Title

Nevada Solar Enterprise Zone Development Study (with Project Plan attached)

Author

Nevada Solar Enterprise Zone Task Force

101366

Document Date

12/30/94

ERC Index number

05.09.410

Document Type

Report

Box Number

1678-1

Recipients

DOE

4-331

NTS EIS
ADMINISTRATIVE RECORD # 05.09.410

Solar Enterprise Zone Development Study

Task Force to the Advisory Committee on
Demonstration and Commercial
Application of Renewable Energy and
Energy Efficiency Technologies

NTS EIS
ADMINISTRATIVE RECORD

U.S. Department of Energy
Nevada Operations Office
PO Box 98518
Las Vegas, NV 89193-8518

U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Office of Solar Energy Conversion
1000 Independence Avenue, SW
Washington, DC 20585

Prepared by:

Nevada
Solar Enterprise Zone
Task Force Work Group

and

NEVADA POWER COMPANY

December 19, 1994

Mrs. Shawn Herrera
US Department Of Energy
Las Vegas, Nevada 89109

Dear Shawn

Per your request, enclosed is a map indicating the location of Harry Allen Site. At the present time no specific location within the map perimeter has been identified as a Solar Site.

If you have any question, please do not hesitate to call me at (702) 367-5384.

Sincerely,

Mark Shank, Team Leader
Supply-Side Planning

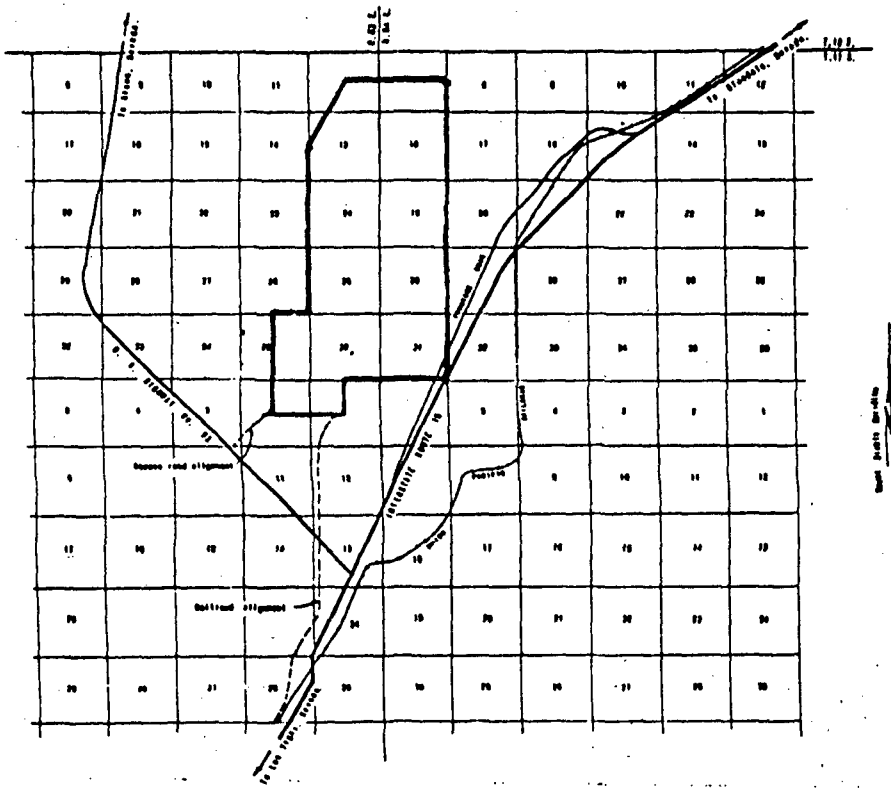
/eg

Enclosures

ACTION
INFO PDMD
MGR ✓
AMA
AMESSH
AMO ✓
AMEM
OCFO

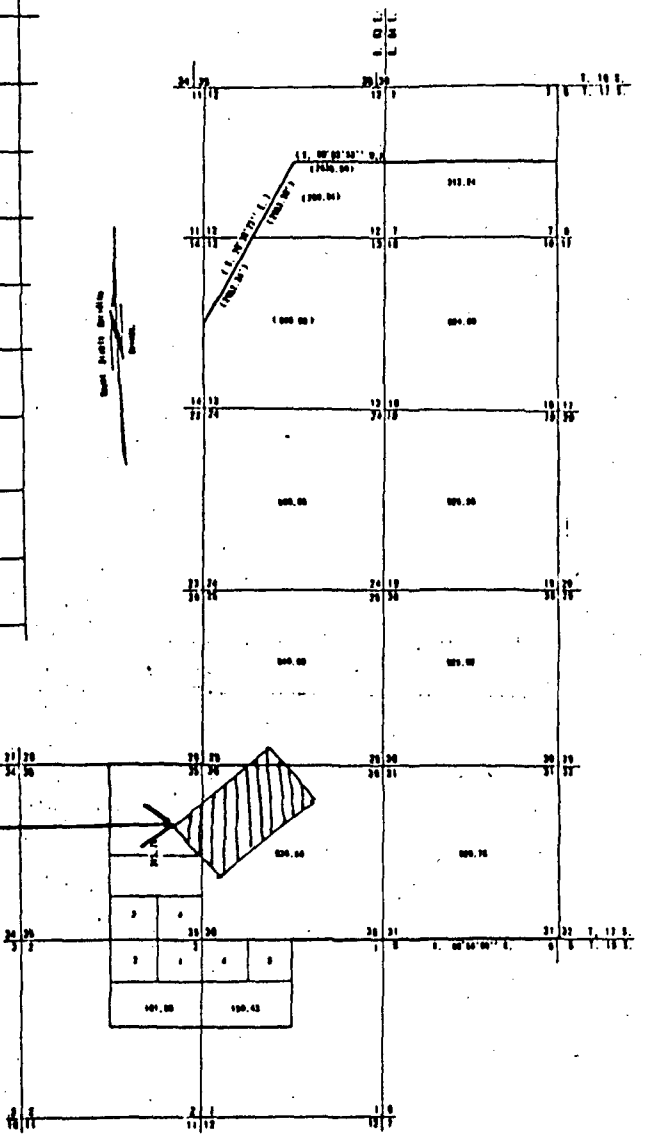
6226 WEST SAHARA AVE. • P.O. BOX 230 • LAS VEGAS, NEVADA 89151-0230 • 702/367-5000

MAP #2



VICINITY MAP

Approximate size and location of existing Harry Allen substation



LOCATION MAP

Basis of bearing (S. 00°00'00" E.) is the south line of Section 29, Township 17 South, Range 56 East, Mount Diablo Meridian per Bureau of Land Management plat approved.

APPLICANT'S CERTIFICATE

SURVEYOR'S STATEMENT

GENERAL NOTES:

1. Bearings and distances are taken from G.L.O. plat of T.17 S., R.56 E., M.D.M., Nevada, approved November 29,1880; G.L.O. plat of T.17 S., R.56 E., M.D.M., Nevada approved May 11,1905; G.L.O. plat of T.16 S., R.63 E., M.D.M., Nevada, approved July 12,1935 and G.L.O. plat of T.16 S., R.64 E., M.D.M., Nevada approved May 11,1900.
2. Interior sectional bearings and distances shown as (series) are computed from sources per Note # 1
3. Acreage are from sources per Note # 1 or are computed from sources per Note # 1 are shown as (acre).

COUNTY OF ELKO
DEPARTMENT OF PUBLIC WORKS
FLOOD CONTROL DIVISION
APPROVED

BY_____

Approval of these plans shall not be construed to be a permit for or an approval of any violation of any of the provisions of the state or county laws and/or specifications.

County of Elko
Department of Public Works
Engineering Division
Approved:

By_____

Date_____, 1990

Approval of these plans shall not be construed to be a permit, or an approval of, any violation of any of the provisions of the State or County laws and/or Specifications.

EXHIBIT "A"

LOCATION MAP, SURVEYOR'S STATEMENT & APPLICANT'S CERTIFICATE

TO ACCOMPANY APPLICATION FOR

GRANT RIGHTS STATUS

FOR

NEVADA POWER COMPANY

Sheet 1 of 1 — N 12873

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This report was prepared by the following members of Nevada Solar Enterprise Zone Work Groups and employees of DynCorp•Meridian:

Solar Enterprise Zone Work Groups		
Work Group	**Sponsor**	**Leader**
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FINANCE	Governor Miller (Represented by Tim Carlson)	George Sterzinger Independent Consultant
LEGAL	Dina Titus Nevada State Senator	Gary Nakarado NREL
INDUSTRY ISSUES	Scott Sklar Solar Energy Industries Assn.	Mac Moore Solar Energy Industries Assn.
WATER	Claude 'Blackie' Evans AFL/CIO	Dr. Robert F. Boehm University of Nevada at Las Vegas
TRANSMISSION & DISTRIBUTION/ NATURAL GAS	Nick Aquilina Independent Consultant and former Manager, DOE Nevada Operations Office	J.D. Ross Director of Engineering & Construction, DOE Nevada Operations Office

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1. INTRODUCTION

This report analyzes the Market, Financial, Legal, Industry, Transmission, Gas and Water issues confronting the development of a 1,000 MW Solar Enterprise Zone (SEZ) in Nevada. The analysis was initiated by the Nevada Solar Enterprise Zone Task Force, which is charged by the Department of Energy (DOE) with examining the feasibility and benefits of a Solar Enterprise Zone that can:

- Provide local employment and economic benefits to offset the impacts of Defense Conversion on the Nevada Test Site (NTS);
- Assist the solar industry to commercialize renewable energy generating technologies through commercial manufacturing experience and technological advances;
- Encourage the development of a competitive, sustained solar energy industry in Nevada, to benefit both NTS employment and the manufacturing base of the State;
- Help develop and commercialize environmentally sound renewable energy technologies for electricity generation, for use across the U.S. and internationally.

This effort is occurring at an important juncture in the development of solar energy and the U.S. defense industry. As the Cold War fades, the need for continued nuclear testing and development is declining. Thousands of skilled workers and millions of dollars worth of equipment and resources dedicated to nuclear testing require new missions and new applications of their skills.

At the same time, environmental concerns, particularly the looming threat of climate change, are creating a growing demand for alternative generating technologies. Over a decade of research, development and industry investment have brought many renewable energy technologies to the verge of commercial competitiveness. Now the industry needs major projects to move to large-scale manufacturing and production to achieve the economies of scale and manufacturing that are the key to

[redacted]

The southwestern United States expects major growth in electrical demand and the need for new, environmentally sound generation early in the next decade, despite a current lull in demand for new capacity. Worldwide the rapidly developing countries of Asia and Latin America

In southern Nevada these two unrelated developments coincide with

- Obtain secure, low-cost financing for solar projects developed at the Solar Enterprise Zone. Low cost financing or public supports are required by pre-commercial projects to reduce the levelized cost of electricity to long-term contract prices. In order to use public supports in the most efficient manner, projects developed at the SEZ should:
  - Integrate as many sources of supports as possible into the overall task of reducing project costs, including leveraging of public funds, warrants or other participation.
  - Provide a profit for public support in pre-commercial projects by obtaining links to share in commercial success.
- Engage Western in the SEZ for its expertise in power marketing and to develop the best peak and intermediate sales opportunities. Western is a natural marketing agent for developing and accessing opportunities to sell "green" power to federal facilities and customers in the west.

1.2 Finance Work Group Findings

Obtaining secure, low-cost financing is critical to the commercial viability of solar projects developed at the Solar Enterprise Zone. The level of financing supports necessary will depend on the infrastructure required, the ability of individual technologies and projects to produce electricity at competitive rates, and the expected market price for the energy produced.

The analysis performed by the Finance Work Group showed that a major investment in low cost financing would produce significant reductions in energy costs for SEZ technologies. At current estimates of market rates and with an appropriate financing structure, this project can move solar technologies to commercial viability. To that end, the Work Group recommends the following :

- Integrate as many sources of supports as possible into the overall task of reducing project costs, including leveraging of public funds, warrants or other participation.
- Task Force endorsement of the initial target capitalization estimated for the current industry commercialization scenario.
- Provide a profit for public support in pre-commercial projects by obtaining links to share in commercial success.
- Pursue state and federal appropriations, debt financing through tax-exempt and Treasury bonds, and all other support mechanisms.

1.3 Market Work Group Findings

Utilities and other stakeholders have generally been positive about the development of these technologies, but are somewhat skeptical of the viability of this initiative. The Market Work Group found that there were some significant barriers to be overcome in order to successfully market SEZ energy, including:

- In the near-term, utility capacity needs are low due to a current excess of available capacity. This situation is expected to remain

- Many states are considering moving towards a more competitive environment for utilities. This regulatory uncertainty means that some utilities may hesitate to commit to unproven resources.
- There is a general unwillingness on the part of consumers to pay a substantial premium for "green power" or pursue actions that would involve utilities acquiring anything less than the least-cost supply options.

Significant capacity growth and gradually rising market prices are anticipated over the coming decade, although short-term capacity needs are small. It is expected that there are enough planned capacity requirements, especially after the year 2000, to absorb the 1,000 MW considered for the initial phase of SEZ development. To overcome the short-term barrier of low capacity requirements, the following recommendations were developed:

- Accept Western's offer to become involved in the SEZ project. Western could play an essential role by firming PV power with hydropower, managing the administration of SEZ power, and assembling capacity commitments from multiple sources.
- Push to make Federal facilities purchasers of "green power". This should be done particularly at the NTS which can currently absorb 35 MW of SEZ power, and export up to 65 MW.

1.4 Industry Work Group Findings

- Incorporating the value of new employment, pollution reduction and other advantages of renewable energy in project financing and power marketing.
- More explicit recognition of these factors in the integrated resource planning process Western is developing with its customers, and in Federal power purchases.
- Developing a competitive framework and mechanisms that employ both public and private capital.

1.5 Legal Work Group Findings

The Legal Work Group worked closely with the Golden Field Office legal counsel and found that:

- Nevada has begun to lay groundwork in the state legislature for state financing and market commitments, which Federal efforts should be designed to complement and reinforce.
- In order for the SEZ to enter into a power purchase agreement beyond 10 years and only obligate the current year's need, a specific statutory exemption from the Antideficiency Act would be required.
- Specific authority is needed to authorize a sole-source purchase of SEZ power by DOE as a set-aside if SEZ energy is above the market price. If such legislation were obtained there should be no difficulty in obtaining power from an on-site operator.
- The SEZ could fall within certain defense conversion provisions of the Defense Authorization Act of 1994 regarding lease and transfer of DOE property for purposes of defense conversion to civilian uses.
- The initial start up of the SEZ can be accomplished under existing authority.
- Expansion of the SEZ will require legislative and DOE policy changes. For these changes to have the greatest effect on the current SEZ deployment schedule, they need to be initiated now.

1.6 Infrastructure Work Group Findings

The Infrastructure Work Group performed an analysis of transmission and natural gas capabilities at three candidate sites, the Nevada Test Site, Boulder City in the Eldorado Valley, and Nevada Power Company's Harry Allen site. It was found that taken together these three sites offer excellent facilities for supporting the 1,000 MW solar scenario. Boulder City and the NTS were identified as the most promising sites, with Harry Allen less promising because its capabilities were dependent on future transmission and capacity expansion plans by Nevada Power Company.

The group found that the NTS could support 100 MW of capacity with no additional investment in upgrading transmission or site infrastructure.

Roughly 35 MW of that load would be absorbed by the NTS and 65 MW would be available for export. Boulder City could host a full 1,000 MW of solar, with investment in a short 500 kVa tie to the New Market Place substation.

Water availability is still a limiting factor for solar thermal development anywhere in Southern Nevada. Boulder City offers the best site, and is willing to provide 3,000 acre-feet per year for solar power development, which would allow approximately 300 MW of solar thermal trough or power tower development. Water supplies for the NTS are much less certain, with an estimate of only 580 acre-feet per year directly available at Jackass Flats, or up to 24,000 acre-feet per year if the SEZ can access water in adjacent subbasins and the Amargosa valley. The terms and conditions for accessing Boulder City's water were identified as important issues that need to be pursued in more detail. The use of dry cooling and water conservation technologies was also discussed as a major technology development issue that solar thermal project developers should consider.

All three sites have viable options for natural gas supply. The natural gas pipeline companies have indicated their willingness to construct and operate facilities to serve the SEZ. However, winter demand for natural gas in Las Vegas is so high that gas companies may be unable to guarantee the delivery to an Eldorado Valley hybrid facility. To determine SEZ winter requirements in Eldorado Valley, more studies should be done with operating scenarios. The outcome of these studies will determine whether it is cost effective to reinforce the gas supply for the SEZ in the Eldorado Valley through the addition of a $47 million pipeline. At the Nevada Test Site, consideration should be given to defense programs' need for gas, which could result in significant dual benefit and potential reduction in cost through shared construction funding. The estimated cost for bringing gas to the NTS through a 64 mile 16" pipeline is $52 million.

The most promising strategy appears to be to concentrate projects at the El Dorado Valley location and the Nevada Test Site initially, and leave open the possibility of projects at the Harry Allen site in the future if anticipated improvements in transmission and Nevada Power Company expansion plans create a favorable situation.

A plan to leverage in-kind and dual-use opportunities at the NTS is needed to help reduce the impacts of infrastructure requirements. DOE and representatives of the solar industry should coordinate the development of the SEZ with other existing or potential projects. Infrastructure investments such as transmission upgrades, natural gas, and construction/labor expertise which are useful for the SEZ could also be attractive for siting the National Ignition Facility, the Advanced Hydrotest Facility, Hydronuclear testing, expanded operations at Yucca Mountain, and other Defense and Environmental Management programs.

2. BACKGROUND AND ASSUMPTIONS

2.1 Meetings and Work Groups

In May 1994, a Feasibility Study for a National Solar Enterprise Zone at the Nevada Test Site was distributed to the public and industry members. This study recognized the significant benefits of the Nevada Test Site for solar development. Immediately after this Feasibility Study was distributed, a Request for Expression of Interest (EOI) was distributed to evaluate industry and market interest in further development of the project.

Table 2-1: Solar Enterprise Zone Work Groups

Work Group	Sponsor	Leader
MARKETING	Rose McKinney-James Nevada Department of Business & Industry	Paul Kearns DOE Golden Field Office Omi Walden Independent Consultant
FINANCE	Governor Milier (Represented by Tim Carlson)	George Sterzinger Independent Consultant
LEGAL	Dina Titus Nevada State Senator	Gary Nakarado NREL
INDUSTRY ISSUES	Scott Sklar Solar Energy Industries Assn.	Mac Moore Solar Energy Industries Assn.
WATER	Claude 'Blackie' Evans AFL/CIO	Dr. Robert F. Boehm University of Nevada at Las Vegas
TRANSMISSION & DISTRIBUTION/ NATURAL GAS	Nick Aquilina Independent Consultant and former Manager, DOE Nevada Operations Office	J.D. Ross Director of Engineering & Construction, DOE Nevada Operations Office

On June 1, 1994, the SEZ Conference was held at Cashman Convention Center in Las Vegas, giving the public and industry members a chance to ask questions about both the technological and economic benefits of a Solar Enterprise Zone. The conference was followed by a public tour

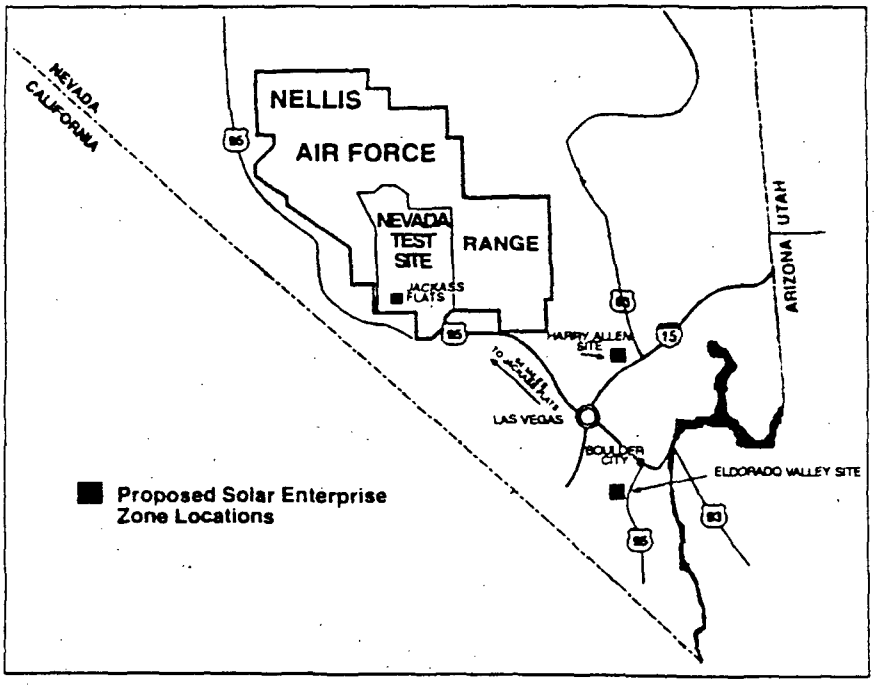
of the Nevada Test Site on June 2 and the DOE North Las Vegas facility on June 3, 1994.

The first official meeting of the Solar Enterprise Zone Task Force took place on July 30, 1994. All of the EOIs were condensed and summarized for this meeting. Chaired by Senator Richard Bryan (D-Nev.) and DOE Assistant Secretary Christine Ervin, the Task Force identified six areas which needed further analysis and requested that work groups be formed to address these areas. Table 2-1 above lists those work groups.

2.2 Three Sites

At the July 30 meeting, it was determined that the SEZ is more accurately described as a "concept" rather than a "place." Respondents to the EOI expressed interest in development of three sites in southern Nevada. Such an approach keeps the need for new infrastructure to a minimum and helps avoid the constraints imposed by the physical limitations (primarily water) of some sites which would inhibit the deployment of certain technologies. The largest of these potential sites is the Nevada Test Site Area 25 with 10,000 acres allotted for the SEZ. The Eldorado Valley Site near Eldorado, McCullough, and Marketplace Substations encompasses 6,000 acres. Nevada Power Company's Harry Allen Site near Apex has 3,600 acres available for solar applications. Figure 2-1 shows the locations of these sites.

Figure 2-1: Location of Potential SEZ Sites



2.2.1 Nevada Test Site

The town of Mercury at the southeast corner of the Nevada Test Site is located 65 miles northwest of Las Vegas. The proposed SEZ is approximately 20 miles west of Mercury. The site is surrounded by federal lands in a remote, arid region with tightly controlled access, a substantial infrastructure, and highly trained personnel. The Nevada Test Site Feasibility Study describes the NTS as being located in an ideal area for solar energy, and as having an infrastructure that can support development of large-scale facilities. A full development of NTS solar facilities is envisioned in the study as 600 MW of generating capacity.

The NTS could support 100 MW of capacity with no additional investment in upgrading transmission or site infrastructure, with 35 MW of that load absorbed by the NTS and 65 MW available for export to Marketplace Substation in Eldorado Valley. Other infrastructure needs are more expensive to fill. Gas support for the solar trough technologies could be supplied from the Kern River pipeline 64 miles away at an estimated cost of $52 million. Water supplies for the NTS are far less certain, with an estimate of only 580 acre-feet per year directly available at Jackass Flats, or up to 24,000 acre-feet per year available if the SEZ can access water in Amargosa Valley, which is south of the Nevada Test Site.

2.2.2 Eldorado Valley

The Eldorado Valley is located between Henderson and Boulder City, Nevada. State Highway 95 to Searchlight cuts through the middle of this area. Eighty thousand acres of the Eldorado Valley are in the final stages of transfer from the Bureau of Land Management to the State of Nevada, which will then be annexed by the City of Boulder City. Boulder City has designated six thousand acres of Eldorado Valley of the BLM land withdrawal for the purpose of renewable resource development.

This acreage is adjacent to the Eldorado, McCullough, and Marketplace Substations. Eldorado Valley lies in the crux of the western transmission intertie that links the utility markets of Arizona, California and Southern Nevada, providing unparalleled access to transmission and utility markets. Eldorado Valley is the most likely place for all the solar power generating stations at the different SEZ sites to deliver power.

There are two natural gas pipelines that transect Eldorado Valley; depending on the actual siting of a parabolic trough generating station, the gas pipelines could be up to six miles away. If a firm supply of natural gas were required during winter months, a reinforcement of the Las Vegas natural gas supply system would need to be constructed at a cost of approximately $47 million. There is virtually no groundwater at this site; however, Boulder City has indicated an interest in delivering

3,000 acre-feet per year, adequate to supply enough water for 300 MW of solar power tower or trough capacity.

2.2.3 Harry Allen

The Nevada Power Company's Harry Allen site is located several miles northwest of Interstate 15 in the Apex industrial area. Harry Allen has transmission capacity for 305 MW of generation; however, Nevada Power has plans to site 280 MW of gas combustion turbine units there, which would leave only 25 MW of capacity left for the development of solar power. The transmission capability of the Harry Allen site could expand dramatically with the completion of the Sunrise Corridor, a project that would link the Pacific Northwest market by 500 kV line to Marketplace Substation and the Arizona, Nevada, and Southern California markets.

Land is somewhat more restricted at this location than the other proposed SEZ locations. Nevada Power Company has identified 3600 acres for development of renewable energy supply. The area is bounded by Interstate 15 and a range of hills which runs parallel to the highway. The APEX industrial development and radio transmitting equipment occupy land to the southwest; therefore, expansion is restricted in at least three directions.

Nevada Power Company (NPC) is currently negotiating with gas pipeline companies for supply to the Harry Allen site. Consequently, natural gas supply is expected to be available well in advance of the time anticipated for construction of hybrid solar technologies at the SEZ. Water availability is very limited at the Harry Allen site, and Nevada Power has plans to truck water out to support its combustion turbines.

2.3 Technology Deployment

The mix of generation will be determined by competitive bid and will potentially include photovoltaics, dish/Stirling, solar trough, and power tower technologies as reflected in the July expressions of interest. At the July 30 meeting, the Task Force accepted a goal of 1000 megawatts (MW) of development by the year 2004, and identified a preliminary profile for deployment of the four technologies each year as shown in Table 2-2.

Table 2-2: Original Solar Enterprise Zone Development Profile

Deployment in MW	1997	1998	1999	2000	2001	2002	2003	Total
Photovoltaics	5	15	25	40	50	40	—	**175**
Dish/Stirling	—	1	5	25	50	—	—	**81**
Parabolic Trough	—	80	—	80	—	200	—	**360**
Power Tower	—	—	100	—	100	—	200	**400**
Total	**5**	**96**	**130**	**145**	**200**	**240**	**200**	**1016**

Since that meeting, the industry has made recommendations for modifying the 1000 MW scenario (Table 2-3) that will enable industry to obtain learning curve effects to drive levelized electricity costs down to the point the technologies are cost competitive and to do so in a manner that minimizes the need for public subsidy. This also divides the photovoltaic deployment into flat plate and concentrator technologies.

Table 2-3: Updated Solar Enterprise Zone Development Profile

Deployment in MW	1997	1998	1999	2000	2001	2002	2003	Total
Flat Plate PV	5	5	10	20	20	20	20	**100**
Concentrator PV	5	10	15	20	30	40	70	**190**
Dish/Stirling	—	1	5	25	40	50	70	**191**
Parabolic Trough	80	200	—	—	—	—	—	**280**
Power Tower	—	—	200	—	—	—	—	**200**
Total	**90**	**216**	**230**	**65**	**90**	**110**	**160**	**961**

Some of these industries propose extending the operating hours of the plant to more closely match utility load requirements by using natural

use natural gas or other means for extending operating hours, but the mechanism for accomplishing this is not clear at this time.

2.4 Power Quality Issues

The two most important power quality issues for determining the value of the power are the capacity factor and firmness of the resource. A plant's capacity factor determines whether the facility can supply on-peak or off-peak power. Depending on the types of technologies deployed, their storage capacity, and their reliance on natural gas, the SEZ technologies will operate at capacity factors at typically 25 percent to 40 percent. Thus, the SEZ would operate between a peaking (typically 10 percent capacity factor) and a baseload (over 80 percent capacity factor) power plant. The SEZ would be able to serve most on-peak demands but would also have some power available during off-peak hours.

The solar technologies that generate firm power are natural gas hybrid technologies such as trough, power tower, and dish/Stirling. The photovoltaic technologies do not generate firm power. To firm the PV power and increase the power's value, the SEZ could write an agreement with the Western Area Power Administration, so that a photovoltaic power generating station could store some of its power at one of the nearby hydroelectric projects.

Assuming the PV power could be firmed without major difficulty, the SEZ would sell a firm resource with a capacity factor between 13 percent to 35 percent for dish/Stirling and photovoltaic technologies and between 35 percent and 75 percent for trough and power tower technologies. The capacity factor for the hybrid technologies depends directly on the amount of natural gas used.

3. SOLAR ENTERPRISE ZONE MARKET

3.1 Summary

3.1.1 Approach

The Market Work Group's task was to analyze the potential market for power from the 1,000 MW SEZ development. In particular the Work Group sought information and ideas concerning:

- whether sufficient demand, both near-term and over the next decade, could be found for the 1,000 MW of solar capacity chosen as the initial target for the SEZ;
- likely terms and conditions for sale of SEZ power, including competitive price conditions, the potential for developing a market for green power, and whether utility capacity requirements would generally match the performance of SEZ technologies; and
- alternative approaches to marketing SEZ power, including the possibility of distributing SEZ output to Federal facilities, and the potential role of the Western Area Power Administration (Western) in marketing and transmitting SEZ power.

The Market Work Group conducted its analysis through a series of meetings with Western, utility stakeholders, a review of utility capacity plans and interest in renewable energy, and research into utility planning documents and published information.

3.1.2 Findings and Recommendations

SEZ power will have access to at least 35 utility entities, including investor-owned, municipal and power agencies, through the substations in Eldorado Valley. Collectively these utilities serve most of Arizona, California and Nevada and have sufficient load growth to support large amounts of solar generated power if priced competitively. The attitude of the consumers, utilities and regulators is favorable to renewable power, but they are not prepared to pay a substantial premium for green power. The SEZ concept is supported by the federal agencies, the solar industry and the concerned public that senses the need to find new clean energy resources. This support base must merge their resources and interests to drive down the cost of SEZ power to a level that is acceptable to the electrical utility industry.

However, the marketability of SEZ power is strongly influenced by changes that are currently occurring in the electrical utility industry. Deregulation of the transmission systems is expected to allow the

movement of existing low cost base load generation to needy markets, thus keeping the price of power low.

The Market Work Group concluded that the public sale of the initial SEZ power will have to be utility grade in quality and must be priced competitively with other options, both supply- and demand-side.

The Market Work Group believes that an early market for SEZ power could be created by legislation that committed federal facilities with transmission access to the SEZ to purchase SEZ power at a premium because of its environmental benefits.

The Market Work Group found Western to be very proactive in discussing ways Western could participate in SEZ development. In fact, Western has just recently begun its own study of potential markets in the Southwest. The study, though not yet complete, focuses on the needs of Native American Indian Nations, DOE and DoD facilities, and federal corrections facilities. Together, this study and the Western study will provide a complete picture of the high-value markets accessible to the SEZ.

As a result of these positive developments, the Market Work Group recommends that the SEZ should enlist Western to perform power marketing services. Western's wide experience in power marketing puts it in a unique position to assist in the development and realization of the SEZ. Some of the services that Western can provide under existing legislative authority include:

- Providing marketing and transmission services;
- Providing operational services such as reserves, regulation and dispatching;
- Shaping and storing intermittent renewable resource generation;
- Planning, designing and constructing transmission facilities.

3.2 General Market Conditions

The electric utility industry is currently undergoing a dramatic change in the way business is conducted. Historically, the utilities operated in a highly regulated environment that required them to seek the delicate equilibrium of offering reasonable and proper service to their customers at the lowest possible price. By doing so they were provided the opportunity to earn a reasonable rate of return on their investment, as approved by their regulators. With long-term growth rates of 3 to 5 percent, this basic balance of interest between the customers and the utility owners was relatively easy to manage where all parties were generally satisfied.

The sharp increase in oil prices during the 1970s alerted energy consumers to the need for conservation, and ultimately to federal and state legislation that encouraged efficiency. At the same time, increased

environmental awareness caused the enactment of laws and regulations that led to improved environmental performance of utilities, usually at the expense of cost efficiency.

Currently, the utilities face the eventual impact of deregulation similar to that experienced by the natural gas industry. The industry has already accepted the notion of generation being provided by non-utility entities and the independent power industry has quickly taken over this burden. There are presently very few base load power plants being planned by the electric utility industry. The Federal Energy Regulatory Commission (FERC) and several state regulators are considering rules and regulations that would provide increasingly open access to the transmission grid and may eventually allow both wholesale and retail transactions within the traditionally sacrosanct service area of established utilities. Regional transmission groups are being formed that will aid access to transmission. Improved transmission access will allow better use of existing base load generation and the movement of lower cost power from surplus areas to traditional load centers.

It is assumed by many utilities that their traditional functions will be split, resulting in generation, transmission and distribution being owned by different entities. During the transition to a less regulated environment, utilities with expensive generation in inventory will be at a competitive disadvantage. This results in less interest in long term contracts in favor of playing the open market for purchases and sales opportunity. These forces are restraining the cost of surplus power in the Southwest.

Other changes in utility operations are being considered in some regulatory jurisdictions. In California, a change in the utility incentive to perform their fundamental obligation to the public is being evaluated. The California Public Utility Commission (CPUC) and larger investor-owned utilities are considering alternative strategies for compensating utilities and their investors in an effort to encourage lean and mean business practices. The focus of this effort is to encourage improved management efficiency. Performance based ratemaking is being considered where utilities would be rewarded for improving efficiency in meeting their utility obligations rather than a return on ratebase or common equity.

Integrated resource planning (IRP) is the latest tool to be applied to the utility planning process. IRPs seek to consider all factors that impact resource planning decisions and to get the input and general agreement of all parties in the process, thus resulting in better decisions that will satisfy customers, regulators and environmental interests. Theoretically, environmental benefits can be quantified in this process, however, the price of generation alternatives appear to take precedent.

Utilities, both investor-owned and municipal, express great concern about the changing business environment and resulting uncertainty regarding the future of the electric utility industry. This uncertainty makes it increasingly difficult for utilities to invest resources in research

and development of new generation technologies or to support less than the most cost effective decisions.

3.3 Potential Market for SEZ Power

In the current utility market, no single set of stakeholders is able or willing to shoulder the risk and cost required to advance renewable energy technology to market competitiveness. Therefore, the SEZ will have to rely on a combination of federal and state agency, public, utility, solar industry and regulator support to succeed. To reduce risk and share the responsibility for this investment, the SEZ should pursue a broad marketing strategy based on the assumption that the first SEZ initiative's energy will have to be utility grade in quality and priced competitively with other options, both supply- and demand-side.

3.3.1 SEZ Power

Table 3-1 below shows the industry's preferred deployment schedule for 900 MW over a 7 year period from 1997 to 2003. The scenario has changed slightly from that shown at the July 1994 Task Force meeting based on recommendations from the Industry Work Group. These changes are explained in more detail in Section 6. Under this scenario, the SEZ will be producing almost 4 billion kWh of power annually once it reaches full deployment. Using California schedules for peak, mid-peak and off-peak, roughly 19 percent of SEZ energy (738 GWh) would be

Table 3-1: Technology Deployment and Energy Output

Capacity (MW)	1997	1998	1999	2000	2001	2002	2003	Total
Trough	80	200						**280**
Tower			200					**200**
Dish		1	5	25	40	50	70	**191**
Flat Plate	5	5	10	20	20	20	20	**100**
Concentrator	5	10	15	20	30	40	70	**190**
Total	**90**	**216**	**230**	**65**	**90**	**110**	**160**	**961**
Cumulative	**90**	**306**	**536**	**601**	**691**	**801**	**961**	
Energy (GWh)	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**Total**
Trough	245	1402	0	0	0	0	0	**1647**
Tower	0	0	263	263	263	0	0	**788**
Dish	0	2	14	91	146	183	256	**691**
Flat Plate	11	11	22	44	44	44	44	**219**
Concentrator	14	29	43	58	87	116	202	**549**
Total	**271**	**1444**	**342**	**456**	**539**	**342**	**502**	**3895**
Cumulative	**271**	**1715**	**2056**	**2512**	**3051**	**3393**	**3895**	

available for sale as high value peak capacity and energy. Another 57 percent (2208 GWh) of capacity and energy would match mid-peak demand, and the remaining 24 percent (949 GWh) would be available

during off-peak hours. Thus, the SEZ will have a valuable energy and capacity commodity to market that should command the best prices available.

The many utilities that have ownership or access to the Eldorado Valley know the cost of transmission service and associated losses. For the purposes of this study, it is assumed that SEZ power will be delivered to the Eldorado Valley and the buyers of SEZ power will make any necessary transmission arrangements.

A major factor that will influence the long-term viability of the SEZ initiative is the relative cost of power in the competitive market place. The cost of power varies considerably among the three state marketing regions and between utilities in each region. The utility entity retail cost to their customers is a function primarily of the wholesale resource mix and the distributed nature of their customer base.

Some of the Western customers rely almost exclusively on hydropower while others have very little. Utilities in Arizona have relatively high rates in the larger cities and low rates in the rural agricultural areas. California utilities have uniformly higher rates. Nevada, on the other hand, has relatively low rates throughout the state. Again, this rate pattern is highly influenced by the availability of federal hydropower. Nevada Power Company, the exception, has little benefit from hydropower yet has maintained relatively low rates for many years as a result of strong coal-fueled baseload resources and conservative management.

The SEZ initiative will compete with all other generation resources, including fossil fuel, nuclear power, other renewable resources and demand-side management programs. Therefore, the cost of competing resources is most important to the viability of the SEZ concept. In general, SEZ power would be sold at wholesale rates on the transmission grid to utility entities with predictable growth rates.

These prices will vary widely depending upon the circumstances of the entities' buying and selling power at a particular time. For example, capacity will have no value during off-peak hours, and may have no value during on-peak hours if the buyer has surplus generation. Scheduled outages of major generation can increase the value of power for several month periods and unscheduled outages can sharply influence power prices, but usually for short periods.

Electrical utilities are in the business of providing utility grade electric service for the lowest practical cost. This is reaffirmed by the integrated resource planning programs that are being developed and applied within the industry. The parties to this process have not, as yet, found an acceptable way to quantify the benefits of renewable generation. The typical response to questions regarding paying extra for renewable generation is that, while they are interested in renewable concepts, all generation additions will have to be cost competitive. The only exception to this rule may be small experimental generation additions. Even these

would require approval of the regulatory authority prior to committing funds to real projects.

Several utilities have conducted surveys to determine the willingness of the customer base to pay part of the additional cost of installing and operating renewable generation. A very successful program to measure consumer commitment is being conducted by the Sacramento Municipal Utility District. Approximately 70 percent of the customers surveyed indicated a willingness to pay "more" for environmentally friendly renewable generation. The utility has customer demand for substantially more than the 100 solar systems per year that are currently available. The positive response may be associated with the visible apparatus on the customer's roof that goes with the program, compared to research and development at some remote location. Other large survey efforts in California produced affirmative results from about 15 percent of the population surveyed

3.3.2 Utilities With Market Access

A SEZ in Southern Nevada will have access to at least 35 utility entities, including investor-owned, municipal and power agencies, through the Eldorado Valley. Collectively these utilities serve most of Arizona, California and Nevada and have sufficient load growth to support large amounts of solar generated power if priced competitively. It is anticipated that the movement toward deregulation being promoted by FERC and various state utility regulators will quickly expand the number of utility loads accessible to the Eldorado Valley within the next several years.

The electric power entities with market access at the Eldorado Valley are shown in Table 3-2.

3.3.3 Federal Electricity Purchases

In addition to utilities, there are many federal agencies that collectively use large amounts of electric power, including the Nevada Test Site

Table 3-2: Utilities with Market Access to the SEZ

Arizona	
Arizona Power Authority	Arizona Power Pooling Association
Arizona Public Service Company	Citizens Utility Company
PacifiCorp	Public Service Company of New Mexico
Tucson Electric Power Company	Mellton-Mohawk Irrigation & Drainage District
Western Area Power Administration	
California	
Anaheim Public Utility Department	Azusa, City of
Banning Public Service Department	Burbank Public Service Department
Colton, City of	Glendale Public Service Department
Imperial Irrigation District	Los Angeles Department of Water & Power
Pacific Gas & Electric	Pasadena Water & Power Department
Riverside Public Utility Department	Sacramento Municipal Utility District
San Diego Gas & Electric	Southern California Edison Company
Vernon, City of	
Nevada	
Boulder City	Colorado River Commission
Lincoln County Power District	Nevada Power Company
Overton Power District	Valley Electric Cooperative

reliable commitments that would provide a sustained market for solar power project developers.

An added advantage of pursuing this approach would be its value as a precedent for pursuing broader green marketing initiatives with other utility customer groups. The Nevada Operations Office is currently opening a competitive solicitation for power supplies and will be seeking authority to set aside at least a portion of the capacity for environmentally benign technologies. Opening this market opportunity would require federal action to change requirements that federal facilities purchase only the lowest cost power sources, and restrictions on long-term power purchase contracts in non-DoD agencies.

3.3.4 Projected Collective Load Growth

Approximately 25 of the entities listed in Table 3-2 were surveyed to elicit load growth data and other pertinent information. The participating utilities were queried on their interest and commitment to renewable energy resources, and willingness to pay a premium for the environmentally friendly generation option. The utility responses were varied. Most of the entities contacted provided information regarding

their projected load growth and general plans for resource additions, both conventional and renewable. Several declined to participate due to their own local circumstances.

The Arizona, California and Nevada marketing regions are projecting load growth in the approximate amounts shown in Table 3-3.

Table 3-3: Projected Load Growth in Southwest

MW	1996	1997	1998	1999	2000	2001	2002	2003	2004	Avg
AZ	224	157	178	211	235	432	288	196	142	**1.65%**
CA	660	168	727	1026	1035	789	939	958	806	**1.50%**
NV	199	174	146	118	107	104	99	109	102	**3.21%**
Total	**1083**	**499**	**1050**	**1355**	**1377**	**1325**	**1326**	**1263**	**1050**	**1.63%**

Electrical utilities are required to plan their acquisitions carefully in order to meet their utility obligations while holding costs down. Consequently, substantial portions of the increased generation requirements shown are already committed, either by firm contract purchases or planned equipment additions. Notwithstanding this, the three state market regions are expected to have ample demand for new generation to absorb capacity in the amounts that a practical SEZ initiative could produce. It is apparent that the marketability of SEZ power will not be decided by composite load growth of the available market, but rather by the quality and price of the resource. If the SEZ initiative can produce industry standard power at a near competitive price, there will be ample market.

3.3.5 Net Solar Generation In Resource Plans

Table 3-4 shows the approximate solar capacity additions planned by utilities, by state and year, a subset of overall capacity expansion plans discussed above. Nevada Power Company is planning small experimental solar projects and a possible 20 MW solar generation on or before 2002 (pending technological advancement and regulatory approval). The timing of these solar additions are subject to changing regulatory attitudes and targets of opportunity that may become available to planners. SEZ initiative power could move up these planned addition dates and add substantial amounts if the quality and price are attractive.

Table 3-4: Expected Solar Capacity Additions

MW	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total
AZ	1	.5	1.5	6	12	0	0	0	0	21
CA	4	4	4	4	8	8	8	8	8	56
NV	0	0	0	0	0	0	20	0	0	20
Total	5	4.5	5.5	10	20	8	8	8	8	97

3.4 Stakeholder Positions

3.4.1 Western Area Power Administration Position

3.4.1.1 Background on Western

Western Area Power Administration (Western), headquartered in Golden, Colorado, annually markets and transmits 10,082 megawatts of hydropower from 54 power plants operated by the U.S. Bureau of Reclamation (Bureau), the U.S. Army Corps of Engineers (Corps) and the International Boundary and Water Commission (IBWC). Western sells about 15 percent of national and 95 percent of regional hydroelectric generation. Western also has had a marketing role in the United States' 547 megawatt entitlement from the coal-fired Navajo Generating Station near Page, Arizona. This allocation of the Navajo plant supports the pumping load of the Central Arizona Project (CAP) with revenues from surplus sales going towards repayment of the CAP. Western has been successful in marketing surplus energy from the Navajo plant, and in June of 1994, marketed the surplus to the Salt River Project, thereby maximizing the revenue stream to the CAP.

Western's power facilities are part of 13 multipurpose water resource projects and include Western's transmission facilities and generation facilities owned and operated by the Corps, Bureau and IBWC. Western's service area covers 3.38 million square kilometers (1.3 million square miles), in 15 central and western states. Western sells power to more than 600 wholesale power customers including municipalities, cooperatives, public utility and irrigation districts, federal and state agencies and investor-owned utilities. They, in turn, provide retail electric service to millions of consumers in these central and western states: Arizona, California, Colorado, Iowa, Kansas, Minnesota, Montana, Nebraska, Nevada, New Mexico, North Dakota, South Dakota, Texas, Utah and Wyoming.

Western operates an extensive, integrated and complex high-voltage power transmission system to supply energy to its customers. Using this 26,000-plus circuit kilometer (16,000-plus circuit mile) Federal transmission system, Western markets and delivers reliable electric power to most of the western half of the United States.

Congress established Western on December 21, 1977, under section 302 of the Department of Energy Organization Act. Under this statute, power marketing responsibilities previously managed by the Bureau of Reclamation were transferred to Western. Western's 1,480 Federal employees operate and maintain this system from 50 duty stations located throughout the Western service area.

Staff at Western's Headquarters in Golden, Colorado; and five area offices in Billings, Montana; Loveland, Colorado; Phoenix, Arizona; Sacramento, California; and Salt Lake City, Utah manage sales for 11 rate-setting systems.

Customer service and system operations also are supported by district

[redacted]

Dakota; Montrose, Colorado; and an Operations Office in Watertown, South Dakota.

Western's primary long-standing mission is to market federal hydroelectric resources "..in such a manner as to encourage the most wide-spread use thereof at the lowest possible rates to consumers consistent with sound business principles..." (Flood Control Act of 1944). Western markets power at rates that: repay operation, maintenance, purchase power and transmission service expenses; ensure the Federal power investment is repaid with interest; and assist in repaying the irrigation investment beyond the irrigators' ability to repay.

Additional direction to Western's mission was provided by the Deputy Secretary of Energy in his June 16, 1994 testimony before the House Subcommittee on Oversight and Investigations. In this testimony, Deputy Secretary White stated, *"Here, today, I make the commitment for Western to assume leadership in helping to create a bigger renewables and efficiency resource in the west."*

- Purchase cost-effective renewable resources for firming hydroelectric generation in meeting contractual obligations to long-term firm power customers;
- Marketing services, which could range from identifying potential customers, negotiating interconnection contracts, providing assistance to utilities in understanding the full value of renewable resources, or acting as an agent for other federal agencies to provide power services under the Economy Act; and
- Planning, designing and constructing transmission facilities (transmission lines, substations, switchyards, and related communication systems) where authorized by law, to facilitate the delivery of renewable resource generation.

In summary, Western can provide the same kind of services it has historically provided federally developed hydropower to solar power developed at the SEZ. The differences between the hydropower currently marketed by Western and the solar power to be developed at the SEZ are cost and reliability. The hydropower marketed by Western is a firm resource with rates set to recover capital and operating expenses (including maintenance). The cost of hydropower is well below the cost of most wholesale power sales in the region. Solar power, on the other hand, may not have the same dependability and reliability of hydropower, particularly during the early stages of deployment. Solar power costs are still on the declining limb of the technology development curve. Without price supports, solar power may cost three to four times the prevailing cost of wholesale power initially. Over time, it can be expected that these price supports can be reduced as solar costs come down and the costs for alternative resources to meet load growth increase.

The customer base for solar power will likely vary from the customer base of the hydropower marketed by Western. The market for solar power will depend on cost, availability of transmission, the degree to which solar power fits in a utility's resource plan and the regulatory environment within which the utility operates.

Western's role in the Solar Enterprise Zone could be expanded with additional authority and resources. This expanded role could include:

- Purchasing renewable energy on a nonreimbursable or partially reimbursable basis;
- Operating a revolving fund for renewable energy technology deployment;
- Taking title to the renewable generation facilities and supporting the full range of operating, maintenance, and marketing responsibilities;
- Acquiring renewable generation for a group of power customers that have selected renewables as a part of their resource plans;

- Participating in additional firming generation projects that allow more effective and efficient use and marketing of intermittent renewable generation.

3.4.2 Federal Energy Regulatory Commission (FERC)

FERC has jurisdiction over electric wholesale power transactions and rates and oversees state implementation of the Public Utility Regulatory Policies Act (PURPA), the Public Utility Holding Companies Act (PUHCA) and the most recent amendments to PUHCA contained in the Energy Policy Act of 1992 (EPAct). FERC is encouraging broader competition in the utility market through the expansion of electric wholesale generators and its new authority to order wholesale electricity wheeling and regulate wheeling tariffs. Power generation projects seeking qualifying facility (QF) status under PURPA would require FERC certification and would have to abide by PURPA restrictions on facility size and use of fossil fuels. With enactment of EPAct most of the advantages of QF status have been extended to include exempt wholesale generators, so it is unlikely that SEZ projects would seek QF status under PURPA.

3.4.3 United States Environmental Protection Agency

The 1990 Clean Air Act Amendments Title IV, established the Acid Rain Program which provides a market-place framework and incentives for electric utilities to reduce emissions of sulfur dioxide (SO_2) and nitrogen

Avoided emissions is perhaps the most lucrative of the three incentives. Each ton of SO_2 avoided through energy efficiency and renewable resource based systems saves one emission allowance. Additionally, the Conservation and Renewable Energy Reserve is a special bonus pool of 300,000 allowances for encouraging the use of efficiency and renewable resource based systems. For each 500 MWh of energy saved by demand-side management systems or generated by renewable resource based systems, utilities earn one allowance from the Reserve.

Reduced use of an affected generation unit is also a compliance option. However, during 1995 through the year 2000, utilities may not reduce generation below their baseline by simple shifting to non-affected units, unless such shifts are offset by efficiency or renewable energy.

Thus, energy efficiency and renewable resource based systems enable utilities to generate or save allowances by:

- Complementing or offsetting the use of other compliance strategies;
- Delaying the use of expensive alternate compliance initiatives;
- Avoiding noncompliance penalties; and
- Increasing revenues by selling extra allowances.

Given the market place value of SO_2 emission allowances, utilities' avoided costs will likewise be affected. Consequently, utilities will incorporate avoided SO_2 costs in their integrated resource planning and evaluation criteria for energy efficiency and renewable resource based systems. Likewise, bidding and dispatch procedures will include avoided SO_2 costs. Additionally, the methodologies for valuing SO_2 avoided costs in utilities' resource planning can apply to other pollutants as trading markets emerge. Allowance trading provides the financial incentive for utilities to pursue energy efficiency and renewable resource based systems and to minimize their cost by doing so.

3.4.4 Arizona Regulatory Context

The Arizona Corporation Commission (ACC) recently held public hearings on its integrated resource plan process. Overall, the ACC is supportive of increasing Arizona's commitment to using renewable energy resources. The Commission's November 1992 *Staff Report On Resource Planning* (released in conjunction with the state hearings) contains a series of recommendations, which if adopted would enhance the market opportunities for solar thermal technologies. The Commission recommends:

- Inclusion of renewables in future resource plan filings. Each utility must:
  - develop a database of existing renewable resources within its system;

- prepare a 3-year renewable resource action plan; and
- include an explicit discussion of their R&D plans and activities regarding renewables in their next resource plan.

- Commission consideration (in rate cases) of allowing cost recovery for prudent investments in renewable generation demonstration projects to better determine the costs and output potential of the technology.
- Utility recovery of prudent costs of set-aside renewable resources (within limits to protect ratepayers, such as limitations on cost per kW or limitations on renewable capacity).
- A collaborative evaluation of renewable technologies relative to conventional technologies to better establish the economics of renewables.
- Long-term set-asides for renewable resources. Recommended set-asides by 2009:

Arizona Public Service	160 MW
Tucson Electric Power	160 MW
Arizona Electric Power Cooperative	40 MW
Citizens Utilities Company	40 MW

- Short-term set-asides for renewables such that the utility plans due to be filed by December 1995 include the following minimum mandatory targets:

Arizona Public Service	12 MW
Tucson Electric Power	5 MW
Arizona Electric Power Cooperative	1 MW
Citizens Utilities Company	1 MW

3.4.4.1 Renewable Set-Asides

Utilities may obtain the proposed renewable capacity by constructing and owning their own renewable resource facilities, sharing facilities among several utilities such as the SEZ initiative, requesting bids from others to construct and operate renewable resource plants and assisting customers to install and operate renewable energy technologies at the customers' sites to generate electricity directly for customer use.

3.4.4.2 Environmental Externalities

A 1989 ACC ruling ordered utilities to consider externalities in their planning process (but not in acquisition) but did not indicate any methodology. State utilities have used a variety of methods, however, no standard has been adopted. In 1992, an Externalities Task Force was formed consisting of commission and utility staff and other interested parties to investigate methodologies for incorporating

externalities into the planning process. The charter for the task force is to identify and quantify costs to be included in the states total societal

trading scheme is in place in the utility's planning area, or if the utility is paying emissions taxes. The legislation allows the CPUC to approve a utility-designed alternative plan to a bid solicitation if such a plan offers equivalent environmental benefits at lower cost.

Before this legislative decision, the CPUC provided specific guidance on how utilities should incorporate externalities into decision-making. The final values varied from 2.8 cents/kWh to 6.9 cents/kWh.

3.4.5.2 Diversity

Though many state regulators have been interested in a methodology for calculating the value of fuel diversity, only California has suggested a methodology. The recommendation was made in a 1991 Public Utility Commission decision, but was temporarily overridden by state legislation which required the use of a set-aside for renewables. Therefore, the method has not been used.

The fuel diversity premium would be calculated by finding the monetary difference between the first fossil Identified Deferrable Resource (IDR) with the most cost effective non-fossil resource. This fuel diversity premium, expressed in dollars per kilowatt, would be applied as an additional capacity payment to non-fossil and renewable QFs, and would be published before an auction.

3.4.5.3 Method for Assessing Resource Need

A computer planning model is used in assessing resource needs which simulates the operation of the entire utility system. The model calculates the system's operating costs for any set of resource assumptions. Pursuant to statutes passed in 1990, the California Energy Commission attempted to account for environmental costs and benefits associated

3.4.5.5 Regulatory Actions

In 1992, the CPUC issued an order requiring bidding for new resources by the state's investor-owned utilities to supply a portion of forecast utility capacity needs. Important elements of this decision were: participation is limited to QFs; standard offer contracts will be offered to winners based on a utility's long-run marginal costs, including both fixed and variable components (a fixed capacity price makes utility dispatch through curtailment less of an economic issue for developers); levelized payments are allowed over a 30-year contract period; the biddable capacity needs are identified for each utility; the costs of residual air emissions are explicitly valued; and a set-aside for renewables is established in lieu of using a fuel diversity value. A state law, which took effect in 1992, requires a set-aside for renewables if both environmental and diversity costs are not included in the bid evaluation criteria.[1]

3.4.5.6 Bidding Status

To date, only public utilities have conducted bidding.[2] Significant amounts of renewable capacity have been bid in the public power auctions. The Northern California Power Agency (NCPA) has released two requests for proposals (RFPs), one in 1989 and 1991. Neither resulted in renewable purchases (except for hydro). The primary evaluation factors were: price (delivered), price structure, project reliability, transmission, operating characteristics, environmental effects, and diversity. Although proposals were submitted for wind, geothermal and biomass projects none of these made the short list.

Renewables represent only 6 percent of the total capacity procured in California through bidding, which seems surprising given the state's renewable resource base and its history of renewable energy development. Bidding to date has been limited to public entities that (with the exception of Sacramento Municipal Utility District (SMUD) have focused on price-related factors.

Although the results of latest bidding exercise were disputed, the three largest California IOU's, SCE, PG&E and SDG&E, successfully negotiated the purchase of renewable energy capacity on a second bid. The winners of this process will supply 1436.8 MW of firm capacity including 284.85 MW of wind, 933.5 MW of cogeneration, 194.5 MW of

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[1] Swezey, B. G., National Renewable Energy Laboratory. *The Impact of Competitive Bidding on the Market Prospects for Renewable Energy Technologies.* (NREL/TP-462-5479) September 1993, p. A-3.

[2] The exception is San Diego Gas & Electric which issued two RFPs in 1992; the first to compare against near term utility capacity purchases and the second to compare against a utility repowering option. These solicitations are distinct from the statewide bidding prices discussed in this section.

geothermal, 5 MW of hydropower, 15.85 MW of landfill gas and 3 MW of biomass.

SMUD recently completed an all-source procurement which approved the selection of five local gas-fired cogeneration projects totaling 607 MW, a gas fired plant, 50 MW of power imports and a 50 MW wind farm. Initiated in 1990, the SMUD RFP stressed price, dispatchability, and locational factors, but also recognized the value of fuel and resource diversity and considered environmental impacts. SMUD also expressed a willingness to finance projects to take advantage of lower cost public financing mechanisms.

3.4.6 Nevada Regulatory Context

The Public Service Commission of Nevada (PSC) regulates investor-owned utility activities including resource planning and environmental permitting on new construction. Nevada currently offers four state incentives to encourage solar energy projects:

- Sales tax deferral;
- Property tax exemption; and
- Accelerated depreciation (71 percent, first 3 years)

Additionally, recent rulings (January 1991) require utilities to consider externalities and economic development in the IRP process. The rule-making was in response to a state legislative mandate stating that appropriate preference may be given to those resources that "provide the greatest economic and environmental benefits to the state."

3.4.6.1 Competitive Bidding

There are currently no requirements for competitive bidding, but Order No. 91-7001 directs utilities to develop bidding procedures for implementation by 1996.[3] Sierra Pacific Power Company, the only utility which has used competitive bidding, has held two solicitations. Renewables (geothermal) have won 35 percent of the 270.4 MW awarded. It does not appear that the environmental benefits of the technologies had an impact on the selection criteria, however. The first solicitation (1988) was for 125 MW of long-term capacity to be supplied from 1989 to 1992. Of the total of 3,200 MW of proposals received, 45

lowest cost and highest value options. A 30-year contract for a 13 MW expansion of an existing non-utility-developed geothermal project was also negotiated as insurance to meet a regulatory mandate for 85 MW of QF capacity by the end of 1990. Both price and the utility's short time frame played an important role in the selection.

A second solicitation was held by Sierra Pacific in 1989 for a total of 197 MW of long-term capacity (10-30 years) over the 1991-1997 time frame. Sierra Pacific received 39 proposals for 2,600 MW. Sierra selected 82.4 MW of geothermal projects for contract negotiation, along with a 25 MW utility purchase option. The lower than requested capacity total was due to a downward revision in capacity needs. The most important factor in this result was the more limited transmission capability to import power from other utilities given the 150 MW of imports procured with the first RFP. Also the price differentials between utility sales proposals and the geothermal projects had narrowed significantly since the first RFP. The geothermal projects also were able to accept lower capacity payments in the later years of the contracts. [4]

3.4.6.2 Environmental Externalities

The PSC requires externalities in resource planning. Utilities with an annual operating revenue of $2,500,000 or more must consider environmental externalities in resource planning (but not acquisition). These regulations currently apply to Nevada Power and Sierra Pacific.

The PSC has specified monetary values for selected air emissions to be used as default values until it rules on the values used in each utility's resource plan. These include the values shown in Table 3-5.

Table 3-5: Nevada PSC Externalities

$/Ton/Year (1989 Real Dollars)				
NOx	SOx	PM 10	ROG	CO_2
$6,800	$1,560	$4,180	$1,180	$22

Consideration of air, land and water impacts within or outside of Nevada is required. Environmental costs are integrated into the present worth of societal cost and used as an alternative criteria to rank resource options.

[4] Swezey, B. G. (September 1993). *The Impact of Competitive Bidding on the Market Prospects for Renewable Electric Technologies.* National Renewable Energy Laboratory (NREL/TP-462-5479).

4. SOLAR ENTERPRISE ZONE FINANCE

4.1 Summary

4.1.1 Approach

The Finance Working Group met with a variety of financial experts in the field of municipal finance, small business investment finance, public works or project finance, and private investment in economically targeted industries. A series of meetings were held in Las Vegas, Washington, D.C. and New York City during the month of September to explore a range of possible supports.

4.1.2 Purpose

Financing or public supports are required by pre-commercial projects to reduce the levelized cost of electricity to long-term contract prices. Financing or public support requirements are a function of the technologies chosen for the initial 1,000 MW deployment scenario, the costs of producing electricity from those projects, and the market or long-term contract price for electricity. This analysis presents financing options that could be used to satisfy these requirements, based on the following principles. To achieve maximum impact, the Solar Enterprise Zone should:

- Integrate as many sources of support as possible into the overall task of reducing project costs (i.e. federal, state, and private sources of financing from energy, labor, job training, defense conversion, infrastructure development, and other sources);
- Leverage as much private investment per dollar of public support as possible and consistent with normal project risk;
- Provide a profit for public support in pre-commercial projects by obtaining warrants or other links to share in commercial success.

It is important that public support be used to reduce the pre-commercial risks, but it is equally important that private developers bear a full share of appropriate finance and business risks. Public support should be used to leverage as much individual, entrepreneurial private capital as possible in the projects it supports.

The portfolio of public supports the Working Group assembled are consistent with these basic principles. The number of options presented is quite large, but is not necessarily inclusive of all possible forms of support. Several areas remain to be explored, and other financing options may be identified. However, the broad recommendations of the Finance Working Group are not expected to change as a result.

4.1.3 Summary Recommendations

Low cost financing and other public supports are required by pre-commercial projects to reduce the levelized cost of electricity to long-term contract prices. Financing support requirements are a function of the technologies chosen for the initial 1,000 MW scenario, the costs of producing electricity from those projects, and the market or long-term contract price for electricity. The Finance Working Group recommends that the SEZ assemble a portfolio of supports for projects matched to the deployment schedule shown in Table 4-1 and the general capital requirements shown in Table 4-2.

Table 4-1: SEZ Technology Deployment

Capacity	1997	1998	1999	2000	2001	2002	2003	Total
Trough	80	200						280
Tower			200					200
Dish		1	5	25	40	50	70	191
Flat Plate	5	5	10	20	20	20	20	100
Concentrator	5	10	15	20	30	40	70	190
Total	**90**	**216**	**230**	**65**	**90**	**110**	**160**	**961**
Cumulative	**90**	**306**	**536**	**601**	**691**	**801**	**961**	
Energy (GWh)	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**Total**
Trough	245	1402	0	0	0	0	0	1647
Tower	0	0	263	263	263	0	0	788
Dish	0	2	14	91	146	183	256	691
Flat Plate	11	11	22	44	44	44	44	219
Concentrator	14	29	43	58	87	116	202	549
Total	**271**	**1444**	**342**	**456**	**539**	**342**	**502**	**3895**
Cumulative	**271**	**1715**	**2056**	**2512**	**3051**	**3393**	**3895**	

The financial group ran two separate analyses of this scenario. Both used 100 percent debt financing by a municipal corporation. There were no Federal or local taxes paid, no accelerated depreciation credit and no investment or energy tax credits received. The first analysis showed the effect on capitalization and levelized energy cost of financing at the current treasury rate of approximately 7.5 percent. The second analysis showed the effects of financing at a municipal or industrial revenue bond rate of 5 percent.

Table 4-1 illustrates the deployment scenario proposed by industry. The scenario calls for deployment of over 500 MW of capacity in the Solar Enterprise Zone before 2000. The majority of this capacity comes from the deployment of two solar trough plants in 1997 and 1998 and a solar power tower plant in 1999. The first solar trough plant is a standard 80 MW SEGS plant. The second is an new concept, 200 MW integrated solar combined cycle plant. The power tower is built in three phases starting in 1999. The first phase has a 15 percent capacity factor and consists of a 200 MW plant with a 100 MW solar field. The second and third phases each add 15 percent to the capacity factor and 100 MW to the solar field.

Because of the size of these projects, this schedule would require outlaying more than half of the total required capitalization of the zone in the first three years. The capital requirements for all projects at both

Table 4-3: SEZ Levelized Energy Production Costs (¢/kWh)

Levelized Energy Cost @ 7.5 percent	1997	1998	1999	2000	2001	2002	2003
Trough	12.56	5.3	0	0	0	0	0
Tower	0	0	14.52	11.17	10.00	0	0
Dish	0	12.97	10.09	7.91	7.46	7.46	7.46
Flat Plate	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Concentrator	13.61	12.75	11.57	8.05	6.88	6.54	6.54
Total	**12.33**	**6.46**	**13.39**	**7.64**	**7.31**	**6.90**	**6.90**
Cumulative	**12.33**	**6.55**	**7.68**	**7.68**	**7.61**	**7.54**	**7.46**

Levelized Energy Cost @ 5 percent	1997	1998	1999	2000	2001	2002	2003
Trough	11.08	5.05	0	0	0	0	0
Tower	0	0	12.06	9.29	8.31	0	0
Dish	0	11.03	8.75	7.2	6.80	6.80	6.80
Flat Plate	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Concentrator	10.8	10.12	9.18	6.4	5.48	5.21	5.21
Total	**10.84**	**5.16**	**11.14**	**6.54**	**6.27**	**6.09**	**6.04**
Cumulative	**10.84**	**6.06**	**6.91**	**6.84**	**6.74**	**6.67**	**6.59**

The actual revenues from SEZ energy will depend on the type of energy produced and the rate for a particular type of energy. Generally, rate schedules in the western states show that during a typical year there are about 768 hours of peak time, 2,508 hours of mid-peak and 5,484 hours of off-peak and super off peak time. For this study we combined off-peak and super off-peak into one time period. Based on this schedule the SEZ could eventually produce 738 GWh of peak energy, 2,208 GWh of mid-peak energy and 949 GWh of off-peak energy (see Table 4-4).

Table 4-4: SEZ Peak, Mid-Peak and Baseload Power Production (GWh)

Available (GWh)	1997	1998	1999	2000	2001	2002	2003
Peak	69	166	177	50	69	84	123
Mid-Peak	202	532	165	396	322	239	353
Off-Peak	0	746	0	9	148	19	26
Total	**271**	**1444**	**342**	**456**	**539**	**342**	**502**
Cum Peak	69	235	412	462	531	615	738
Cum Mid-Peak	202	733	898	1295	1617	1855	2208
Cum Off-Peak	0	746	746	756	904	923	949
Total	**271**	**1715**	**2056**	**2512**	**3061**	**3393**	**3896**

Table 4-2 showed the anticipated capital needs for the SEZ over 7-years. The timing and level of support shown would support the initial development of the SEZ and the commercial establishment of 1,000 megawatts of capacity. Additional funds would be needed for infrastructure development at the NTS and the other sites, with total

costs varying depending on what level of infrastructure investment is associated with the SEZ's final project and site selections. Infrastructure investment could be structured such that they could lay the groundwork for up to 9,000 additional megawatts of solar installations. These estimates, it should be stressed, are initial estimates and have to be refined as further information concerning cost estimates, market price and project development are made available. Refinement of cost data, project scheduling, and anticipated market prices are ongoing.

4.1.3.1 Financing Alternatives Portfolio

The final portfolio of financial tools used by the SEZ is subject to the needs and the availability of the various supports suggested. However, the Finance Working Group believes a reasonable target is to rely on direct federal support for 20 percent of funds for project capital cost reductions, investment in infrastructure, and/or as backing for state bonds to further reduce interest rates. Approximately 60 percent of total supports should come from reduced interest rate financing for the project, 5 percent from forward pricing from the project developers, 5 percent from other as yet to be identified program supports such as defense conversion and labor or job training programs, 5 percent from integrating small business investment or minority enterprise small business investment corporations, and 5 percent from private funds that can be attracted to economically targeted investments in the SEZ.

These percentages are flexible and are meant to provide an initial estimate of what the Finance Working Group believes is reflective of the interest of industry and is achievable given the statutory and budgetary limitations at this time. The analysis of levelized energy costs presented earlier is based only on low-interest financing. Additional efforts to reduce project costs will be necessary to produce competitive power from the SEZ, particularly during the first few years when technology costs will be higher and capacity markets more constrained. The dramatic reduction in the costs of electricity provided by low-cost financing, and by technology improvements expected from industry can put the SEZ in position to leverage a menu of other options to achieve reductions that will put solar power closer to the competitive range, and help defray transmission costs, which are not reflected in the financial analysis because they vary significantly from transaction to transaction.

Finally, it is the recommendation of the Finance Working Group that the level of support for the SEZ be tied to the reduction in funding for the existing programs at the NTS in Nevada. Over the past four years, the

available through a variety of financial instruments to the solar industry for the development of pre-commercial projects at the SEZ.

The portfolio of financial instruments will include direct grants, low-cost financing, and targeted private investment funds. These supports should leverage at least an additional $1 billion of private investment into the area and into the industry. For each of the supports offered, the Finance Working Group strongly recommends that the SEZ obtain a warrant or contingency payment agreement that will establish a substantial participation in the technologies' future commercial success. On balance then, the Finance Working Group believes it is possible to put together a package of supports that are tied to reductions in funding of the NTS but also provide for a substantial probability of a payback equal to the level of public support offered. *It is the final recommendation of the Finance Working Group that the package of supports, in particular the federal portion of those supports, be pursued with various budgetary authorities in order to establish the feasibility for obtaining the various grants and guarantees necessary for the initiative to go forward.*

4.2 Finance Requirements

The accelerated development of solar technologies fall into pre-commercial and commercial stages. In order to be considered for project development at the SEZ, the Finance Working Group recommends that a finding be made that any technology or project have potential to achieve commercial viability on an unsupported basis. In the pre-commercial phase, the Finance Working Group recognized that solar technologies and projects will produce electric power on a levelized cost basis that would be above the market price. The function of public support is to reduce the levelized cost of electricity in the pre-commercial period to the approximate market price so that the private sector can develop the projects and assume the normal business risks of the project.

In the pre-commercial phase, the Finance Working Group recommends that the Task Force pursue two broad categories of support. First, public supports can and should be given for basic infrastructure improvements that would ready the NTS or other sites to accept solar technologies for pre-commercial development. In addition, the public supports can and should be given on a project basis in order to further reduce the extraordinary risk and cost, associated with developing those projects in the pre-commercial period.

The magnitude of public supports required by the SEZ will depend upon three basic factors:

- First, the level of infrastructure investment required, such as water service, transmission upgrades, gas service, etc. This will in turn be a function of decisions about the development sites.

- Second, the ability of the individual technologies and projects to produce electricity at competitive costs without financial supports has to be determined.
- Third, the expected market price, that is, the levelized twenty or thirty year firm contract price, must be determined.

Given those three factors, the level of public supports can be determined once the decision is made about the distribution of the 1,000 megawatts among the various technology groups for initial development. Determining these values will involve further analysis, and eventually can only be determined by negotiation with project developers and utilities.

Given the current level of information about public support requirements, it seems likely that 25 percent to 35 percent of the public supports will be the maximum required for infrastructure development for the first 1,000 megawatts. That would leave at least 75 percent of the total public supports for individual project financing. Once the market price for the electricity generated at the SEZ is determined, it will be important to work with the solar industry to determine with greater certainty the ability of the portfolio of supports available to the SEZ to reduce or mitigate the commercial development risk faced by each technology.

As stated earlier, the expected portfolio of supports available from the SEZ includes a wide range of financing mechanisms. Obviously, a dollar grant for direct capital reduction is more effective than a dollar of low cost financing in terms of its ability to reduce final levelized costs. However, direct grants also reduce the amount of leveraging possible through using the money to back bonds, and therefore constrains the total amount of projects that can be financed. Efforts should go forward to secure at least these levels of support and to simultaneously work with the various industry groups to determine the most effective combination of measures to achieve the desired goal.

4.3 Principles Of Financial Support

In order to use public supports in the most efficient manner, it is critical that the SEZ look for all possible measures of financial support for the pre-commercial solar projects that they are developing and suggest ways in which the present structure of these financing mechanisms can be expanded to facilitate the SEZ's mission. Beyond the obvious assembly of renewable energy supports, the SEZ should look to such things as forward pricing from the project developers and coordination of efforts with the Department of Labor to structure the SEZ as an economically targeted investment.

Once the initial portfolio of supports has been assembled, the SEZ should establish clear principles for leveraging the maximum amount of private, project investment per dollar of public support. In order to do this, it will be necessary to determine on an independent basis the anticipated appropriate level of private investment in these initial

projects. As a benchmark, it seems appropriate that private developers should put up capital equal to what would be required to produce electricity from their given technologies at a rate equal to the market price. Thus, even in the initial pre-commercial projects, those with substantial public supports, the private developers will be expected to face a normal business and technology risk from individual projects. If private developers take on this level of risk, the Finance Working Group feels that the public supports assembled will have leveraged the maximum possible investment into the initial commercialization of these important solar technologies.

The leveraging of investment from public supports does not end with the pre-commercial projects. In any assessment of the environmental benefits of developing these renewable energy projects, the Finance Working Group recommends that the SEZ estimate the environmental benefits based upon the train of investments in pre-commercial and anticipated commercial projects that the SEZ supports.

An early distinction made by the Finance Working Group was the division of any technology into the pre-commercial and commercial phase. The Finance Working Group recognizes that the public supports are necessary in the pre-commercial period. In exchange for that support, the Finance Working Group recommends strongly that the Solar Enterprise Zone obtain either warrants, contingency payments or some other form of repayment that will allow the public to participate in the successful commercialization phases of the technologies they have supported. The Finance Working Group recognizes that this retention of participation in the successful commercial development of the technology will be important in several ways. First, it will over time provide an additional source of capital to the SEZ that can be reinvested or redeployed to further the commercialization of solar technologies. In addition, participation in successful commercialization should be used in any negotiation with the Office of Management and Budget in determining the budget impact of supports such as the full faith and credit guarantee of the Treasury as backing for low cost debt financing vehicles.

Using these principles, we believe the SEZ can show a substantial payback from the investment of public funds. This public payback should be measured in two ways. First, in terms of the environmental benefits from the commercialization of solar technologies. Second, the public benefits should include a measure of the likely payback that will result from the participation in the successful commercialization of these technologies. Both of these benefits, the environmental and the direct financial, should be used to show a substantial payback to the public from the provision of initial supports.

4.4 Public Support Portfolio

The following section describes the variety of supports the Finance Working Group believes can be assembled and offered to solar project developers in order to reduce pre-commercial project costs to competitive levels. This list is not an exhaustive catalog of all possible supports, and we intend to continue research and review of available financial mechanisms over the intervening period.

4.4.1 Land and Site Preparation

At least at the NTS, the SEZ can offer developers access to land for project development that has been prepared and environmentally assessed and mitigated, graded, prepared and secured for project development. All of this is a substantial portion of the early capital requirement of projects. Most industry estimates are that land and site preparation do not amount to more than five to seven percent of total project costs. However, these costs often come at the earliest possible stage of development, and are made completely with equity capital since financing these activities by debt is difficult. As such, this resource can be important in a disproportionate way to project developers in assisting them to start on project development. Based upon discussions with Kramer Junction and in particular Dave Kearney, the value of land and site preparation could reduce overall costs by roughly $200 per kW).

All of the sites will require some upgrading and investment in infrastructure. However, that investment is balanced by the creation of a substantial asset. The exact value of the asset depends upon the extent to which it is utilized. The capital costs for bringing a 500 MW export capability to the NTS, including a gas pipeline and a transmission upgrade, is roughly $100 million, it would create an asset that would reduce development costs of every new project by up to $200/kW. Natural gas and added transmission and generating facilities would also provide an attractive asset for other non-energy projects being considered for the NTS, which would help in achieving defense conversion objectives.

4.4.2 Forward Pricing

Private developers can reduce the cost of pre-commercial projects to competitive levels by subsidizing the pre-commercial projects with funds that will be recouped through higher returns to future successful projects. Basically the project developer banks on future technology improvements and profits to justify accepting low or no profit on early projects. This type of support may not be feasible for all development firms, particularly undercapitalized ones. Nevertheless, the SEZ should base a portion of its total financing portfolio in the form of forward pricing obtained through negotiations with those project developers capable of providing such support.

4.4.3 Commercialization Joint Venture Funds

Under both Public Law 101-218 and the Energy Policy Act of 1992, the Secretary of Energy is allowed and encouraged to commercialize renewable technologies by entering into joint ventures with private developers on a 50/50 cost share or some reasonable basis. These funds provide one of the most effective ways of reducing the levelized cost of pre-commercial projects to a level equal to the long-run contract price. To the extent these funds are available, the Department of Energy is encouraged to make them available to the SEZ for use with other supports in the development of technology at the NTS or suitable alternative sites. The Finance Working Group recognized that the attractiveness of joint venture funds was to some extent offset by the limited nature and the difficulty in obtaining them. While the joint venture funds may be the most effective way of lowering the cost of pre-commercial projects, the Finance Working Group recognized that they cannot be the only mechanism available in the portfolio. To the extent joint venture funds are offered for pre-commercial projects, the Finance Working Group recommends that significant participation in the potential commercial success of technologies be obtained either through stock warrants or negotiated contingency payments from project developers.

4.4.4 Low Cost Financing

In discussions with industry representatives it is clear that the preferred method of support for pre-commercial projects is low cost debt for project financing. In discussions with public finance experts as well as with industry representatives, one of the initial ways the SEZ could obtain access to low cost financing would be through utilization of all or a portion of the state of Nevada's available industrial revenue bonds. While those bonds are readily available and have a history of being successful in the development of businesses in Nevada, a severe drawback associated with this particular source is the state cap set at $150 million per year. This cap is low in terms of the need of the SEZ funding requirements. There are also a substantial number of projects that are already waiting for assistance from the available pool of industrial development bonds.

Besides using the available pool of industrial development bonds, several other mechanisms by which the Solar Enterprise Zone could obtain access to tax-exempt, state financing were identified. One of those avenues would be to establish one or a series of 501(c)3 non-profit corporations for the purpose of developing the solar technologies in question. A 501(c)3 corporation, if it can be established consistent with the legal requirements, will avoid the state cap on industrial revenue bonds, although it does have its own cap of $150 million of debt outstanding. In other words, were the Solar Enterprise Zone to establish one or more 501(c)3 corporations, those corporations could issue tax-exempt financing over and above the $150 million allocated to the state

at the present time. Another way to avoid the cap on industrial development bonds would be to create in federal tax law an additional special purpose exemption that would establish the commercialization of solar technology as an exempt purpose that would qualify for the issuance of tax-exempt bonds. As examples, hospitals, airports, and high speed rail systems currently have what are known as bullet exemptions which allow them to issue industrial development bonds on a tax-exempt basis over and above the normal state allocation.

Tax-exempt financing has the advantage of offering investors dividends exempt from taxation. As a result, investors are willing to accept a lower interest rate on tax-exempt financing than on equivalent taxed financing vehicles. Thus, the advantage of the tax-exempt financing stems from the forgiveness of taxes. This can provide an important advantage which will translate directly into lower cost of debt, which in turn would lower the levelized cost of electricity from SEZ projects. A problem with tax-exempt financing is that it does not reduce the technology risk which may be substantial for some solar commercial developments. The solar technologies under consideration for development at the Solar Enterprise Zone range from technologies that have been established and have a proven commercial operating record, i.e., the solar trough technology, at Kramer Junction, to technologies that have an unproven ability to operate on a commercial basis. This technological risk will be translated through the tax-exempt financing into a higher interest rate. In discussions the Finance Working Group had with industry representatives, it was strongly urged that the risk of this technology be lifted off of the project developers. In early solar trough projects, the technology risk had to be hedged by offering warrants of performance to investors. These warrants in turn imposed a cost on the project. If the technology risk is either reflected directly in the higher interest rates passed on through the cost of an insurance premium to the project developers, the fundamental purpose of lowering the pre-commercial cost of electricity from these technologies will not be achieved.

In order to remove the technology risk from the pre-commercial projects, one of two avenues is available. If state tax-exempt financing through 501(c)3 or bullet exemption is pursued, a pool of funds should be assembled which can be offered to investors as essentially a warrant or guarantee of performance which should be sufficient to remove the technology risk. An alternative route, would be to pursue full faith and credit guarantees from the federal government for a portion of the SEZ's obligations. These full faith and credit guarantees serve to insulate the particular issuance of debt from the technology risk that the debt would be applied to. Under current federal budgetary restrictions, any full faith and credit guarantees will have to be assessed by the Office of Management and Budget in order to determine their impact on the federal budget. Essentially, this process involves assessing the rate of utilization of the full faith and credit guarantees, and the subsequent assessment of the net present value of those guarantees as they are

used over the life of the project. This net present value then has be offset by some other tax revenues. The Financing Group recommends that when the cost of full faith and credit guarantees is evaluated, it should also include an assessment of the likely payback from the SEZ's participation in the commercial success of solar technologies. The budgetary cost of any full faith and credit guarantees can be significantly reduced by netting those budgetary losses against the budgetary gains that would be obtained by warrants or other forms of participation in the commercial success.

In summary, the tax-exempt or low cost financing should be looked at as a major portion of the portfolio of supports that can be assembled and offered to project developers. It is the opinion of the Finance Working Group that both 501(c)3 financing with an offsetting insurance pool and obligations backed by full faith and credit guarantees should be pursued.

4.4.5 Special Tax Exemption

Targeted industries operating in special areas are offered either partial or full forgiveness of federal tax liability. As an example, medical and pharmaceutical companies operating in Puerto Rico have utilized this type of financing support in the past. Although it would require modification of the tax code and therefore not be available for immediate utilization in the Solar Enterprise Zone, one recommendation of the Finance Working Group is that the Solar Enterprise Zone pursue an exemption from taxes for projects developing technology in a pre-commercial phase in the Solar Enterprise Zone. Project qualifying under both of those conditions could be forgiven all or part of their federal tax liability, in essence allowing them to mimic from a financial perspective a project developed using only before tax dollars and effectively lowering the levelized cost of electricity from these projects.

4.4.6 Small Business Investment Corporation

The Finance Working Group has had several lengthy discussions with Nevada representatives of small business investment corporations. A small business investment corporation or a minority enterprise small business investment corporation could operate in parallel with the Solar Enterprise Zone to reduce the ultimate levelized cost of electricity. Low cost loans to qualified small businesses can be used to acquire operations. If a minority enterprise small business investment corporation can be established to work with the solar developers, the ability to leverage private investment as well as the availability of funds to write down the interest on funds obtained through private placement is substantial. Small business subcontractors or equipment manufacturers that would supply parts to solar projects could be backed by a small business investment corporation, which in turn could reduce the cost of services and products supplied to solar project developers. Although no

attempt has been made to quantify the effect of this participation, it is highly recommended that the small business investment corporation be integrated with the development of solar projects by the Solar Enterprise Zone. In addition to lowering the levelized costs of electricity from the pre-commercial projects, the support of the small business investment corporation could also be expected to maximize the local manufacturing and employment potential in Nevada.

4.4.7 Private Funds

The Solar Enterprise Zone offers a unique way for private investment to participate in solar technology. The Solar Enterprise Zone in the development of a 1,000 MW portfolio of solar technology offers private investors the possibility of diversifying investment in a variety of technologies not easily available in the absence of the Solar Enterprise Zone. This diversity can significantly reduce the technology risk faced by any particular investment and could provide an attractive investment opportunity for private funds. In addition, the Finance Working Group recommends that the Solar Enterprise Zone pursue what is known as Economically Targeted Investments. There are several investment banking firms which specialize in placing public funds, such as union pension funds, in investment projects that further important non-financial goals of the private funds. In the case of pension funds, investments are sometimes made in projects that will provide the potential for employment of members of that union. Thus, economically targeted investments seek a reasonable market return on investments as well as a leveraging of non-financial benefits such as job creation. Since a major function of the Solar Enterprise Zone is to enhance local economic development and job creation in the Las Vegas area, the ability of the Solar Enterprise Zone to attract economically targeted investments is substantial and should be pursued.

4.4.8 Extraordinary Measures

In addition to assembling a portfolio of public supports from mechanisms that are readily available, the Finance Working Group looked at some measures that would require modification of existing law but which seem to provide the possibility of rather substantial supports. The Energy Policy Act of 1992 allows for a tax credit of 1.5¢/kWh for every kWh generated from identified renewable resources. Solar energy is not among those resources at the present time. In addition, the tax credits are available to the business owning the renewable projects only to the extent the tax credits do not reduce taxes below the alternative minimum tax for that particular business. At current estimates on SEZ energy generation this credit could have a value of $50 million to SEZ developers. Relaxing one or both of those restrictions would create a substantial public support for the development of pre-commercial projects at the SEZ. The tax credit restrictions can be lifted first by

making them available to solar technology and second by making the tax credits available for sale to individual investors who buy them solely for the utilization of the tax credits and not in order to become equity investors in the solar technology projects.

If the tax credits were available to a solar thermal technology that could operate on a purely solar basis at a sixty percent capacity factor, and if the tax credits could be offered to individual investors, the tax credits could attract $670 of public support per kW of installed solar thermal capacity. (That calculation is based upon a capacity factor of sixty percent, a required return to investors of ten percent on a tax-free investment). Thus, making those two concessions available to this particular solar thermal technology would provide a source of capital capable of reducing the installed capacity cost by $671 per kW for every kilowatt installed. Thus, if the initial, pre-commercial estimated cost of this particular solar thermal technology was $3,000 per kW, the availability of this single concession would reduce the installed capital cost by almost 25 percent. This reduction alone would be sufficient to reduce the levelized cost of electricity by an equivalent 25 percent figure.

5. LEGAL ISSUES

5.1 Summary

5.1.1 Approach

The Legal Work Group's activities had two major thrusts. The first, and most critical effort, was conducted by the sponsor of the Legal Work Group, State Senator Dina Titus. She has been heading a Legislative Commission which was formulating draft legislation and recommendations for the Nevada Legislature that would create a new legal framework for renewable energy development in Nevada. The second effort was to provide analyses in response to the concepts

5.2 Nevada Initiatives

5.2.1 Legislative and Regulatory Actions

The State of Nevada is currently reviewing legislative initiatives that would benefit the development of the Solar Enterprise Zone. In light of these efforts, the Legal Work Group recommends that the Nevada State Legislature:

- Issue a legislative finding of state policy that government and private enterprise need to accelerate the commercialization of renewable energy generating technologies and to maximize the use of indigenous resources to the extent economically feasible;
- Express the Legislature's support for efforts to develop a Solar Enterprise Zone in Nevada;
- Create an ongoing statutory committee on energy in the Legislature;
- Urge all departments in the Executive Branch of the Nevada State Government to work with the U.S. Department of Energy and other federal offices to coordinate efforts, pursue facility construction and develop a solar strategic plan for southern Nevada; Urge, by resolution, that the Governor's Office direct the Nevada Department of Business and Industry and the Public Service Commission (PSC) to provide input to the solar strategic plan on opportunities to coordinate programs and initiatives that can benefit from and encourage the development of a competitive solar industry in Nevada, including:
    - job training programs;
    - minority and small business development programs;
    - industrial development incentives;
    - technical and regulatory assistance; and
    - aid in siting, licensing and permitting processes;
- Urge the PSC to develop policies that encourage the analysis and selection of solar energy generating options in utility resource planning, and issue guidance on cost recovery and rate issues to assure utilities of Nevada's commitment to solar development.

5.2.2 Finance Actions

The Legal Work Group recommends that the Nevada State Legislature take the following actions related to financing SEZ activities:

- Endorse a state partnership with federal agencies, the solar industry and utilities to organize and create new supports for renewable

energy development as part of the development and implementation of a Nevada Solar Enterprise Zone, including:

- using revenue bonds and other low-cost financing mechanisms available to Nevada;
- leading project development efforts for the proposed Solar Enterprise Zone in Southern Nevada;
- leveraging federal and state resources available to support solar energy development;
- developing markets and purchase commitments for solar energy projects;
- advising the legislature and the Governor's office on opportunities and barriers for further accelerating solar energy commercialization; and
- managing its projects and contractual agreements with solar energy developers to provide an opportunity to increase profits from successful technology commercialization efforts.

- Adopt a resolution encouraging the Nevada Congressional delegation to seek an exemption from federal restrictions on the volume of tax-exempt bond financing for the Solar Enterprise Zone.
- Include all forms of renewable energy property on eligibility lists for property tax exemption.
- Exempt renewable energy equipment from sales and use taxes.

5.2.3 Market Actions

The Legal Work Group recommends that the Nevada State Legislature take the following actions related to building a market for SEZ power:

- Require the PSC of Nevada to develop optional green tariffs for Nevada customers who wish to support renewable energy projects through a specific tariff earmarked for those types of projects. Require that in developing and implementing a green tariff program, the PSC of Nevada consider successes and failures in development of green pricing and advise the utilities under its supervision on structuring the tariff and marketing efforts for the program to maximize participation and the benefits for solar energy development.
- Require that Nevada's investor-owned utilities meet not less than 10% of new growth with solar and renewable energy resources until utility resource plans reach a level of 10% of overall capacity from renewable resources, within a competitive price range compared to the cost of constructing conventional generating alternatives. Direct

the PSC of Nevada, in implementing this requirement, to coordinate with other state efforts to foster renewable energy development by earmarking the set-aside for projects from the Solar Enterprise Zone initiative. Urge the PSC to develop policies and procedures that will maximize the value of this set-aside for solar energy commercialization. Options considered for maximizing the benefits of the set-aside for solar energy development should include but not be limited to:

- increasing or accelerating the set-aside to match the capacity and installation dates of proposed solar projects;
- coordination with any green tariff efforts initiated by the legislature or the PSC;
- clear cost and pricing guidelines that take account of the economic and environmental benefits of solar energy as well as current competitive cost levels in utility cost recovery and rate decisions, which can provide realistic benchmarks for solar energy project developers and support programs;
- providing solar projects with the right of first refusal for all new capacity additions by allowing Solar Enterprise Zone projects the right to make competitive counter-offers.

- Recommend that the PSC support modular, distributed uses of renewable energy, including for those customers at remote locations who would otherwise need costly line extensions or other less desirable generation options.

5.2.4 Infrastructure Actions

Finally, the Legal Work Group recommends that the Nevada State Legislature direct the State Energy Office, in cooperation with the Public Service Commission (PSC) of Nevada and in coordination with other state and federal renewable energy efforts, to examine the feasibility of utility participation in the development of renewable technologies, and to study the potential of using the transmission system to access renewable energy resources.

5.3 Term Contract Authority to Purchase Power

DOE has unlimited term contract authority to enter into purchase arrangements (§646(a), DOE Organization Act). This authority would be applicable to utility purchases. The term of such contracts is limited by funding availability as required under the Antideficiency Act (31 U.S.C. §1341). Because DOE has no-year funding, it could enter into a 25 year power purchase contract only if the total amount of the 25 year purchase was obligated by DOE up-front at time of execution.

GSA has statutory exception from the Antideficiency Act. (42 U.S.C. §201(a)(3)). This authority allows GSA authority to enter into up to 10 year power purchase contracts and only obligate the current year's purchase from available funds. This 10 year authority was delegated to DOE by GSA in 1987.

In order to enter into a power purchase agreement beyond 10 years and only obligate the current year's need, a specific statutory exemption from the Antideficiency Act would be required.

5.4 Authority Needed to Avoid Competitive Procurement of Power

DOE Order 4550.1c FAR subpart 8.3 and DEAR subpart 9089.3 requires the competitive procurement of utility services at market rates or less. A sole source procurement for power above the competitive market price would not likely fit within the exceptions to the full and open competition requirement of the Competition in Contracting Act (41 U.S.C §253(c)). (The only exception that is close is the "Public Interest" exception, 42 U.S.C. §253(c)(7), and it is unlikely this exception could be justified here.)

Specific authority is needed to authorize a sole-source purchase of SEZ power by DOE if it is above the market price as a set-aside. If such legislation is obtained there should be no difficulty in obtaining power from an on-site operator.

5.5 SEZ Relationship to EPAct and Defense Authorization Act

The Energy Policy Act in section 2111, (42 U.S.C. §13471(a)), requires the Secretary to conduct a five year program to "provide... for the generation of electricity from renewable energy sources for grid and nongrid application, including field demonstrations... to prove technical and economic feasibility for providing cost effective generation." The SEZ could be considered part of this EPAct authorized program.

The SEZ could also fall within certain defense conversion provisions of the Defense Authorization Act of 1994, Pub. L. No 103-160, §§ 3154 and 3155 regarding lease and transfer of DOE property for purposes of defense conversion to civilian uses.

6. INDUSTRY ISSUES

6.1 Summary

6.1.1 Approach

The Industry Work Group's task was to seek input from solar industry representatives, particularly those who submitted an Expression of Interest (EOI). In particular, the Work Group consulted with the solar industry to:

- identify a deployment scenario that would enable industry to lower overall costs by achieving economies of scale;
- supply the other work groups with technical and financial data;
- investigate the opportunities for exporting solar technologies;
- identify the employment impacts of manufacturing and solar power generating facilities; and
- outline the benefits anticipated from the development of a SEZ.

6.1.2 Findings and Recommendations

The Industry Work Group found that a 1,000 MW planning scenario will be sufficient to act as a catalyst for expanding sustainable solar technology commercialization if:

- the scenario is modified to match Table 6-1, which best complements the commercialization strategies of technology companies or consortia;
- the competitive structure provides for multi-year project commitments;
- there are separate technology tracks; and
- there is a multiple site approach.

The Industry Work Group found there are sufficient market opportunities to support a robust solar industry after the SEZ planning period. There are at least 15,000 MW in capacity additions in the western United States for which cost-effective solar technologies could compete in the 10 years after the SEZ planning period. There are approximately 250,000 MW of capacity additions in international markets where solar technologies could compete in the 10 years after the SEZ planning period. Capturing 20 percent of domestic opportunities, or 300 MW per year, and 2 percent of international opportunities, or 500 MW per year, would support a vibrant solar technology industry.

Solar technologies can be cost competitive in the anticipated deregulated electricity market in the post SEZ period because of a combination of decreasing solar electricity costs and increasing solar electricity value. Solar electricity costs will fall because of production volumes and technology advances. Solar electricity value will increase as the benefits of clean electricity and the risk associated fuel price swings are taken into account in the commodity market price for electricity.

The Industry Work Group believes that investment in the Solar Enterprise Zone will bring significant employment benefits with construction jobs in the near-term, and expanding manufacturing jobs over the long-term, as well as local economic development and environmental benefits.

6.2 Sustainable Solar Technology Commercialization

To achieve sustainable solar technology commercialization, industry needs to deploy enough systems to scale-up manufacturing and obtain the learning curve effects, which will drive levelized electricity costs down to the point where the technologies are cost competitive. In discussions with industry, the Work Group found that the 1,000 MW planning scenario could act as the catalyst for driving down costs, but would have to be properly structured to achieve this result. The Work Group recommends the competitive structure should include:

- a modification of the original planning scenario to align it with technology commercialization strategies;
- multi-year project commitments so technology companies or consortia can achieve learning curve effects;
- separate technology tracks; and
- a multiple site approach.

6.2.1 Deployment Scenario

The Work Group found that a modified deployment scenario that complements the commercialization strategies of technology companies or consortia would help the SEZ become a catalyst for commercialization as opposed to an isolated project opportunity. As a result, the deployment scenario outlined in Table 6-1 is a slight modification of the original deployment schedule. The industry members realize that the planning scenario may need further refinement to take into account the market for the solar electricity produced by the plants, overall cost of the initiative and the commercialization strategies of other, potential new participants.

Table 6-1: Updated Deployment Scenario

Deployment in MW	'97	'98	'99	'00	'01	'02	'03	Total
Flat Plate PV	5	5	10	20	20	20	20	100
Concentrator PV	5	10	15	20	30	40	70	190
Dish/Stirling	—	1	5	25	40	50	70	191
Solar Trough	80	200	—	—	—	—	—	280
Central Receiver	—	—	200	—	—	—	—	200
Total	**90**	**216**	**230**	**65**	**90**	**110**	**160**	**961**

The following is a brief explanation of the rationale for the new scenario by technology:

6.2.1.1 Parabolic Trough

The commercialization strategy for the parabolic trough consortia organized by the Kramer Junction Company focuses on near term project opportunities in international markets. Some potential customers have expressed interest in the older Solar Electric Generating System (SEGS) technology, while others have expressed interest in the proposed Integrated Solar Combined Cycle System (ISCCS). The SEZ provides the necessary domestic proving ground for these technologies, which is a crucial element in obtaining customer and multi-lateral funding agency commitments for these international projects. Thus, the trough consortium has proposed deployment of both technologies as early as possible.

6.2.1.2 Power Tower

The commercialization strategy for the power tower consortium focuses on deployment in the SEZ, which allows for a steady 5-year build rate for heliostats, the mirrors that focus the sun on the power tower. Amortization of heliostat manufacturing tooling and facilities over the initial SEZ plants not only provides cost-effective heliostats for SEZ plants, it allows the cost of heliostats for subsequent power towers to be based on the maintenance of existing infrastructure only. This will allow a significant drop in the price of heliostats so that subsequent power towers will be able to compete directly with conventional power plants. The consortium's preferred option is constructing a 200 MW solar-only plant over a 3-year period. The plant would be operational at a 15 percent capacity in the first year; through additions in the second and third years, capacity would increase to 45 percent. The commercialization strategy calls for an additional 200 MW intermediate

capacity solar-only plant, but because it is likely to be cost competitive it is not included in the 1,000 MW planning scenario.

6.2.1.3 Dish Engine

The commercialization strategy for the various dish engine manufacturers calls for a steady ramp-up of production over a period of years. An annual production rate of 75 to 100 MW per company is required to achieve lowest possible unit costs, and a levelized electricity cost competitive with conventional utility peaking and intermediate capacity power plants. Neither the original 1,000 MW scenario nor the recommended modification contemplates this level of deployment in the SEZ. However, because of the modular nature of the technology, there will be high value distributed utility and remote power applications outside the SEZ which require no public support. To achieve the production volumes required to compete directly with conventional fuels, power plants will require additional deployment in the SEZ and/or successful exploitation of these high value markets outside the SEZ.

6.2.1.4 Concentrating Photovoltaic

The commercialization strategy for the various concentrating PV manufacturers also calls for a steady ramp-up of production over a period of years. An annual production rate of 50 to 100 MW per company is required to achieve lowest possible unit costs, and a levelized electricity cost competitive with conventional utility peaking and intermediate capacity power plants. As with dish engine, neither the original 1,000 MW scenario nor the recommended modification contemplates this level of deployment in the SEZ. However, because of the modular nature of the technology there will be high value distributed utility and remote power applications outside the SEZ which will require no public support. To achieve the production volumes required to compete directly with conventional power plants, additional deployment in the SEZ and/or successful exploitation of these high value markets outside the SEZ will be required.

6.2.1.5 Flat Plate Photovoltaic

The strategy of the two flat plate PV EOI responses is to combine the construction of a manufacturing facility and phased deployment of a total of 100 MW of the output of the plant over a 5-year period.

6.2.2 Learning Curve Effects

achieve the goal of technology cost reduction, the competitive structure of the SEZ should provide for commitments over a series of years.

6.2.3 Technology Issues

The Work Group encourages considering a broad range of solar technologies for SEZ deployment. The variety of solar technologies have different strengths and market applications and all show strong potential to be cost competitive with traditional fossil-based technologies. However, each is at a different stage in its technology development and may require differing levels of assistance. The purpose of the SEZ is to expand sustainable solar technology commercialization and not the commercialization efforts of one particular company or technology. Thus, the competitive structure of the SEZ needs to take into account the differing development stages of the technologies and allow for differing levels or kinds of public assistance. To achieve this, the Work Group recommends that the competitive structure include separate technology tracks to allow for competition among companies within a technology group.

6.2.4 Siting

The Industry Work Group encourages a multiple site approach, to keep the need for new infrastructure to a minimum and to help avoid the constraints imposed by the physical limitations (primarily water) of some sites which would inhibit the deployment of certain technologies.

6.3 Post SEZ Market Opportunities

The Industry Work Group came to the conclusion that there will be significant opportunities in domestic and international markets to support a robust solar electric industry in the years following the SEZ planning period.

Meridian Corporation recently completed a survey of certain utilities in three western states - California, Nevada and Arizona - which revealed announced capacity additions (a generally conservative measure of actual needs) of 10,000 MW over the years 2002-2012. These capacity additions are primarily for peaking and intermediate capacity plants which are appropriate for solar technologies. There are several other western states where solar thermal and concentrating technologies could compete effectively: New Mexico, Utah, Texas and possibly Idaho and Oregon.

There are several trends which impact positively on solar electric market opportunities. First, increasingly stringent air quality standards for local pollutants such as SO_x, NO_x, and particulates, as well as global pollutants such as CO_2 favor solar electric technologies. Second,

increasing environmental concerns will continue to reduce federal hydroelectric capacity in the West, creating a need to replace this capacity. Third, deregulation of the utility industry, which in the near-term is a net negative for solar technology development, will likely be a net positive over the long-term for the following reasons:

- Competition will likely mean utility shareholders will assume more of the risks - the risk of increasing environmental costs and fuel price risk - currently borne by utility ratepayers. Central station and distributed solar technologies will allow the utilities, Independent Power Producers, and/or their customers to avoid these risks.
- Competition will create opportunities for small scale, distributed technologies such as dish engines, flat plate and concentrating PV.
- Competition will likely create a broad range of electricity products through the development of a futures and forward markets for electricity. In such markets, solar electricity will command a premium price because the value of clean electricity and the risk of fuel price variability will be explicitly priced.

While further market analysis is needed, it appears there are at least 15,000 MW in capacity additions in western states for which cost effective solar technologies could compete in the 10 years after the SEZ planning period. Capturing 20 percent of this capacity, or 3,000 MW, would support a robust solar electric technology industry over the period.

International markets, opportunities are even greater. Solar thermal and concentrating PV technology companies are focusing on utility, industrial, and remote power markets in Mexico, India, China, North Africa, and certain Latin American countries. As the solar resource is better characterized, other countries or regions may present attractive opportunities. The domestic market trends which impact positively on solar technology market opportunities are present in international markets as well. The World Bank and other multi-lateral funding institutions are increasingly using environmental criteria in power project financing, and the Global Environment Facility (GEF) has been set up specifically to assist environmentally oriented infrastructure projects.

Based on IEA and World Bank projections, there will be approximately 250,000 MW of capacity additions over the period 2000-2010 in the above mentioned countries. Capturing 2 percent, or 5,000 MW, would support a robust solar technology industry over the period.

6.4 Benefits Provided by the SEZ

Investment in sustainable solar technology commercialization will provide employment, local economic development, environmental benefits, and the creation of export opportunities.

6.4.1 Employment

6.4.1.1 Employment Estimates

At the macroeconomic level, solar electric technologies provide greater U.S. employment opportunities than conventional fossil fuel technologies. The "fuel" for solar - the mirror collector field or PV array - is manufactured, as opposed to mined, pumped out of the ground, or imported from a foreign country.

The SEZ provides the state of Nevada the chance to capture these employment opportunities, but it will also enhance employment opportunities in the many other states which would provide the components to the SEZ power plants. Estimated employment impacts for Nevada and the US are exhibited in Figure 6-1 and Figure 6-2.

Figure 6-1: Nevada Employment

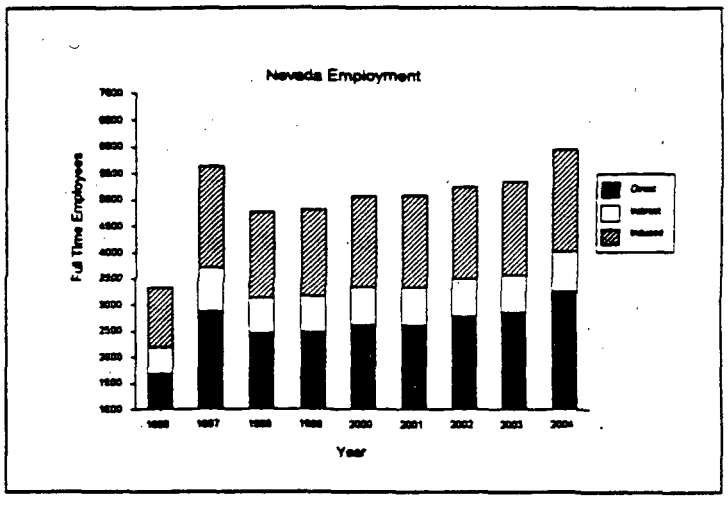
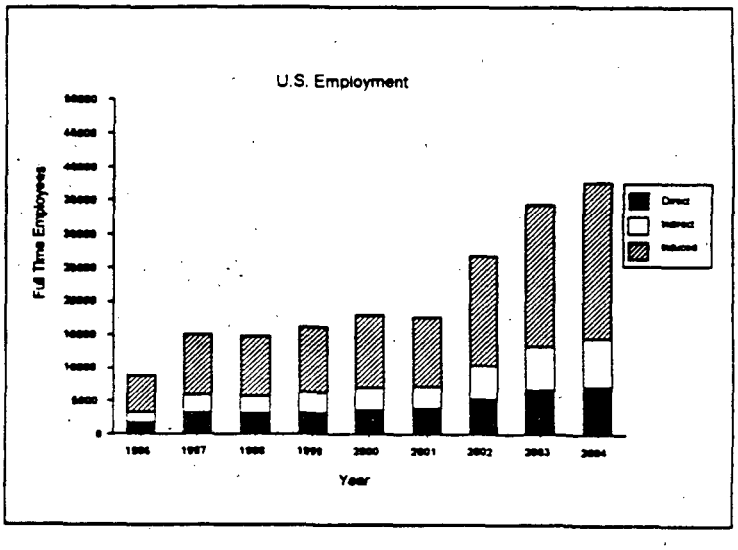


Figure 6-2: U.S. Employment



In the early years, the employment figures in Nevada are driven by construction jobs for the deployment the SEZ power plants. Manufacturing (with the exception of the proposed flat plate PV plants) is primarily done at existing plant locations in other states. In later years, a transition will be made from primarily construction to primarily manufacturing jobs as new and existing solar technology companies will need to increase their capacity to take advantage of expanding market opportunities. The SEZ acts as the catalyst for sustainable

commercialization, and the technologies diffuse into fully commercial markets at a rate of about 800 MW per annum over the period 2003-2012 (300 MW per annum domestic, 500 MW per annum international). Southern Nevada is centrally located to domestic markets and its proximity to Mexico make it an attractive spot for a solar manufacturing facilities. All companies have indicated a willingness to consider locating manufacturing facilities in the southern Nevada area, and we have included in the estimates a dish engine factory, a PV concentrator factory and a heliostat production factory all coming on-line in the 2001-2003 time frame.

6.4.1.2 SEZ in Relation to Existing NTS Employees

An important goal of the SEZ is to provide employment for NTS workers as the NTS's defense mission is downsized. Industry believes if properly structured, the SEZ initiative can fulfill this goal with construction jobs in the near-term, and the transition to manufacturing jobs over the long-term.

Construction labor is a significant component in the installed capital cost of a solar power plant. Industry recommends exploring the possibility of sub-contracting NTS personnel (and construction equipment) to private developers at a subsidized rate. Such assistance may provide a greater overall impact on lowering the electricity costs of the initial plants than contributions of land or the building of infrastructure. In the near-term it is not likely the NTS will be called on to perform its defense mission; however, it will need to maintain personnel to be prepared if necessary. Putting personnel to work on SEZ projects in the interim is an efficient "dual use". In addition, the SEZ provides a gradual transition for personnel from NTS employment to related employment (construction of SEZ plants), to employment in a new industry (solar manufacturing jobs).

6.4.2 Local Economic Development

The solar technology commercialization will also contribute to local economic development. In the near-term, in addition to the proposed flat plate PV manufacturing facilities, the SEZ will stimulate local manufacturing support facilities such as assembly plants and research and development support businesses. Over the long-term, a properly structured SEZ will lead to manufacturing facilities.

6.4.3 Environmental Benefits

The proposed modified deployment scenario provides significant environmental benefits by offsetting fossil fuel generated electricity with low or non polluting solar electricity. Table 6-2 shows the air pollution that would be generated if the power used was coal-fired rather than solar energy.

Table 6-2: Pollution Offset Estimates

Pollution Offsets	'97	'98	'99	'00	'01	'02	'03	Total	Post '03 Annual Increase
SO_2 ('000 kg)	394	892	1549	2394	3366	3831	4567	16,993	1752
NOx ('000 kg)	448	1014	1762	2723	3829	4357	5194	19,329	1993
CO_2 (Million kg)	138	313	544	841	1182	1346	1604	5969	615

The air quality regulations covering these pollutants will be evolving over the SEZ planning period. Regulations for SO_2 are covered in Title IV of the Clean Air Act, Phase I of which will go into effect in 1996, followed by a much stricter Phase II in 2000. Regulations for NOx are in the process of further development. Control of CO_2 is under development through voluntary efforts, but may be regulated in the future if voluntary targets are not met. The Grand Canyon Air Quality Transport Commission (under the aegis of the Western Governors Association) is in the process of developing a plan to improve air quality in the Grand Canyon.

Throughout the SEZ planning period, western state utilities and Independent Power Producers will be developing strategies and spending significantly to comply with these evolving and increasingly stringent regulations. Even if a utility is relatively clean, current regulatory policy direction (as already enacted for SO_2 pollution) allows a utility to sell "pollution credits" to other utilities by over complying with the regulatory requirement.

The Industry Work Group found that the solar industry does not rely on power markets paying a premium for the environmental benefits of solar electricity in the near-term. However, industry recommended establishing a mechanism which, over time, will assist in developing power contracts that take into account the premium an individual utility will pay for solar electricity based on its ability to offset the cost of pollution control equipment and/or the ability to generate pollution credits.

6.4.4 Export Opportunities

There is significant export potential for solar technologies in both the near and long-term. In particular, the Mexican market presents an export opportunity which will encourage solar manufacturing facilities in the southern Nevada area.

7. WATER

7.1 Summary

7.1.1 Approach

The Water Work Group's task was to prepare an initial investigation of issues relevant to the cooling of solar thermal power generation plants at proposed SEZ sites. In particular, the Work Group sought information concerning:

- Water availability;
- The cost of accessing the water; and
- The applicability of dry cooling as an alternative to water cooling.

The Water Work Group conducted its inquiry through analysis of available data and a series of interviews with experts on southern Nevada water issues, including representatives from the Colorado River Commission, the State Engineers Office, the Southern Nevada Water Authority, the City of Boulder City, and the Nevada Operations Office of the U.S. Department of Energy.

7.1.2 Findings and Recommendations

The Water Work Group found that under 4,000 acre-feet per year (AFY) would be needed for parabolic trough and power tower applications at the proposed 1000 MW SEZ. The photovoltaic and dish/Stirling applications need negligible amounts of water.

The water work group has identified between 2,000 and 4,000 acre-feet per year (AFY) of water for use at the SEZ sites. This may cover the nearly 4,000 AFY needed for full deployment of the 1,000 MW scenario, but would leave little room for additional water-consumptive solar technologies at the SEZ. Consequently, the Water Work Group recommends that the Task Force consider further investigation of dry cooling for parabolic trough and power tower technologies. Dry cooling for these typically water intensive technologies can be used at a premium power cost of up to 10 percent (a capital cost increase of about 4.8 percent and a performance decrease of approximately 4.4 percent).

The Nevada Test Site (NTS) and Eldorado Valley are the most promising sites for water. Ground water will be the major source for power plant applications at the NTS. Estimates of ground water flow at the NTS range from about 1,000 AFY at the proposed SEZ site to 24,000 AFY for all basins comprising the NTS. Experts disagree on the ultimate destination of groundwater flow which sustains ecosystems in and around the NTS. However, considerable data available at the NTS

indicates that use of 1,000 AFY of this water should not have damaging effects.

Between 1,000 and 3,000 AFY of water may be available from Boulder City for solar power generation applications in the Eldorado Valley. Because the Eldorado Valley site is downhill from Boulder City, the pumping charges for using Boulder City water would be minimal. Actual charges for land and water use will be worked out for each individual project but could run as high as $174,000 for untreated irrigation water or $348,000 per year for treated water in a 100 MW solar trough. It is possible that Boulder City may supply water at low cost for some sharing of the power generated.

Permits will have to be obtained for SEZ use of Nevada water. Depending upon the location, both the National Park Service and the U.S. Fish and Wildlife Service may be in opposition.

The State Engineer's Office should be an active participant in all future water use discussions. For SEZ applications outside of the NTS, the Southern Nevada Water Authority and Las Vegas Valley Water District should also be involved.

7.1.3 Background and Assumptions

It is too early to determine exactly how much water will be required to support 1,000 MW of solar technologies; however, the EOIs indicated that less than 4,000 AFY would be needed for the most recent industry scenario: 200 MW power tower, 80 MW parabolic trough (SEGS) plant, and a 200 MW integrated solar combined cycle system (ISCCS). Of these technologies, the power tower uses approximately 11 AFY/MW, the SEGS uses 10.6 AFY/MW, and the ISCCS uses 3.5 AFY/MW. Photovoltaic and dish/Stirling systems do not require water for cooling. Cooling of the SEGS and power tower systems with air, rather than water, has been considered, and is referred to as "dry" cooling. As will be shown later, dry cooling tends to impose both capital and operating cost penalties on the power generated.

There are two sources of water in southern Nevada: the Colorado River and ground water. To determine the availability of water from the Colorado River, the Water Work Group met with Janet Rogers of the Colorado River Commission (a state of Nevada entity charged with overseeing the allocations of the Nevada portion of the Colorado River flow). She was very explicit that no new water could be used from the Nevada allocation from Colorado River for consumptive purposes like evaporative cooling for power plants.[1] Hence, the Water Work Group primarily focused its efforts on determining the availability of ground

[1] A water expert outside state government expressed surprise at this stance, inasmuch as developing a power generation capability could be valuable later in sea water desalting schemes that might be able to "buy" Nevada a higher allocation from the Colorado River at some later date.

water for solar generation. One exception will involve the discussion of Boulder City, which receives water from the Colorado River.

There are three crucial steps for accessing ground water in southern Nevada: finding the water, obtaining a permit and drilling the well. First, the water availability must be substantiated. This will almost always involve drilling exploratory wells, which can be a costly endeavor. The depth of the water has a profound effect on this cost. In general, the higher the altitude of the location, the higher will be the cost of the well.

When the water availability is established, the right to appropriate the water has to be permitted through the State Engineer's Office. The State Engineer's Office primarily considers three questions before granting a permit: (1) Is unappropriated water available? (2) Will the requested permit impact existing rights? and (3) Is the request in the public interest?

As with exploratory drilling, the costs of wells vary depending on the depth of the well, the contractors used and on the well's purpose. In Area 5 at the NTS, for example, a well drilled to research the NTS hydrology, cost approximately $800,000;[2] however, wells drilled there without scientific controls can cost considerably less. Costs at Eldorado Valley and Harry Allen sites may be less because required depths may be shallower.

7.2 Water Resources at the NTS and Adjoining Areas

The hydrology of the region around the NTS may be the most complex in the western United States. Groundwater is found in two layers made up of volcanic rock and limestone. The volcanic layer acts like a basin with a constant level of water over a wide area. The limestone layers underlying the volcanic layer is more like a network of rivers, holes and sinks. Consequently, drilling for water in the limestone is financially risky: there is a good chance of sinking a dry well.

Within the NTS site, the focus will be on available ground water at the proposed SEZ site (hereafter referred to as Area 25) of the Test Site. However, some information will also be given for Area 5 which lies east of Area 25. While the latter is not considered to be a site for potential solar power generation plants because of defense and other reservations, location may have more abundant water than Area 25. It is possible that water might be transported from a source in Area 5 to a use in Area 25. This, of course, would require investment in a transport system.

[2] Reynolds Electrical & Engineering Co., Inc., "Order of Magnitude Estimate, Area 5 Standard Water Well," personal communication from S. Herrera, USDOE, September 7, 1994.

The water under the NTS generally flows from the NE to the SW toward Death Valley.[3] There is an ongoing DOE study to map the velocity of water flows and identify flow rates of contaminated water (Approximately 25 percent of the underground nuclear tests were performed in the water table.)

From July 1993 through June 1994 the NTS used 1884 AF of water. Unfortunately, the data on the total supply available to the NTS is not very clear. Studies estimating ground water recharge in and around Area 25 reach widely different conclusions because the hydrology at the NTS is so complex. The NTS Hydrology Program Manager, D. Duncan, estimates that approximately 1,000 AFY of water flow under Area 25, and he states that this estimate could be a factor of 2 in error. Table 7-1 lists some of the estimated recharge rates.

Table 7-1: Ground Water Estimates at NTS and Area 25

Ground Water Estimates at NTS and Area 25	
Location	**Recharge Rate**
Precipitation recharge in the western portion of Jackass Flat sub-basin in Area 25[4]	580 AFY
State of Nevada estimate of recharge within NTS and closely adjoining areas	24,000 AFY
Eastern Pahute Mesa recharge (40 miles north of Area 25)[5]	800 AFY
Alkali Flat sub-basin recharge (adjacent to Area 25)[6]	15,700 AFY

Water might be brought to Area 25 from other areas within or outside the NTS. One adjacent site that could potentially supply water for the NTS is the Amargosa Valley. Expecting a thriving agricultural community in the Amargosa, Nevada permitted 24,000 AFY, but sandstorms and high winds have made water-intensive farming uneconomical, so only 3900 AFY is currently used. There has been a recent attempt to make the 20,100 AFY of unused water rights available for repermitting.

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[3] G.W. Quinn, P.E., Chief Engineer, Southern Nevada Branch Office, State of Nevada Division of Water Resources, 702/486-7052 & D. Duncan, Hydrology Program Manager, USDOE Nevada Operations Office, 702/295-0952.

[4] Nevada State Engineer Ruling #3870.

[5] L. Borg et al., "Information Pertinent to the Migration of Radionuclides in Ground Water at the Nevada Test Site, Part 1: Review and Analysis of Existing Information, "Lawrence Livermore National Laboratory, UCRL-52078 Pt. 1, May 25, 1976.

[6] "Hydrology of Yucca Mountain and Vicinity, Nevada-California– Investigative Results through Mid-1983," USGS Water-Resources Investigations Report 84-4267.

The Moapa Valley, east of the NTS, is another region where agricultural water may be available. The recharge rate for the ground water under the valley is estimated to be approximately 20,000 AFY. This water, however, would be more economically used at the Harry Allen site. Figures 7-1, 7-2, and 7-3 identify the basins and the perennial yield in thousands of AFY for areas around the potential SEZ sites.

Use of locations outside of Area 25 would require a sizable expenditure for transporting the water if the rights could be secured. The Las Vegas Valley Water District has submitted applications to obtain water rights in most valleys north and east of Las Vegas.

7.2.1 NTS Permitting and Environmental Concerns

In the past, the Federal Government has been able to bypass the state permitting process at the NTS because NTS weapons testing activities were covered under the Federal Reserve Water Rights Act. For the SEZ to bypass the permitting process, its activities would also have to be covered under this Act. It was the consensus of two experts[7] on water issues that a solar application would not be covered in the original definition of activities within the Nevada Test Site. The Yucca Mountain Site Characterization Project obtained state permits for 430.19 AFY when it needed water in a similar area.

There are three environmental issues surrounding water use at the NTS: (1) the decrease of water flow to National Park Service lands, (2) effects on endangered species, and (3) flows of contaminated water. The National Park Service and the U.S. Fish and Wildlife Service will have concerns about the major underground flow zones and the ultimate water disposition because it could have damaging effects on Park Service land in Death Valley and Ash Meadows (Devil's Hole) and a Fish and Wildlife Service refuge in Ash Meadows. Studies sponsored by the State of Nevada and the Las Vegas Valley Water District concluded that NTS water use probably does not affect Devil's Hole to a significant extent. There is also reason to believe that because deeper water originates north of the NTS and "underflows" to Death Valley, the water use in Area 25 would not affect Death Valley. However, the view of the State of Nevada Water Resources Division[8] is that this is an issue that cannot be dismissed easily. It does seem apparent that some interveners would bring this issue into application deliberations for permits.

[7] G.W. Quinn, P.E., Chief Engineer, Southern Nevada Branch Office, State of Nevada Division of Water Resources, 702/486-7052 & D. Duncan, Hydrology Program Manager, USDOE Nevada Operations Office, 702/295-0952.

[8] G.W. Quinn, P.E., Chief Engineer, Southern Nevada Branch Office, State of Nevada Division of Water Resources, 1515 E. Topicana Avenue, Suite 375, Las Vegas, NV 89119. Phone 702/486-7052, fax 702/795-7938.

Figure 7-1: Hydrologic Basins and Perennial Yield at the NTS

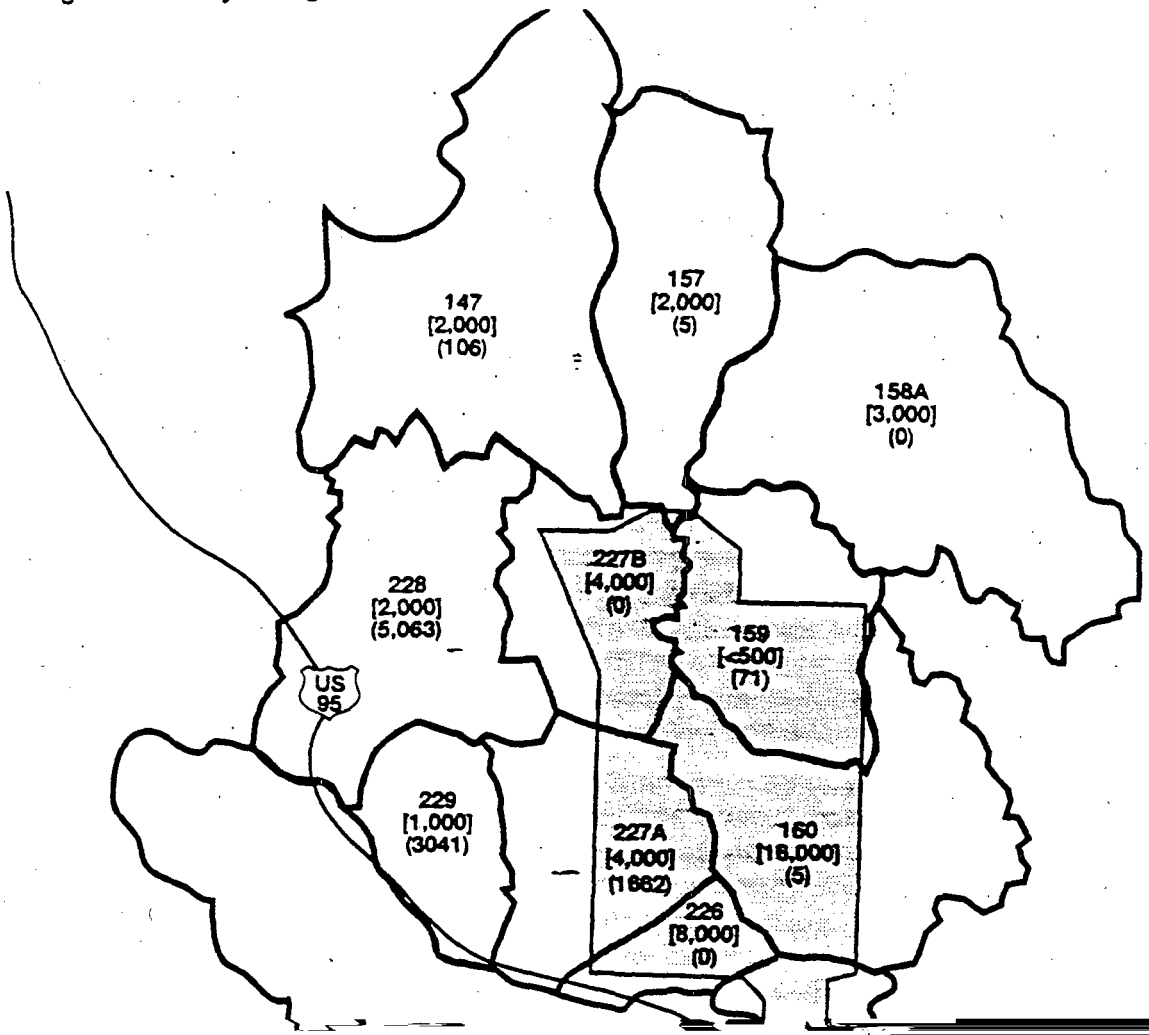
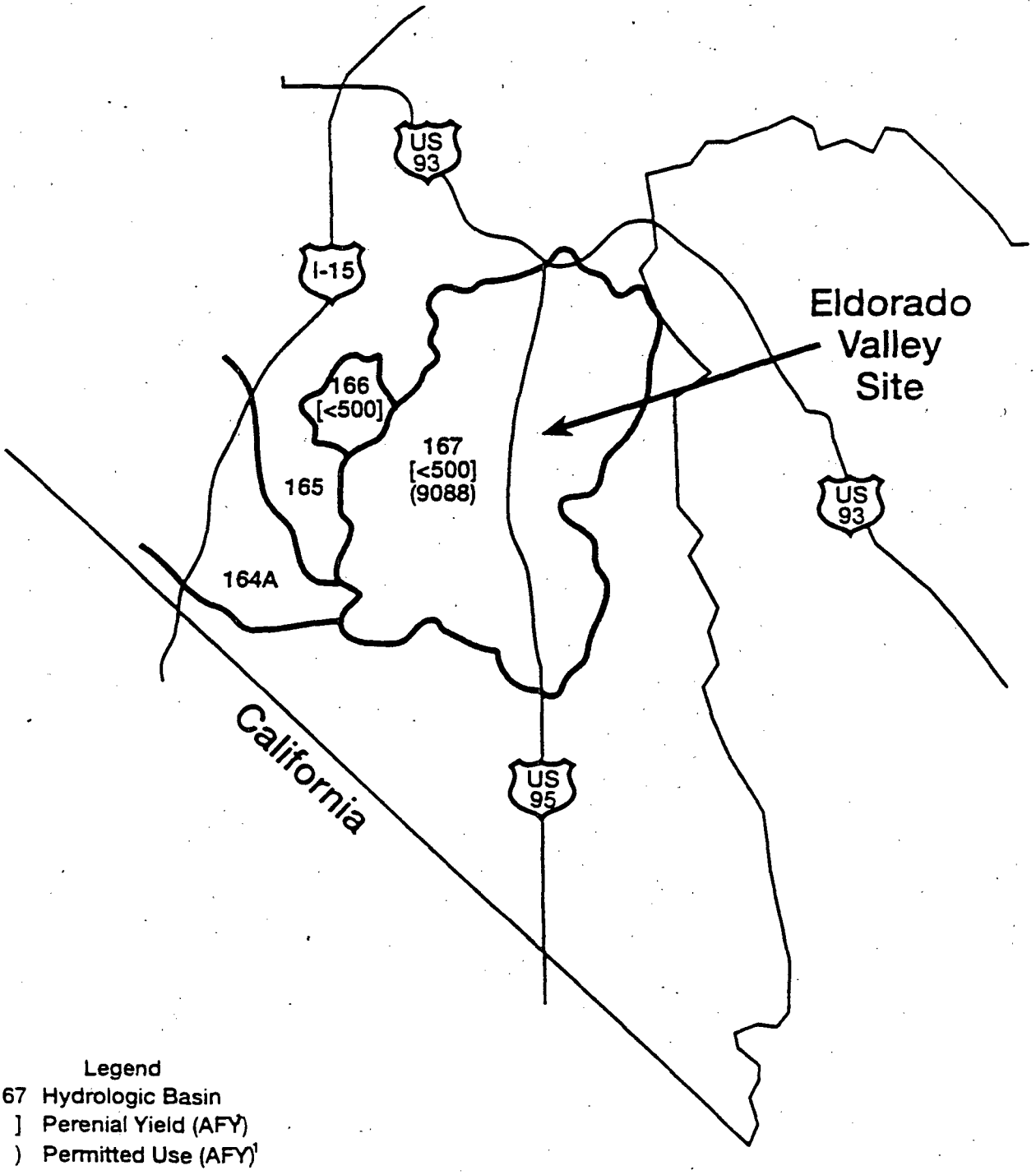


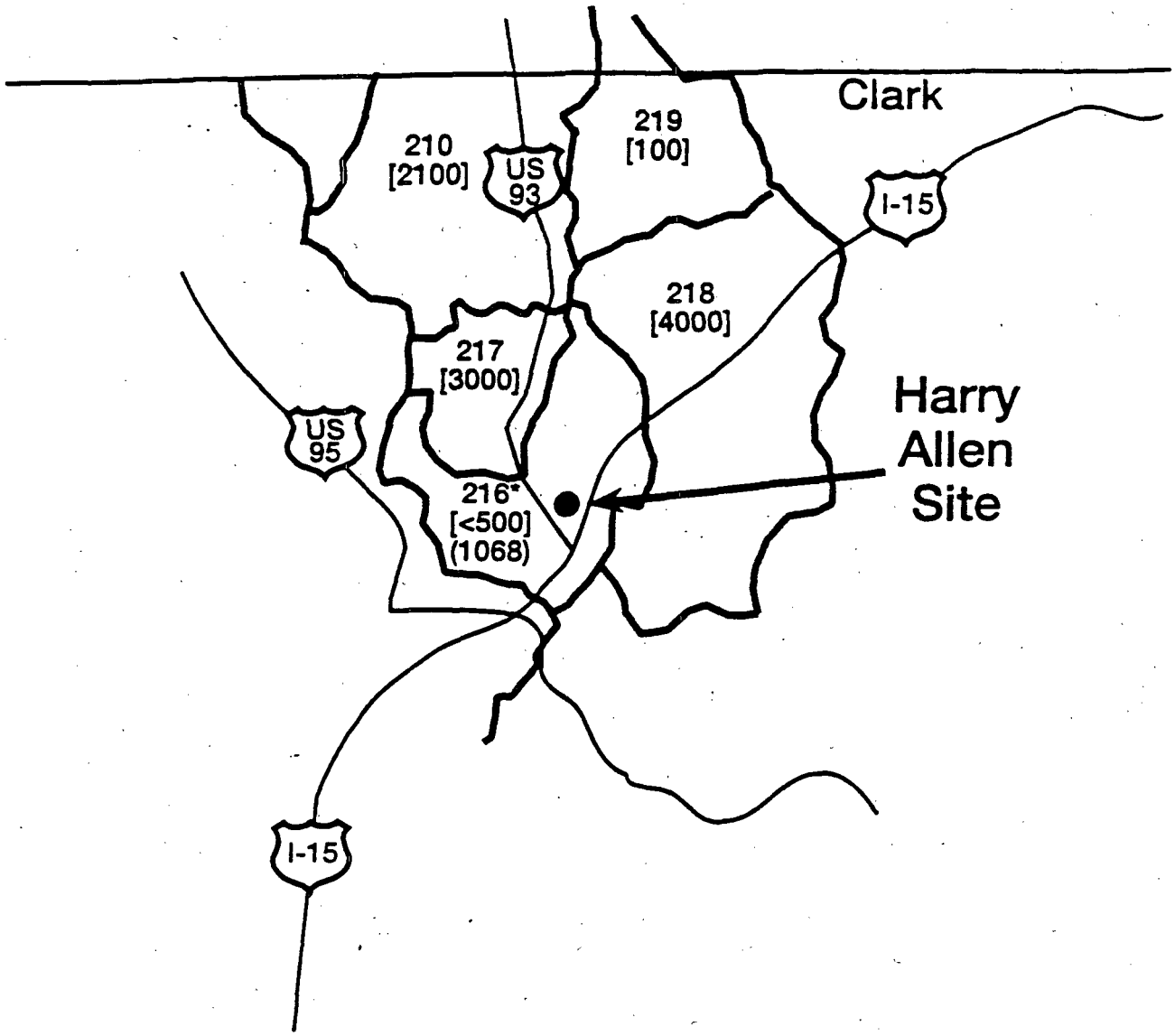
Figure 7-2: Hydrologic Basins and Perennial Yield at the Eldorado Valley



Legend
167 Hydrologic Basin
[ ] Perenial Yield (AFY)
( ) Permitted Use (AFY)[1]

1. G.W. Quinn, State of Nevada, Division of Water Resources

Figure 7-3: Hydrologic Basins and Perennial Yield at the Harry Allen Site



Legend
216 Hydrologic Basin

A final consideration that needs to be evaluated before substantial water withdrawals could be made from the NTS is the potential for mobilization of contaminants related to underground nuclear testing. While health risks are calculated to be low with present uses of groundwater, substantial water use could change those systems. Impacts of significant additional water withdrawals would have to be evaluated, probably in an Environmental Impact Study.

7.3 Water Resources in the Eldorado Valley

Currently, Boulder City has a water allocation of 18,000 AFY. The city uses about 7,000 AFY of water at the present time, and this use is projected to grow at about 3 percent per year.[9] A 14" pipeline currently exists from Hoover Dam that is not being used to capacity. The city will consider allocating 1,000 to 3,000 AFY of irrigation water or an irrigation-waste water mixture either for a pilot project or to augment groundwater in the Eldorado Valley.

In 1989, Luz International Limited studied the possibility of siting a 480 MW SEGS solar application in the Eldorado Valley. The project was never completed, but the study has valuable information on cost estimates, water needs and water availability.[10] The study assumed that each of the six separate 80 MW generators would consume approximately 700 AFY. Most of the water was anticipated to be piped in from Hoover Dam, requiring a 24" line 16 miles long. The 1989 cost estimates were approximately $22 million for improving/installing water systems of a size necessary for this plant.

Ned Shamo of the City of Boulder City has indicated that a maximum price might be 50 cents per 1,000 gallons for raw irrigation or waste water and $1 per 1,000 gallons for treated water[11], but power service or grants in lieu of money could be negotiated. The 50 cent price would add approximately $172,000 annually for every 100 MW of solar trough that used 1,060 AFY.

7.4 Dry Cooling Implications

Power tower and parabolic trough plants are typically designed to cool condensers by cycling water through cooling towers, where some of the water evaporates. The amount evaporated per unit power generation depends upon the climatic conditions.

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[9] Personal communication from Alan Gove, Director of Public Works, Boulder City, Nevada, September 8, 1994.

[10] "Water Supply and Environmental Considerations for Siting a 480 MW Solar Power Plant in Eldorado Valley, Nevada, "The MARK Group, Engineers and Geologists, Inc., Report 89-2226.1, December 4, 1989.

[11] 1992 Energy Technology Status Report. California Energy Commission. page 2-39.

If an adequate water supply is not available, an alternative is to design a plant with "dry" cooling. In this scheme, air is used to remove the condenser heat from the cooling water. The capital cost of the plant is often higher using this method because the air handling units (some times called dry cooling towers) tend to be more expensive than their water counterparts. This is because air is a less effective cooling medium than water. The "sink" temperature for heat rejection is higher in air (i.e., the dry bulb temperature) than in water (near the wet bulb temperature), and in an arid region the difference between these temperatures can be quite large. Performance of solar powered plants that have a relatively low source temperature (e.g. SEGS) are sensitive to the sink temperature. Dry cooling works best in a climate with a relatively large differential between night and day temperatures, which is not the case in southern Nevada.

Dry cooling systems are well established and are used in areas of scarce water resource throughout the world. Dry cooling of power plants in Europe and other overseas locations has been used since the 1960s. However, installed costs for direct air-cooled systems are approximately four to five times more than conventional wet cooling towers. The use of dry cooling imposes: (1) higher heat rates (2) higher operating costs and (3) reduced availability on those days when the weather is hot. Therefore, wet cooling systems are the economical choice unless water costs exceed $1/1,000 gallon. Dry cooling is cost-competitive for utility applications under limited conditions, but is chosen to solve environmental, siting, or water scarcity issues

In 1993, a design study was made for an 80 MW SEGS plant to be constructed in central Spain. There are several climatic differences between that location and southern Nevada. Among other factors, it has a solar insolation that may only be 65 percent of the insolation in Nevada. The SEGS design included supplementary natural gas firing to increase the capacity factor of the plant. (All plants of this type currently in operation have supplementary gas firing.) A "solar only" base was also considered. Some key results of the study are given in Table 7-2. These values are not applicable to the Solar Enterprise Zone, however, the percentage difference between wet and dry cooling is of interest.

Scientists at the National Renewable Energy Laboratory have not performed any studies of dry cooling for solar power plants.[12] An industry engineer who studied dry cooling effects for the power tower project in California estimated that dry cooling in southern Nevada would increase the cost of a power tower project by 10 percent.

[12] Personal communication from Tim Wedelin of NREL, Golden, Colorado, September 12, 1994.

Table 7-2: Results of a 1993 Study of Dry Cooling

—80 MW SEGS Plant for Central Spain[13]			
	Wet	**Dry**	**Percent Increase**
Capital Costs, $/kW (Solar Only)	$ 2,936	$ 3,078	+4.8%
Performance, MWh/yr (Solar Only)	125,580	120,102	-4.4%
18% Capacity Factor (Solar Only)	$0.175	$0.199	+13.7%
51% Capacity Factor (Gas Supplement)	$0.102	$0.107	+4.9%
82% Capacity Factor (Gas Supplement)	$0.081	$0.085	+4.9%

[13] Personal communication from D. Kearney, Kearney & Associates, Del Mar, California, August 30, 1994.

8. NATURAL GAS SUPPLY

8.1 Summary

8.1.1 Approach

The Natural Gas Work Group's task was to prepare a system and cost study and explore natural gas purchase options. In particular, the Work Group sought information and ideas concerning:

- The expected demand for natural gas given the 1,000 MW scenario and the proposed technologies;
- The cost of building infrastructure to supply gas to the three proposed SEZ sites;
- The cost of transporting gas to the proposed SEZ sites; and
- Which sites would be most appropriate for technologies that use natural gas.

The Natural Gas Work Group conducted its inquiry through a series of meetings with gas company representatives, an analysis of the data on gas use by the proposed solar technologies, and field visits.

8.1.2 Findings and Recommendations

The Natural Gas Work Group found that the Nevada Test Site, Eldorado Valley, and Harry Allen sites are all completely viable as solar sites from a natural gas standpoint. The natural gas pipeline companies have indicated their willingness to construct and operate facilities to serve the SEZ. Generally, gas pipeline companies can meet the needs of the solar hybrid systems.

The Gas Work Group found that the 1,000 MW scenario would most likely accommodate 360 MW of hybrid solar systems. Using data from SEGS VIII-XI, the Gas Work Group found that 80 MW of parabolic trough would require 850 thousand standard cubic feet (MCF) per hour and 360 MW of solar trough plant would thus require 3,625 MCF per hour. The Gas Work Group analyzed the problem assuming that all the natural gas would be going to one site.

At the Nevada Test Site, consideration should be given to defense programs' need for gas, which could result in significant dual benefit and potential reduction in cost through shared construction funding. The estimated cost for bringing gas to the NTS through a 64 mile 16" pipeline is $52 million.

The Work Group found that winter demand for natural gas in Las Vegas, supplied through the two intrastate pipelines in Eldorado Valley, is so high that Southwest Gas may be unable to guarantee the delivery of

natural gas to an Eldorado Valley hybrid facility. Therefore, the decision to invest $47 million to reinforce the Southwest Gas system in Eldorado Valley should be based on a marketing plan that investigates whether firm solar generation is needed during the winter months.

At the Harry Allen site, results of studies of related issues of land, water, and transmission must be evaluated before determining if the readily available gas supply can be put to use.

8.1.3 Background and Assumptions

In preparing the report, the Gas Work Group studied the three proposed sites—NTS, Eldorado Valley, and Harry Allen—and made field visits to determine probable siting and corresponding adjacencies to existing gas pipelines. The Work Group also conferred with organizations shown in Table 8-1.

Table 8-1: Organizations Contacted by Work Group

COMPANY	REPRESENTATIVE
Southwest Gas Company	E. J. Hilts
Kern River Gas	Tony Rabago
Transwestern Gas	Robert Bradley
El Paso Gas	John Uxer, Jr.
Nevada Power Company	Eric Dominguez
Nevada Public Service Comm.	Jerry Lein

In addition, the Kramer Junction Company, a solar trough system operating company, provided supporting information and analysis.

Four technologies are being considered for development in the Solar Enterprise Zone—photovoltaics, power tower, parabolic trough, and dish/Stirling. At the July 30 meeting, the Task Force embraced a goal of 1,000 MW of development by the year 2003, and identified the "profile" for the four technologies as listed in Table 8-2. The analysis performed by the Natural Gas Work Group is based on this original scenario and not the revised scenario developed by the Industry Work Group.

Table 8-2: Solar Enterprise Zone Development Profile

Technology	1997	1998	1999	2000	2001	2002	2003	Total (MW)
Photovoltaics	5	15	25	40	50	40		175
Power Tower			100		100		200	400
Parabolic Trough		80		80		200		360
Dish/Stirling		1	5	25	50			81
Total	5	96	130	145	200	240	200	1016

Three of the technologies, parabolic trough, dish/Stirling, and power tower, come in hybrid configurations. One reason for a solar plant to use natural gas is to enable the supplier to sell a firm generating resource. Having natural gas backup power enables the solar plant to guarantee that the facility will be able to produce power whether or not the sun is shining. Firm power contracts are also the most valuable, often doubling the value of the power generated. A second reason for using a hybrid solar/natural gas configuration is to extend the operating hours of the solar plant to more closely match peaking utility load requirements. Often, utilities will have peaking requirements in the early evening and natural gas gives the solar facility the ability to meet these needs.

Of these technologies, only the parabolic trough is currently operating with utility scale systems. While the solar power tower can be configured to use gas, SEZ developers have indicated that their favored solar power tower configuration would not use natural gas, but rather molten salt to extend hours of operation. Dish/Stirling companies may use natural gas or other means for operating hour extension, but the mechanism for accomplishing this is not clear at this time. Therefore, the Natural Gas Work Group made the assumption that the target gas user was the parabolic trough technology, and the gas supply would have to be sufficient for 360 MW of development.

The amount of gas required, and the daily and yearly profiles for gas consumption, were based upon the actual operating experience of the Kramer Junction Company with Solar Electric Generating Stations (SEGS) III-VII, and of UCOS (Harper Lake) with SEGS VIII and IX.

8.2 Analysis

The Public Utility Regulatory Policies Act (PURPA) currently constrains natural gas use in the SEGS parabolic trough plants. PURPA provides incentives for power production with renewable resources by Independent Power Producers (IPPs), and restricts the operation of renewable plants with natural gas by limiting the plant's capacity factor to

40 percent (slightly under 10 hours a day on average). The plants are thus operated such that no more than 25 percent of power is produced from non-renewable sources. Analysis of 1993 operating data for SEGS III-VII indicates that 24.9 percent of power production was from natural gas.

Plant operating officials indicate that if the PURPA operating restrictions on IPPs were removed, substantially greater percentages of power would be produced from natural gas, to provide a better match with the utilities' load requirements. This would make the solar plants a more valuable generating resource to the utilities, thus allowing the greatest economic recovery for the plants.

Based on this information, the Work Group analyzed two gas consumption scenarios – 25 percent and 50 percent of power from the parabolic trough plants produced from natural gas, equating to 40 percent and 60 percent plant capacity factors. SEGS III-VII 1993 operating experience indicates that, on average, the plants operated 9.3 hours per day. With 25 percent of this operation being from natural gas, 7 hours of operation per day was by solar, and 2.3 hours per day was by natural gas. Under a 50 percent scenario, operation from solar would again occur 7 hours a day, but operation from gas would increase to 7 hours per day, for a total plant operation of 14 hours per day average.

Pipeline size requirements in either the 25 or 50 percent operating scenario are the same because hourly gas consumption is the same. Maximum pipeline loading occurs when the plants are operating entirely from natural gas. Using data from SEGS VIII-XI, Southwest Gas calculated that 80 MW of parabolic trough would require 850 thousand standard cubic feet (MCF) per hour and 360 MW of solar trough plant would thus require 3,625 MCF per hour. The operating experience of the 30 MW SEGS III - VII indicates an average hourly gas usage of 7768 MCF.

While the annual AVERAGE power production by gas is 2.3 hours per day for SEGS III-VII, the ACTUAL production by gas varies widely on a seasonal basis. This wide seasonal variation would have significant impact on the ability of existing pipelines to serve the Solar Enterprise Zone. Las Vegas local distribution area pipelines are heavily used during the winter for heating. Solar generating stations provide the least operating hours by solar resource during the winter due to short days and less direct solar radiation. If a firm electric generating resource is required by the electric utility, natural gas usage by the solar plants will peak in the winter, coincident with already heavy local distribution pipeline loading, therefore leaving Kern River as the only incremental source of gas supply/capacity to meet the requirement.

To illustrate the seasonal variations in natural gas usage by the parabolic trough technology, gas usage for SEGS plants III through IX have been plotted. Figure 8-1 compares the average 1993 operating experience of SEGS III through VII, five 30 MW plants with similar gas usage profiles, to the operating experience of SEGS VIII and IX, both 80 MW plants. As

the graph indicates, SEGS III-VII utilize natural gas heavily during both the winter and summer season, while SEGS VIII and IX restrict most natural gas usage to the summer season.

It is interesting to note that even though SEGS III-VII extensively use gas during the winter season, the energy produced from these plants during the winter is substantially less than in the summer. Figure 8-2 plots energy production against gas usage for SEGS III-VIII.

This clearly indicates the impacts of fewer daylight hours and less direct solar radiation on plant energy production, even with supplemental production using natural gas.

Figure 8-1: Natural Gas Usage

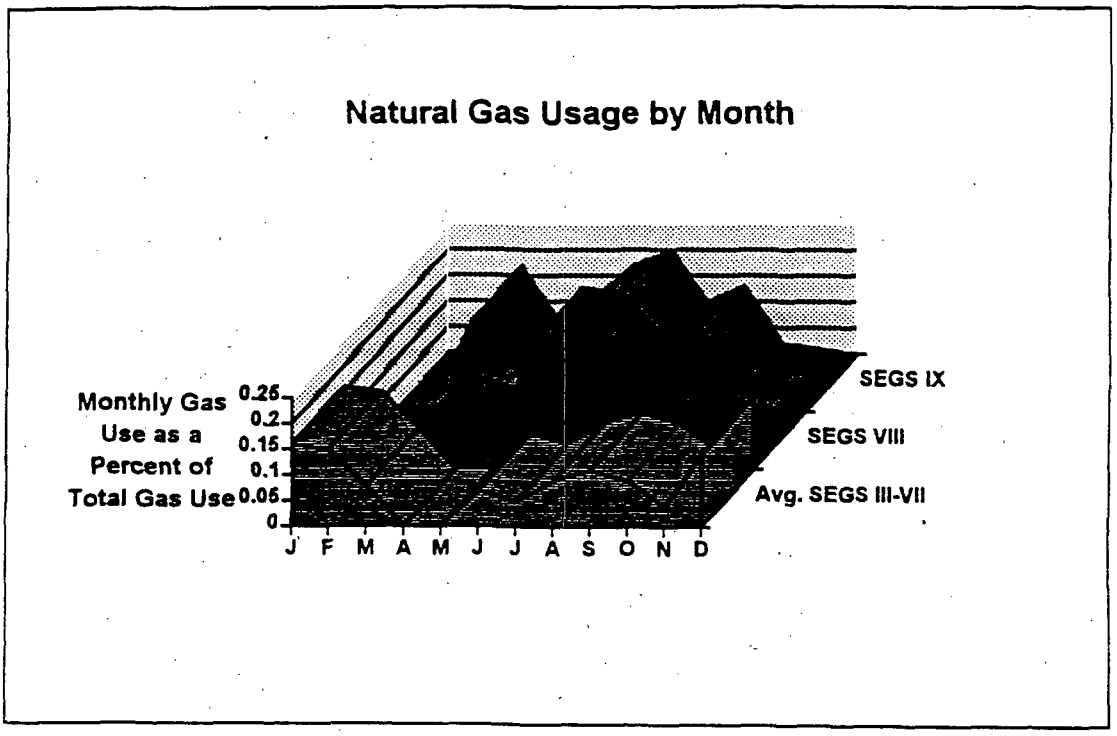
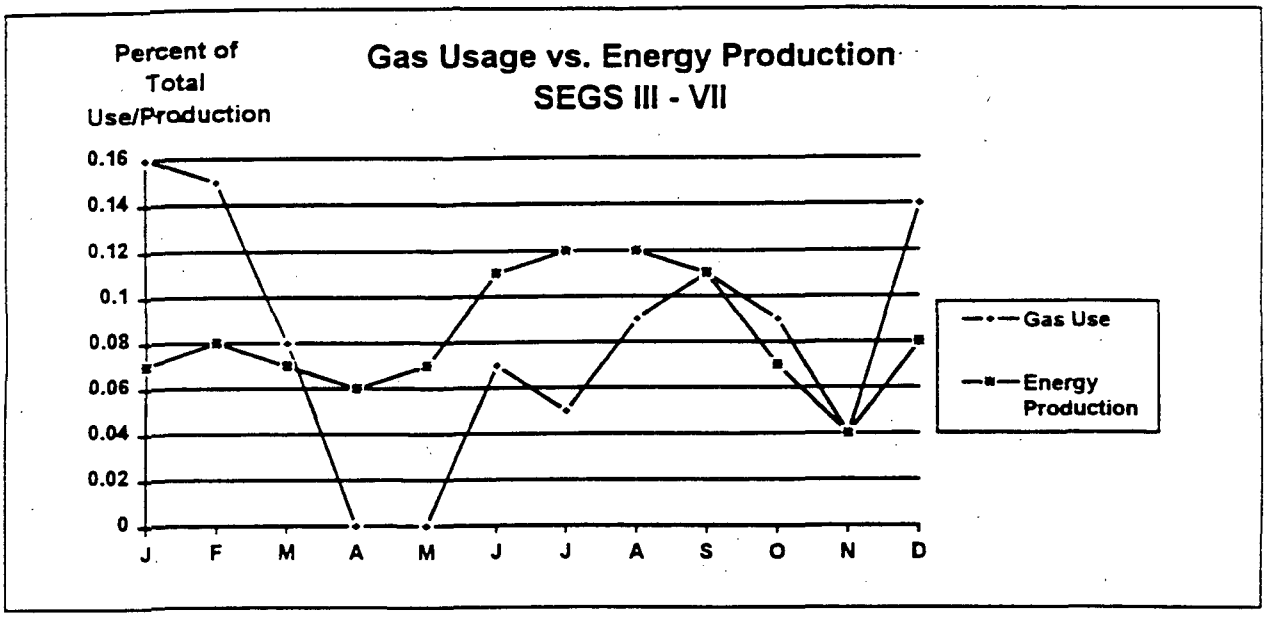


Figure 8-2: Gas Usage vs. Energy Production, SEGS



The impact of winter pipeline loading and possible constraints on parabolic trough operation is most severe at the Eldorado Valley site. This location is transected by two Southwest Gas main pipelines. However, both pipelines are main supply lines for the Las Vegas area and its heavy winter gas demand. Complete winter flexibility of operation of a solar plant would require construction of an additional line from south of Laughlin to reinforce the Southwest Gas system or the displacement fo gas volumes bound for winter gas demand by the local distribution to the Eldorado site with incremental deliveries of Kern River

Table 8-3: SEZ Distance to Natural Gas Pipeline

Distance in Miles	NTS	Eldorado Valley	Harry Allen
El Paso Gas	173	68	109
Kern River	64	22	1
SW Gas	64	0 to 6	15
Transwestern	180	75	116

supplied gas. Summer operation is possible from the existing system,

and winter operation is also possible on a contingent supply basis. Table 8-3 gives the distances from the SEZ to the natural gas pipeline.

NTS would be served by the Kern River pipeline, which is more independent of the winter loading scenario described above. Although the final pipeline supplier has not yet been negotiated for the Harry Allen site, the Kern River pipeline is within one mile of this site, and could be tapped if necessary to supply gas for hybrid solar systems. No system upgrades are believed to be necessary for sites supplied by the Kern River pipeline. Table 8-4 outlines the natural gas requirements for the SEZ.

Table 8-4: SEZ Natural Gas Requirements

Scenario	All Sites
Natural Gas Requirement in 25% Scenario	6,513,266 MCF/Year
Natural Gas Requirement in 50% Scenario	19,644,430 MCF/Year
Maximum 1 Hour Natural Gas Requirement	850 MCF for 80 MW (SEGS VIII - IX) 3625 MCF for 360 MW (SEGS VIII - IX) 7,768 MCF for 360 MW (SEGS III - VII)

Table 8-5: SEZ Natural Gas Pipeline Cost[1]

	NTS	Eldorado Valley	Harry Allen
Pipeline Size	16"	20"	16"
Company & Pipeline Cost	Southwest Gas $52 million	Southwest Gas $47 million If firm gas supply is required for winter operation. Otherwise, existing gas lines are adequate	Kern River will supply gas to Nevada Power's two 72 MW natural gas fired units under construction at Harry Allen. Therefore it is assumed that all necessary natural gas infrastructure required for solar support will be available at this site by a target date of March 1995.

Regardless of which company's pipeline is used to serve the potential SEZ sites, all the gas companies agree that such gas capacity and supply contracts can be negotiated on a competitive basis. The high cost and the potential environmental impact of constructing a pipeline substantially favors tapping the nearest source with available capacity and supply. Interconnection agreements are common among gas pipeline companies, and such agreements do not appear to adversely affect the delivered cost of natural gas. Tariff rates are readily available, and have been used to determine the delivered cost of gas. The actual cost of gas delivered is provided for each of the proposed SEZ locations is provided in Table 8-6.

[1] Due to the deregulated nature of gas, and the ability of gas transportation companies to deliver across multiple owners' pipelines without adversely affecting the delivered cost of gas, the Gas Subgroup believes that, for planning purposes, it is appropriate to estimate the cost of construction only from the nearest main pipeline. Prior to entering into any contracts, each company would develop refined estimates, and the integration of the SEZ gas requirements with other transport requirements could result in a more favorable estimate from one company versus another.

Table 8-6: Solar Enterprise Zone Natural Gas Transportation Costs[2]

	NTS ($/MCF)	Eldorado Valley ($/MCF)	Harry Allen ($/MCF)
Transportation cost, 25% Scenario, Based on Firm Transportation Capacity Contract, 1994 Tariff Rates			
Kern River	$0.7773	$0.7773	$0.7773
SW Gas/El Paso	$0.8406	$0.8406	$0.8406
Annual Cost of Gas plus Transportation, 25% Scenario			
Kern River	$2.1573	$2.1573	$2.1573
SW Gas/El Paso	$2.2206	$2.2206	$2.2206
Transportation cost, 50% Scenario, Based on Firm Transportation Capacity Contract, 1994 Tariff Rates			
Kern River	$0.7773	$0.7773	$0.7773
SW Gas/El Paso	$0.8406	$0.8406	$0.8406
Annual Cost of Gas plus Transportation, 50% Scenario			
Kern River	$2.1573	$2.1573	$2.1573
SW Gas/El Paso	$2.2206	$2.2206	$2.2206

Natural gas pricing at the wellhead has been estimated at $1.38 per MCF (1994 data) by the American Gas Association (AGA) over a 15 year period. This value would apply to all the SEZ sites under consideration.

8.3 Nevada Test Site

A full development of NTS solar facilities is envisioned in the study as 600 MW of generating capacity. Gas support for the solar trough technologies at the NTS could be supplied from the Kern River pipeline.

[2] It does not appear feasible for Transwestern to build an interconnect because other pipelines are closer to the proposed SEZ sites. Transwestern would, however, be willing to discuss an interconnect over the Southwest Gas system. Although El Paso Gas was not tasked to provide pipeline construction costs, El Paso could supply transportation service to the proposed SEZ sites and should be considered in future studies.

The nearest point on this pipeline is 64 miles away and it has been estimated that it would cost $52 million to supply the NTS. The size of the pipeline required to deliver the gas is 16 inches. There may be opportunities for cost sharing with other defense programs missions that have identified a need for gas. Fissile Materials Storage and Disposition has identified a requirement for 71 million MCF annually. This is more than three times the needs of a 1,000 MW solar enterprise zone. Tritium supply would also benefit from availability of gas.

8.4 Eldorado Valley

The Eldorado Valley is located between Henderson and Boulder City, Nevada. State Highway 95 to Searchlight cuts through the middle of this area. Two major natural gas pipelines transect this valley, one immediately adjacent to state highway 95 and the other approximately one mile west of the highway. Depending on the actual siting of a parabolic trough generating station, the Southwest Gas pipelines could be directly adjacent or up to six miles away.

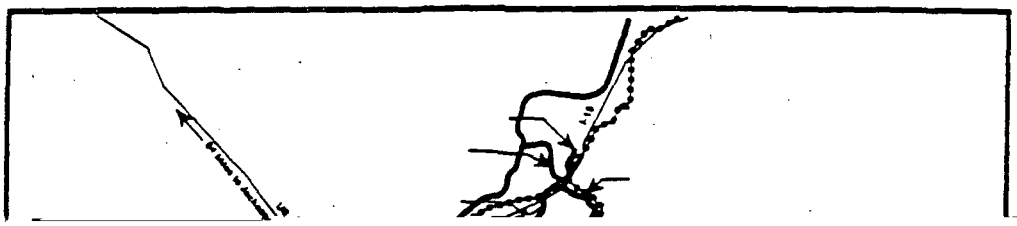
If a firm supply of natural gas is required during winter months at the Eldorado location, Southwest Gas indicates that reinforcement of the Las Vegas natural gas supply system would need to be constructed at a cost of approximately $47 million. The anticipated route is from the El Paso gas pipeline south of Laughlin along the right-of-way used by the present two pipelines through Eldorado Valley (Figure 8-3). If contingent winter natural gas supply is acceptable, the length of an extension of the Southwest Gas pipeline to the SEZ would have a negotiable cost, depending on the exact positioning of the solar trough plant on the 6000 acre zone.

8.5 Harry Allen

The Nevada Power Company's Harry Allen site is located several miles northwest of Interstate 15 in the Apex industrial area. Two natural gas combustion turbine units rated at 72 MW each are in the early stages of construction—and Nevada Power has plans to develop two more. The current transmission capacity could handle 305 MW, but with 280 MW slated to come on-line, there is only 25 MW available for solar power development. The amount of capacity currently available prevents the SEZ from operating a solar trough system, which typically is rated at over 80 MW; however, it is possible that Nevada Power could cancel its plans to build the third and fourth 70 MW gas turbines making the site available for trough development. A 25 MW site could be well suited for modular dish/Stirling systems, however.

NPC has decided to supply the Harry Allen site from Kern River. The Kern River pipeline is approximately one mile northwest of the site, and is the nearest pipeline to the facility. Natural gas supply is expected to be available to the site well in advance of the timeframe anticipated for construction of hybrid facilities as a part of the SEZ.

Figure 8-3: Southern Nevada Natural Gas Pipelines



9. TRANSMISSION

9.1 Summary

9.1.1 Approach

The Transmission Work Group's task was to analyze the transmission system at the NTS, the Eldorado Valley site, and the Harry Allen site. In particular, the Work Group sought information and ideas concerning:

The cost of building infrastructure to provide transmission access to the proposed SEZ sites; and

The effects of new capacity on the existing transmission system and future substation and line upgrades.

The Transmission Work Group conducted its inquiry through site visits and a series of meetings with Western Area Power Administration, Nevada Power, and Valley Electric Association. The Work Group also worked closely with the Phoenix Area Office of Western Area Power Administration to perform power flow analysis.

9.1.2 Findings and Recommendations

The Transmission Work Group strongly recommends that more detailed studies of SEZ generation impacts on the southern Nevada transmission system be undertaken.

The Transmission Work Group recommends a low-risk phased approach to upgrading the NTS transmission system. Phased upgrades of the NTS transmission system could offer opportunities for cost-sharing with other DOE projects proposed for the NTS (i.e., the Tritium Supply Site) which will have significant power needs.

At the NTS, for an $811,000 investment, the current system could be quickly upgraded to accommodate approximately 100 MW of solar power – 30 MW for use at the NTS and 70 MW for export from the SEZ. A $26.7 million second phase investment would enable the system to handle 200 MW of solar capacity. If another $26.7 million were invested in the third phase, the transmission system could be upgraded again to accommodate between 430 and 550 MW of total generating capacity.

The Transmission Work Group finds that the Eldorado Valley site offers the best opportunity for transmission upgrade for the least overall cost. For an approximately $2 million investment, the site could be upgraded to deliver a 1,000 MW of SEZ power to the southwestern United States.

Currently, the Harry Allen site has little transmission available for new capacity. An investment of $811,000 would enable the Harry Allen site to accommodate 25 MW and an additional $16.5 million could bring the site to a capacity of 140 MW. The Transmission Work Group recommends that the Task Force begin negotiations with Nevada Power Company to substantially upgrade the Harry Allen site by helping Nevada Power secure Congressional approval and financing for two 500 kV transmission lines from Harry Allen to Eldorado Valley.

9.2 Nevada Test Site

This report assumes that Area 25, also known a Jackass Flats, at the Nevada Test Site will be the preferred site for development of a SEZ. Jackass Flats has approximately 10,000 acres available for a SEZ and is served by two 138 kV lines. Figure 9-1 shows the location of the transmission system at the NTS. One line, with a capacity of 65 MW, is owned by Nevada Power Company and runs from Northwest substation through Mercury to the Jackass Flats substation; the other line, with a capacity of 97 MW, is owned by the Valley Electric Association (VEA) and connects Jackass Flats to the Amargosa substation via Pahrump.

The following technical assumptions were made by the Transmission Work Group for the purposes of this analysis:

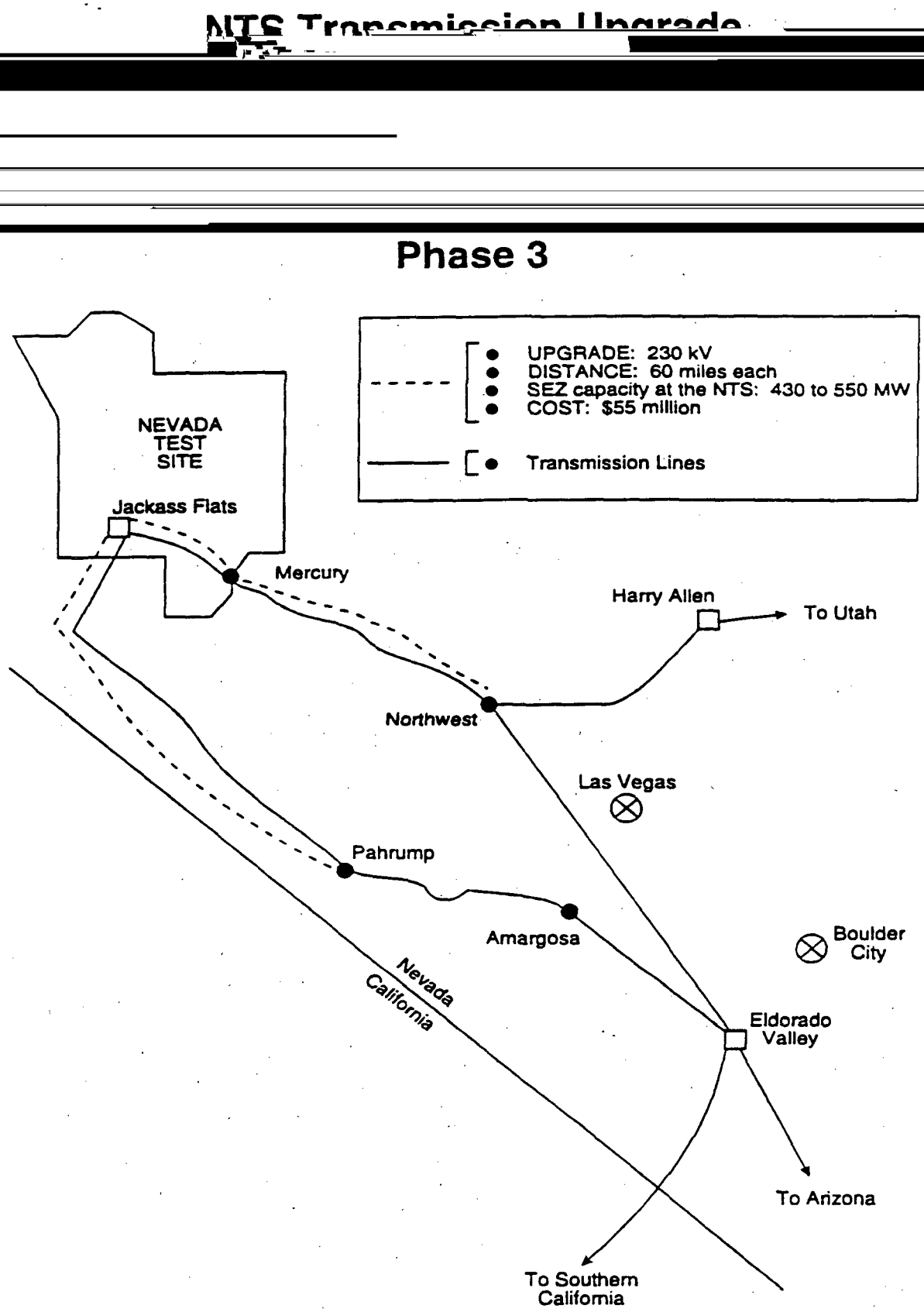
- SEZ will be operational in 1998
- NTS will continue to use approximately 30 MW of capacity
- The VEA Pahrump-Eldorado Valley 230 kV line will be operational
- A phased approach will be used for development of the SEZ
- The SEZ will interconnect with the 138 kV system at Jackass Flats

The Transmission Work Group agreed that the NTS transmission system would require power flow analysis and asked the Phoenix Area Office of the Western to perform it. A 1998 base case with heavy summer loads was selected as the model. To ensure a reliable system, the Transmission Work Group assumed a single contingency outage criteria; for example, if one line went out, the other would be able to carry the whole load until the first was operational again.

The Transmission Work Group analyzed the following phased approach and asked Western to perform power flow analysis for the first two phases.

- Phase 1: Link the SEZ to the grid, otherwise use existing transmission system
- Phase 2: Construct one 230 or 500 kV line
- Phase 3 Option 1: Construct another 230 kV lines
- Phase 3 Option 2: Construct another 500/345 kV lines

Figure 9-1: NTS Transmission Upgrade Phase 3



9.2.1 NTS Phase 1: Use Existing Transmission System

The worst case single outage for the existing transmission system was determined to be an outage of VEA's Jackass Flats-Amargosa line. Power flow studies run with this line out of service determined that 70 MW of power could be exported from the NTS over the Nevada Power Company lines if the VEA line was out. Since the NTS uses approximately 30 MW, the maximum SEZ generation would be 100 MW. Raising or lowering the NTS load will raise or lower the amount of SEZ capacity.

9.2.2 NTS Phase 2: Construct either a 230 kV or a 500 kV Line

Western ran a power flow analysis to determine the capacity of the transmission system if one additional transmission line was constructed. The consensus of the Work Group was that the new circuit would be the strongest circuit and therefore would be the worst case outage for this scenario. The thermal capacity of the two existing 138 kV circuits was determined to be the limiting factor, and assuming that the NTS would absorb 30 MW of load, the Transmission Work Group concluded that the NTS would be able to export 170 MW — for a total of 200 MW of SEZ capacity. Again, the amount of generation that could be accommodated would be sensitive to the load at the NTS.

9.2.3 NTS Phase 3 Option 1: Construct another 230 kV Line

Figure 9-1 shows where the new lines would be placed. Each of the 230 kV lines would run about 60 miles and would not replace the existing 138 kV circuits. Although power flow analysis was not conducted for this scenario, the thermal capacity of the new 230 kV circuits was assumed to match the thermal capacity of VEA's Pahrump-Eldorado Valley 230 kV circuit of 350 MW. Assuming the worst case outage to be one of the new 230 kV circuits, the capacity of this system for export would be between 400 MW and 520 MW. The 400 MW number assumes that 50 MW of power would flow through the two 138 kV lines and the 230 KV line would load to a thermal capacity of 350 MW. The 520 MW number assumes that both the 138 kV circuits and the 230 kV circuit would all load to their thermal limits.

9.2.4 NTS Phase 3 Option 2: Construct another 500 kV Line

Power flow analysis was not conducted for this scenario. The Transmission Work Group assumed that the system would be designed and constructed to accommodate the full 1,000 MW of SEZ power.

9.3 Eldorado Valley

From a transmission perspective, the 6,000 acres in Eldorado Valley set aside by Boulder City is the best place to site a 1000 MW solar facility.

Within a couple of miles of the proposed SEZ site, there are two 500 kV substations and a third under construction that will connect the transmission systems of Arizona, California and Southern Nevada. These substations are:

- Southern California Edison's Eldorado Substation
- Los Angeles Department of Water and Power's McCullough Substation
- Marketplace Switching Station (scheduled for completion in Dec. 1995)

The consensus of the Transmission Work Group was that a 500 kV interconnection to the Marketplace substation in the Eldorado Valley could be designed and constructed to accommodate up to 1000 MW of generation at the SEZ.

9.4 Harry Allen

The transmission system at Harry Allen site, owned and operated by Nevada Power Company (NPC), consists of a 345/230 kV substation, a 345 kV tie with PacifiCorp, a Phase Shifter and a 345/230 kV autotransformer. There is also a 230 kV line that delivers power to the internal transmission system of NPC. Nevada Power is currently constructing 144 MW of power plants on the site and has plans for an additional144 MW. According to Nevada Power, after the construction of 288 MW of peaking power plants, the Harry Allen site will be able to accommodate up to 25 MW of solar generation with only an investment of $811,000 for a generator bay.

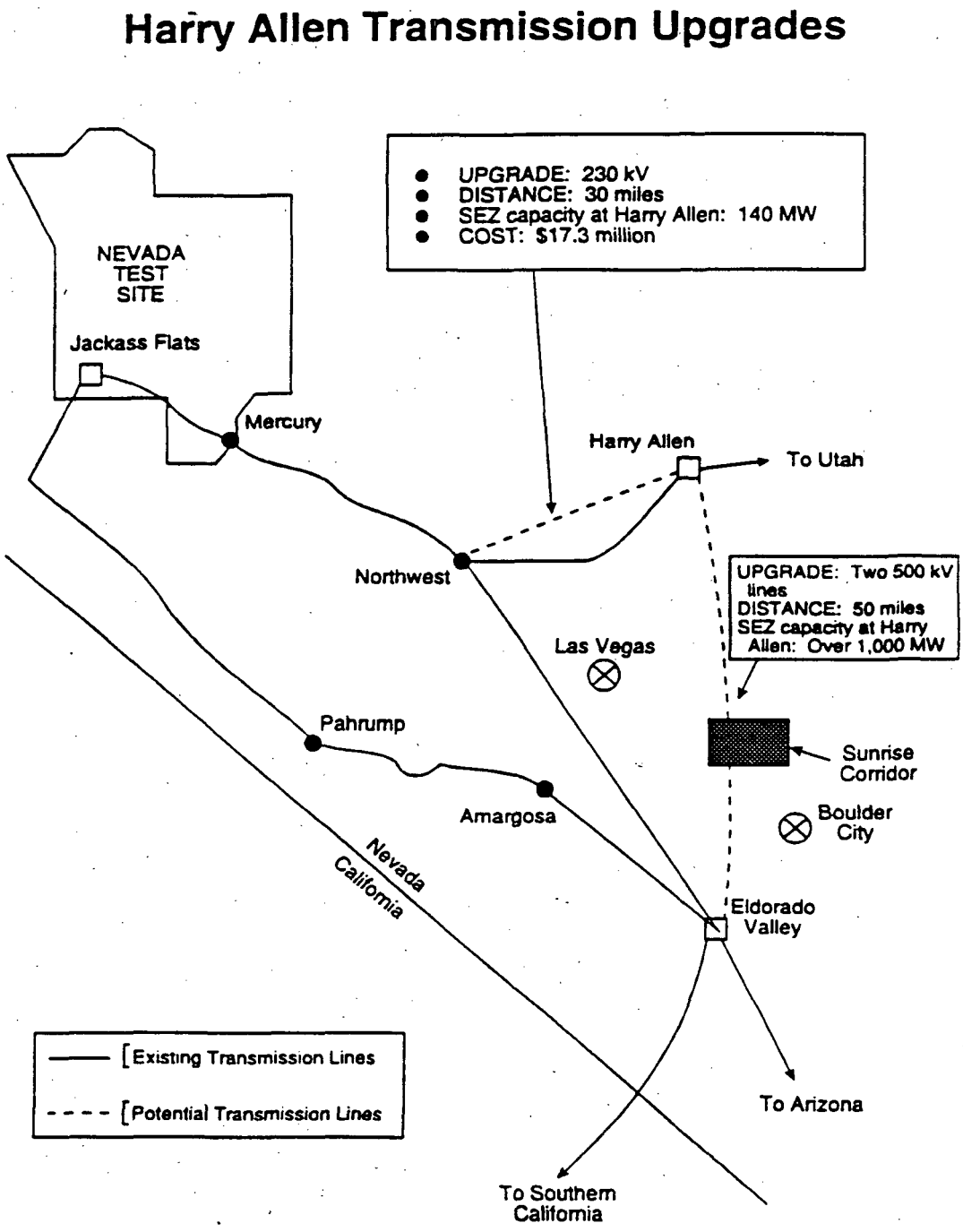
To determine the cost of upgrading to the Harry Allen system to accommodate more solar generated power, the Transmission Work Group assumed an in-service date of 1998 for the SEZ at Harry Allen and the following technical assumptions:

- Both existing Reid Gardner-Pecos 230 kV circuits will be tied into the Harry Allen 230 kV bus;
- A new 230 kV circuit from a Harry Allen to Pecos will be in service;
- A 230 kV circuit from Arden substation to Northwest substation will be installed; and
- The existing Harry Allen substation bus (connected to the phase shifter) will not be tied to the new 230 kV bus.

Generation capacity larger than 25 MW would require construction of additional transmission facilities. The most practical addition to the transmission system would be a 30 mile, 230 kV circuit from Harry Allen to Northwest substation plus additional substation equipment. This addition would allow up to 140 MW of solar generation and cost approximately $17 million. This potential solar capacity would increase if

any of the 280 MW of gas-fired generation assumed for Harry Allen did not occur.

Figure 9-2: Harry Allen Transmission Upgrades



Currently, Nevada Power has plans to build two 500 kV lines from Harry Allen to one of the substations in Eldorado Valley, but construction has not yet begun because Nevada Power is waiting for approval from the United States Congress to string power lines across a section of federal lands known as Sunrise Corridor. There might be an opportunity to work with Nevada Power to cost share the construction of the lines and seek approval from Congress in exchange for an expanded SEZ capacity at Harry Allen.

9.5 System Configuration and Cost

Costs for the system configuration at the NTS and Eldorado Valley were developed using data provided by Western. Costs include allowances for engineering and design, planning, land right-of-way, environmental work, and construction. Costs for the Harry Allen site configuration were provided by NPC. All costs are summary in nature and should only be used for conceptual purposes in comparing options. More detailed cost estimates should be performed for budget purposes.

Table 9-1: System Configurations and Cost

Site	Configuration Description	Upgrade Description	Cost
NTS Phase 1	Construct a 138 kV generator bay at Jackass Flats Substation.	138 kV Generator Bay	$811,000

Nevada Solar Enterprise Zone

Project Plan

December 1994

Project Development & Management Division
Nevada Operations Office
U.S. Department of Energy
Las Vegas, Nevada

This is an abbreviated version of the Nevada Solar Enterprise Zone project plan. A fully developed project plan will be provided by the end of January 1995.

Nevada Solar Enterprise Zone Project Plan

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Solar Enterprise Zone Project Plan

Mission Need and Objectives

Mission

The mission of this project is to advance the competitive position of solar-power generation technologies by constructing up to 1,000 megawatts (MW) of solar-generated electrical power and to create a sustaining manufacturing and technology infrastructure in Southern Nevada. This initiative will be completed by January 2004.

Objectives

The objectives of the Solar Enterprise Zone (SEZ) project consist of the following items:

- Provide local employment and economic benefits to offset the impact of defense conversion on the Nevada Test Site (NTS).
- Help develop and commercialize environmentally sound solar-based renewable energy technologies for electricity generation for use across the U.S. and internationally.
- Encourage the development of a competitive, sustained solar energy industry in Southern Nevada to benefit both NTS employment and the manufacturing base of the State.
- Assist the solar industry effort to commercialize renewable energy generating technologies through commercial manufacturing experience and technological advances.

Background

As national defense activities change, the need for continued nuclear testing and weapons' development is declining. Thousands of skilled workers and millions of dollars worth of equipment and resources dedicated to nuclear explosive testing require new missions and new applications of their skills.

At the same time, environmental concerns are creating a growing demand for alternative generating technologies. Over a decade of research, development, and industry investment have brought many renewable energy technologies to the verge of commercial competitiveness. To move solar power generation forward and to achieve the economies of scale and manufacturing that are the key to broad commercial competitiveness, the industry needs a major project that includes large-scale manufacturing and production capability.

Utilities in the southwestern United States project major growth in electrical demand and the need for new, environmentally sound generation early in the next decade, despite a current surplus of capacity in the region. Worldwide, the rapidly developing countries of Asia and Latin America are building new generating capacity at an unprecedented rate, representing both a huge potential export market and an enormous threat to the global environment. Solar energy could fill that demand without damaging the environment, if investments are made now in commercializing the technology and building industry capabilities to compete with established fossil fuel alternatives.

The declining need for nuclear testing and weapons' development is unrelated to the environmental concerns that are creating a growing demand for alternative generating technologies; however, in Southern Nevada these developments coincide with some of the best solar resources in the world and political leadership that has a vision of Nevada as a potential leader in solar energy development. From that vision came the concept of reemploying the resources at the NTS and redeploying resources dedicated to testing nuclear weapons to commercializing solar energy.

Planning Process/Community Involvement

SEZ stakeholders (e.g., Nevada interest groups and communities, the Nevada University systems, and the solar industry) have been involved in the planning of this project from its inception. A major SEZ project will stimulate the local and regional economy, while simultaneously serving national energy and environmental objectives. Department of Energy Nevada Operations Office (DOE/NV) strategies include aggressive public outreach to build a base of support within the public, the educational community, and business and industry in Nevada.

Stakeholders' Conference and Discussions (Origins of Public Involvement)

The National Defense Authorization Acts for FYs 1992 and 1993 directed the Secretary of Energy to study the solar energy potential of the NTS. The *NTS Solar Feasibility Study* (April 1994), which was the result of this mandate, found that the NTS was a significant solar resource that can, in turn, provide important employment, local economic development and even export potential if developed. In order for commercialization to proceed and eventually become self-sustaining, however, the development of the solar resource must be supported. The analysis presented in this report shows how a variety of Federal, state and local support can affect the cost of electricity from the solar technologies. With early, sustained support to introduce these technologies in the market and create demand, the industry will be able to climb the technology learning curve and grow toward more competitive products and installations.

The DOE hosted a solar conference at the Cashman Field Center in Las Vegas on June 1, 1994. Members of both the private sector and government attended to hear presentations by a diverse group of professionals on various aspects of development of a SEZ at the NTS. The conference was followed by a tour of the NTS on June 2, 1994, and then a tour of DOE's scientific and industrial portion of the North Las Vegas facility on June 3, 1994. A representative from

Senator Richard Bryan's office provided some insightful remarks regarding the legislative climate for a SEZ. Robert H. Annan, Director, Office of Solar Energy Conversion, presented an outstanding overview of the SEZ Task Force goals and objectives.

As a result of the conference, DOE received 27 responses to the Request for Expression of Interest (EOI) entitled *Development of a Solar Enterprise Zone for Promoting the Continuing Commercialization of Solar Power Technologies.* The responses were significant and favorable. The diversity of the respondents has been wide, ranging from large engineering and solar-manufacturing firms to small, individual consultants in the solar industry. The EOI received uniform support for the SEZ concept with varying interest in the NTS location. No respondent opposed the SEZ concept.

SEZ Task Force

A SEZ Task Force was formally empowered by the notice of its creation in the Federal Register in June of 1994. Its goal was to build a consensus for advancing the SEZ concept and to determine the potential of Southern Nevada sites being considered for power plant locations. An orientation briefing was held in Washington, D.C., on June 23, 1994, in anticipation of the first meeting of the SEZ Task Force.

On July 30, 1994, the SEZ Task Force held their first public meeting in Las Vegas, Nevada. This was also the first meeting of the Task Force, co-chaired by Nevada Senator Richard N. Bryan and Christine A. Ervin, Assistant Secretary for Energy Efficiency and Renewable Energy, DOE. The purpose of the meeting was to present the responses of the EOI to the Task Force, discuss issues and concerns, and solicit public comments. The Task Force recommended that workgroups be formed to address outstanding issues. Respondents to the EOI expressed interest in development of three sites in Southern Nevada. The sites being considered are the NTS, including the Tonopah Test Range (TTR); Eldorado Valley; and Harry Allen. See Attachment A for site locations.

On September 30, 1994, the SEZ Task Force held their second public meeting in Washington, D.C. The purpose of this meeting was to present recommendations to the Task Force by each workgroup that was formed to address the outstanding issues. The Task Force also listened to public comments.

On December 6, 1994, the SEZ Task Force held their third public meeting in Las Vegas, Nevada. It was recommended that a development corporation (to be referenced in this document as the *Authority)* be formed to carry out the SEZ development plans. The Authority, established under Internal Revenue Service (IRS) Code 501(c)3, would have the capability of issuing tax-free, low-interest bonds. The Board of Directors of the Authority will have overall responsibility for the SEZ project. Prior to formal designation of a Board, the SEZ Task Force will serve as the interim Board of Directors.

Community Information

Local communities have been provided information on the SEZ initiative through communication with DOE/NV and contractor employees; the media, including local newspaper and television coverage; and local community agencies. The *Nevada SEZ Development Study* (December 1994), which includes employment impact information, was distributed to stakeholders.

Technical Plan

The mix of types of solar generation will be determined through a competitive process and will potentially include photovoltaics, dish/Stirling, solar trough, and power tower technologies. The SEZ development plan has envisioned a phased approach to construction based on the market readiness of each of these technologies (Attachment B).

The Authority will evaluate several sites for deployment of solar technologies. The first 100MW of generation is tentatively targeted for the NTS.

Existing buildings, construction equipment, and both federal and contractor personnel can be used in the site preparation for the SEZ as well as in all other phases. Professional services can be provided by engineers or other professionals at the NTS throughout the project from development through operation of the solar plants.

Technical studies will be performed by professionals from the University of Nevada system. The manufacturing infrastructure, which will be created by the SEZ, will provide sustaining jobs as competitiveness is actualized through manufacturing innovation and economics of scale.

Management Approach

Authority

The Authority has been organized according to the following guidelines:

- Acting as a Board of Directors for the Authority, Task Force members will establish rules for nominating and confirming a permanent Board of Directors.
- Nominations for board membership will be solicited from private industry and not less than one-half of the board members will be from the private sector.
- Other board members will be selected to represent participating federal and state agencies, consistent with federal and state laws and regulations.

- The Acting Board of Directors will develop *conflict-of-interest* standards for Board members to prevent gaining unfair advantage or directly benefiting from Board activities.

The activities of the Authority's Board of Directors will include, but are not limited to, the following items:

- Support the State of Nevada's capability to expand economic development in cooperation with the State and its Department of Business and Industry.

- Work with federal power marketing administrations, utilities, state regulatory commissions, federal installations, other potential power purchasers, and the DOE/NV to identify and secure market commitments for solar projects. The goal should be to develop commitments sufficient to commercialize solar technologies that can provide 1,000MW of new capacity.

- Structure supports provided by the public sector to provide for a payback to the public from successful commercialization efforts.

- Develop a master plan for employing the resources made available for the SEZ.

Given the overriding importance and benefits of the Authority, the Task Force has directed that the following federal and state legislation be examined:

- A *bullet* exemption from Internal Revenue Service (IRS) Code restrictions to allow the Authority to use its 501(c)3 status to perform the following tasks:

  - Issue bonds beyond the $150 million cap.

  - Relax restriction on benefits to private, for-profit entities.

  - Expand options for combining federal funds and bond proceeds for project development without jeopardizing tax-exempt status.

- Legislation to make solar tax credits, accelerated depreciation, and other incentives offered to assist renewable energy development available to for-profit project developers assisted by the Authority.

- Legislation to make the ten-percent solar-investment tax credit available to any entity that builds a project in the SEZ.

- Legislation to permit DOE to make long-term power purchase commitments beyond the current ten-year limit.

- Legislation to encourage federal agencies to purchase renewable power from the SEZ, if its price is less than ten percent over competing market rates.

- Nevada legislation supporting renewable energy that assists in the development of the SEZ.

Western Area Power Administration

The Task Force recommended utilizing the Federal Power Marketing Agencies (PMA), such as Western Area Power Administration (Western) to act as suppliers for customers purchasing power from the SEZ on federal facilities. The role of Western will be to survey and evaluate, with outside contractor support, potential market opportunities throughout the southwestern U.S., with an initial focus on new loads for Native American industries, DOE facilities, military installantions, Federal correction facilities and other wholesale markets. This survey and evaluation will determine Westerns long-term involvement with the SEZ.

Acquisition Strategy

Conference Report 103-701, accompanying the National Defense Authorization Act for FY 1995 authorized the DOE to use funds available for worker and community transition activities to begin the implementation of the SEZ Task Force and *Nevada Test Site Solar Feasibility Study* (April 1994) recommendations.

Allocation of $3.85 million by DOE in FY 1995 will support development work studies and preparation of the SEZ site for the anticipated construction. The bulk of funding for plant construction will be provided by private industry through the Authority's issuance of tax-exempt bonds.

The project implementation strategy is a two-phased approach. Phase I (short term) will construct a 100MW solar-generation facility; Phase II (long term) will include the construction of facilities to generate up to an additional 900MW.

A preliminary project schedule and cost estimate for the projected statement of work (Phases I and II) are provided in the following sections. The validity of the SEZ project schedule relies upon the availability of the public and private funds necessary to complete the infrastructure upgrades, to achieve technological advancement, to secure the necessary market commitments, and to provide sufficient manufacturing capacity. A funding profile for federal moneys has also been included within the ***Resources Plan*** section of this document.

Project Schedule

Item	*Month*	*Year*
Begin Project Plan	December	1994
Final Project Plan	January	1995
Draft Request for Proposal	March	1995
Final Request for Proposal	September	1995
Environmental Impact Statement	September	1995
All Requirements Power Supply Contract:		
Issue	April	1995
Proposal Due	June	1995
Contract Award	February	1996
Site Preparation:		
Start	October	1995
Complete	January	1996
Solar Energy Plant Construction:		
Start	January	1996
Complete	December	2002

Resources Plan

Summary Cost Estimate

*Funding Resources**

Fiscal Year	DOE/DP Worker & Community Trans. Appropriation/ Obligation	DOE/EE Program Appropriation/ Obligation	Total Government Appropriation/ Obligation	Cost
1995	$ 3,850,000	$ 0	$ 3,850,000	$ 3,350,000
1996	10,000,000	1,200,000	11,200,000	$ 11,200,000
1997	10,000,000	20,000,000	30,000,000	30,000,000
1998	10,000,000	20,000,000	30,000,000	30,000,000
1999	10,000,000	20,000,000	30,000,000	30,000,000
2000	6,150,000	14,000,000	20,150,000	20,150,000
2001	0	14,000,000	14,000,00	14,000,000
2002	0	10,800,000	10,800,000	10,800,000
2003	0	0	0	500,000
Total	$ 50,000,000	$100,000,000	$150,000,000	$150,000,000

* The bulk of funding for plant construction will be provided by private industry through the Authority's issuance of tax-exempt bonds.

Human Resources

According to the NTS Solar Feasibility Study, solar development could contribute significantly to diversification of Nevada's economy through the use of instate resources while simultaneously serving national energy and environmental objectives.

Individual solar projects will have relatively little long-term impact on replacing the jobs lost at the NTS. Central station construction would employ the full-time equivalent (FTE) of 1,800 to 2,100 workers for up to two years but would then decline to between 40 to 45 permanent FTEs.

Lasting, substantial contributions to Nevada's economy from solar development require a strategy that will help the solar industry to continue toward broader competitiveness so that it may expand its growth potential and sustain large-scale development and manufacturing capability in Nevada.

Given current electricity markets and the relative maturity of the solar industry, projects and employment will have to build gradually over time. Investments in solar development will have to be sustained to support multiple projects over time in order to translate future improvements in technology and competitiveness into significant employment benefits. Phased construction of 600 megawatts of central-station generation over a six- to eight-year period will sustain construction employment at 1,500 to 2,100 FTEs and eventually lead to approximately 175 permanent FTEs involved in operation and maintenance. Export development would create

additional long-term local manufacturing employment and its resulting economic multiplier effect.

An important goal of the SEZ is to provide employment for NTS workers as the site's defense mission is downsized. In addition to providing construction jobs, other near-term support from M&O contractors will also be solicited for the following efforts:

- Sitewide Environmental Impact Statement
- Microclimate Studies
- Groundwater Studies
- Dry Cooling Studies
- Other Environmental Studies
- Power Marketing Analysis
- Power System Analysis
- NTS All Requirements Power Supply Contract Preparation & Negotiation
- Project Plan
- Site Preparation
- Support to Authority for Construction of Solar Plants
- Worker Transition Training Development & Implementation

DOE/NV will utilize its strong partnering skills with the solar industry, Nevada stakeholders, and the University of Nevada system to continue to maximize all available potential.

Measurement of Results

The success of the SEZ employment goals will be tracked through procedures and guidelines developed to measure the following categories:

- Jobs saved
- Jobs transitioned
- Jobs created

Risk Assessment

Environmental

The most serious environmental complication in some of the areas designated for the SEZ at the NTS is the presence of the desert tortoise (a threatened species). Although occurrences are low, it should not be assumed that tortoises are absent or that they will not be affected by disturbances in that habitat. Biological expertise exists within DOE/NV and contractor organizations to develop appropriate mitigation measures.

There is a possible connection between groundwater use in one area of the NTS chosen for the SEZ and the habitat of the endangered pupfish. As mitigation for this concern, low-water-usage generating facilities are being considered for use in this area. Additionally, other areas of the NTS with better access to NTS water-delivery systems have been selected for siting of rankine-cycle (i.e., water using) technologies.

If a natural gas pipeline is constructed from Las Vegas or some other location to the SEZ at the NTS, significant disturbance to the environment could occur over the possible 65 miles of construction. Although existing alignments of power and telephone lines, existing roads, and a vacated railroad bed will be used whenever possible, new construction could create an adverse environmental impact. Although not essential for some solar technologies, a supply of natural gas would enhance the marketability of the SEZ power. Furthermore such a pipeline will serve multiple programmatic needs, enhancing the competitiveness of the NTS to attract future missions.

Funds

Uncertainties exist since obtaining secure, low-cost financing is critical to the commercial viability of solar-generation projects developed at the SEZ. The level of financing supports necessary will depend on the infrastructure required, the ability of individual technologies and projects to produce electricity at competitive rates, and the expected market price for the energy produced.

Legal

Nevada has begun to lay groundwork in the State Legislature for State financing and market commitments. Federal efforts should be designed to complement and reinforce the Nevada activities.

In order for the DOE to purchase power for terms beyond ten years and only obligate the current year's need, a specific statutory exemption from the Antideficiency Act would be required. Power marketed by the Authority to non-DOE customers would not be subject to this limitation.

Specific federal authority is needed to authorize a sole-source purchase of SEZ power by DOE as a set-aside if SEZ-provided energy is above the market price. If such legislation were obtained there should be no difficulty in obtaining power from an on-site operator. Other mechanisms are also being considered to assure SEZ power is provided at a competitive rate.

The SEZ could fall within certain defense conversion provisions of the Defense Authorization Act of 1994 regarding lease and transfer of DOE property for purposes of defense conversion to civilian uses.

The initial start up of the SEZ can be accomplished under existing authority.

Marketability

In the near-term, utility electric power capacity needs are low due to reduced regional load growth and increased transactions among widely distributed utilities. This situation is expected to continue until approximately the year 2000.

Both federal and state regulators are considering the move toward a more competitive marketing environment for utilities. The resulting regulatory uncertainty means that some utilities may hesitate to commit to unproven resources, particularly for long periods of time.

There is a general unwillingness on the part of consumers to pay a substantial premium for *green power* or pursue actions that would involve utilities acquiring anything less than the superficial least-cost supply options. Part of the SEZ mission will be to identify the true long-term cost of fossil-fuel generation in comparison to renewable generation.

The role of the federal government is critical to developing the manufacturing and technology infrastructure over the remainder of this decade.

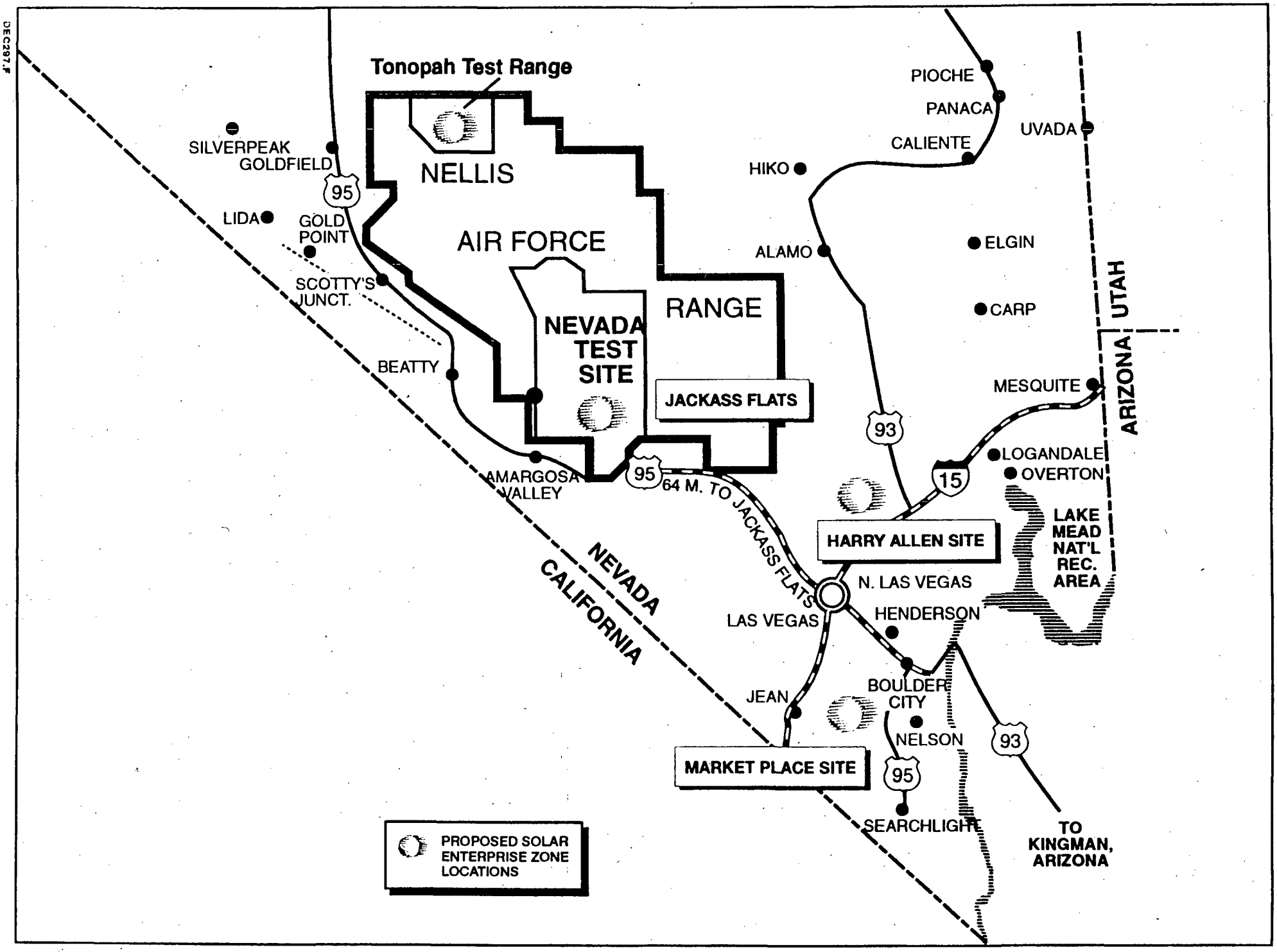
Resources

Water availability is a limiting factor for solar-thermal development anywhere in Southern Nevada. The availability of water at each of the proposed SEZ sites will determine which type of solar technology will be pursued.

Technology

Several of the technologies being considered for this project are currently in the research and development stage, which requires the assessment of risk factors for this project.

ATTACHMENT A


DEC297.ai
Tonopah Test Range
NELLIS
AIR FORCE
RANGE
NEVADA
TEST
SITE
JACKASS FLATS
SILVERPEAK
GOLDFIELD
LIDA
GOLD
POINT
SCOTTY'S
JUNCT.
BEATTY
AMARGOSA
VALLEY
95
64 M. TO JACKASS FLATS
PIOCHE
PANACA
CALIENTE
UVADA
HIKO
ALAMO
ELGIN
CARP
UTAH
ARIZONA
MESQUITE
93
15
LOGANDALE
OVERTON
LAKE
MEAD
NAT'L
REC.
AREA
HARRY ALLEN SITE
N. LAS VEGAS
HENDERSON
LAS VEGAS
NEVADA
CALIFORNIA
JEAN
BOULDER
CITY
NELSON
MARKET PLACE SITE
SEARCHLIGHT
TO
KINGMAN,
ARIZONA
PROPOSED SOLAR
ENTERPRISE ZONE
LOCATIONS

ATTACHMENT B

Solar Enterprise Zone Development Profile

Deployment in MW	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	***Total***
Flat Plate PV	5	5	10	20	20	20	20	**100**
Concentrator PV	5	10	15	20	30	40	70	**190**
Dish/Stirling	--	1	5	25	40	50	70	**191**
Parabolic Trough	80	200	--	--	--	--	--	**280**
Power Tower	--	--	200	--	--	--	--	**200**
Total	**90**	**216**	**230**	**65**	**90**	**110**	**160**	**961**

The mix of generation will be determined by competitive bid and will potentially include photovoltaics, dish/Stirling, solar trough, and power tower technologies. The SEZ Task Force accepted a goal of 1,000 megawatt (MW) of development by the year 2004 and identified a preliminary profile for deployment of the four technologies each year. The chart above depicts the planned construction schedule that will enable industry to obtain learning curve effects to drive levelized electricity costs down to the point where the technologies are cost competitive and to do so in a manner that minimizes the need for public subsidy.