmental lands (e.g. wilderness areas, national parks, and wildlife refuges), major urban areas (as defined by the US Geological Survey landuse/landcover dataset, supplemented by the US Census Bureau urban area dataset), water features, areas with slope >3%, and remaining areas less than 1 sq.km. Information obtained by phone; NREL contact, Donna Heimiller (303-275-4667).
- ¹⁰ NREL, "Concentrating Solar Power Projects: BrightSource Coyote Springs 2 (PG&E 4), http://www.nrel.gov/csp/solarpaces/project_detail.cfm/projectID=81
- ¹¹ NREL, "2008 Solar Technology Market Report", p10
- ¹² NREL 2008, p55
- ¹³ NREL 2008, pp74-75
- ¹⁴ BrightSource Energy, "Technology: How LPT Works," http://www.brightsourceenergy.com/technology/how_lpt_works#power_block
- ¹⁵ NREL 2008, p54
- ¹⁶ NRE 2008, p75
- ¹⁷ NREL, "CEP Water Reduction Study," p75, http://www1.eere.energy.gov/solar/pdfs/csp_water_study.pdf
- ¹⁸ New York Times, "Environment: Green *A blog about energy and the environment*; BrightSource Expands Land Deal in Nevada," <http://green.blogs.nytimes.com/2009/09/24/brightsource-expands-land-deal-in-nevada/#more-24681>
- ¹⁹ AB 1 of 2007, Revised Adopted Regulation of The Public Utilities Commission of Nevada
- ²⁰ NV Energy (formerly Nevada Power and Sierra Pacific Power)
- ²¹ Amounts awarded are calculated by using per capita numbers as the formula to determine the amount of funding to be allotted to each jurisdiction.
- ²² 18.2 persons per square mile, 2000 Census
- ²³ Nevada Commission on Economic Development, <http://www.diversifynevada.com/>
- ²⁴ U.S. Major Military Bases and Installations, Nevada <http://usmilitary.about.com/library/milinfo/statefacts/blnv.htm>
- ²⁵ NREL, "Geothermal Resources of the United States," http://www.nrel.gov/gis/images/geothermal_resource2009-final.jpg; NREL 2008, "Geothermal Technology Market Report," <http://www.nrel.gov/analysis/pdfs/46022.pdf>
- ²⁶ Nellis AFB, "2007 Draft Environment Assessment for the Integrated Natural Resource Management Plan," p25
- ²⁷ *Ibid*
- ²⁸ Nellis 2007, p3
- ²⁹ *Ibid*
- ³⁰ US Fish & Wildlife Service (FWS), "Species Reports: Listings and Occurrences in Nevada," http://ecos.fws.gov/tess_public/pub/stateListingAndOccurrenceIndividual.jsp?state=NV&s8fid=112761032792&s8fid=112762573902&s8fid=24012919484343
- ³¹ *Ibid*
- ³² FWS, "Ash Meadows National Wildlife Refuge: Welcome to Ash Meadows NWR," <http://www.fws.gov/desertcomplex/ashmeadows/>

³³ Nellis 2007, p39

³⁴ 82.9 percent of Nevada is federally owned, or approximately 58.2 million acres. <Public Land Statistics>

³⁵ Payment in Lieu of Taxes (PILT) may be paid in instances of federal land acquisition to soften the effect of lost property tax revenues. PILT pays an average of \$1.13 per acre in western states, but whether or not this is equivalent to what would be received in property tax revenue depends on land values and property tax rates in each community, http://findarticles.com/p/articles/mi_m0HIC/is_2_17/ai_98543759/?tag=content;col1FirefoxHTML\Shell\Open\Command

³⁶ The Energy Foundation, "Analysis: New direction necessary for Nevada's energy needs; *Four-pronged approach: new transmission, efficiency, renewables, natural gas,*"

http://www.ef.org/documents/Press_Release_-_Laying_a_Foundation_Nevada's_Electricity_Future_-_final.pdf

³⁷ 16 U.S. Code, Section 470aa – 470mm

³⁸ "Mineral Rights: Basic Information about Mineral, Surface, Oil and Gas Rights," Geology.com

³⁹ 32 C.F.R., Part 256: (a) Sets forth Department of Defense policy on achieving compatible use of public and private lands in the vicinity of military airfields; (b) Defines (1) required restrictions on the uses and heights of natural and man-made objects in the vicinity of air installations to provide for safety of flight and to assure that people and facilities are not concentrated in areas susceptible to aircraft accidents; and (2) Desirable restrictions on land use to assure its compatibility with the characteristics, including noise, of air installations operations; (c) Describes the procedures by which Air Installations Compatible Use Zones (AICUZ) may be defined; and (d) Provides policy on the extent of Government interest in real property within these zones which may be retained or acquired to protect the operational capability of active military airfields (subject in each case to the availability of required authorizations and appropriations).

⁴⁰ US Fish & Wildlife Service (FWS), "Species Reports: Listings and Occurrences in Nevada,"

http://ecos.fws.gov/tess_public/pub/stateListingAndOccurrenceIndividual.jsp?state=NV&s8fid=112761032792&s8fid=112762573902&s8fid=24012919484343