

Transmission Initiative Routing Study



Prepared for:
NEAC

An Initiative to Export Nevada's Renewable Energy

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A COLLABORATIVE EFFORT BY:



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APPENDIX B

North Project Details, Estimates and Maps (Client Privileged and Confidential Information; Provided Under Separate Cover)

APPENDIX C

East Project Details, Estimates and Maps (Client Privileged and Confidential Information; Provided Under Separate Cover)

APPENDIX D

South Project Details, Estimates and Maps (Client Privileged and Confidential Information; Provided Under Separate Cover)

Section 1: Executive Summary



SECTION 1: EXECUTIVE SUMMARY

1.1 SECTION PURPOSE

This report has been prepared for the Nevada Energy Assistance Corporation (NEAC), a 501(c)(3) non-profit agency; in support of the Nevada State Office of Energy's (NSOE) mission to ensure a strategically planned development of energy resources in the State of Nevada. Working for NEAC and in direct concert with the NSOE, the partnered team of Tri Sage Consulting has conducted extensive evaluation of viable projects for high voltage transmission lines for the benefit of renewable energy development and export out of Nevada. This report provides the process and details associated with this routing and evaluation effort, and it summarizes the conclusions of proposed projects to enhance renewable export for Nevada.

The team of Tri Sage Consulting, Energy Source, LLC and US Geomatics (referenced throughout this report as the "Tri Sage team") has recommended herein three preferred high voltage transmission line projects that will support the export of renewable energy transport out of the state of Nevada. The details of how the planning and routing was completed, along with assumptions, key stakeholder meetings and technical aspects are all detailed in the following sections. Presented in this section is the summary of the findings.

1.2 EXPORT OPPORTUNITY SUMMARY

The transmission system in Nevada is primarily owned and operated by NV Energy. This system can currently accommodate renewable energy export, however, the current transmission infrastructure is fully utilized by generators in and outside of Nevada to export or transmit resources through of the state Nevada. The transmission system in the north is fully subscribed on a firm basis for both import and export of energy. In the south, firm export transmission capacity is also fully subscribed and includes coal generated power transmitted from Utah, through the State of Nevada, to California.

Using the renewable energy zones established by the Renewable Energy Transmission Access Advisory Committee (RETAAC) team (RETAAC mapping shown for reference in Appendix A), and incorporating both knowledge and known renewable developments into the overall export opportunity evaluation, three areas were identified that would allow for both sufficient supply and demand to interface through new transmission line projects.

1.3 PREFERRED PROJECT SUMMARIES

Three corridor level routing opportunities were identified and studied, which then allowed the team to establish multiple routing alternatives and ultimately identify three proposed high voltage transmission line export projects. These projects provide transmission access to the north, east, and south, enhancing new transmission export paths into the neighboring states of California and Utah.

Figure 1.1 - NEAC Proposed Export Route Map, provided below for reference, depicts the three proposed transmission line projects along with the RETAAC renewable energy zones and the existing major transmission lines within the state.

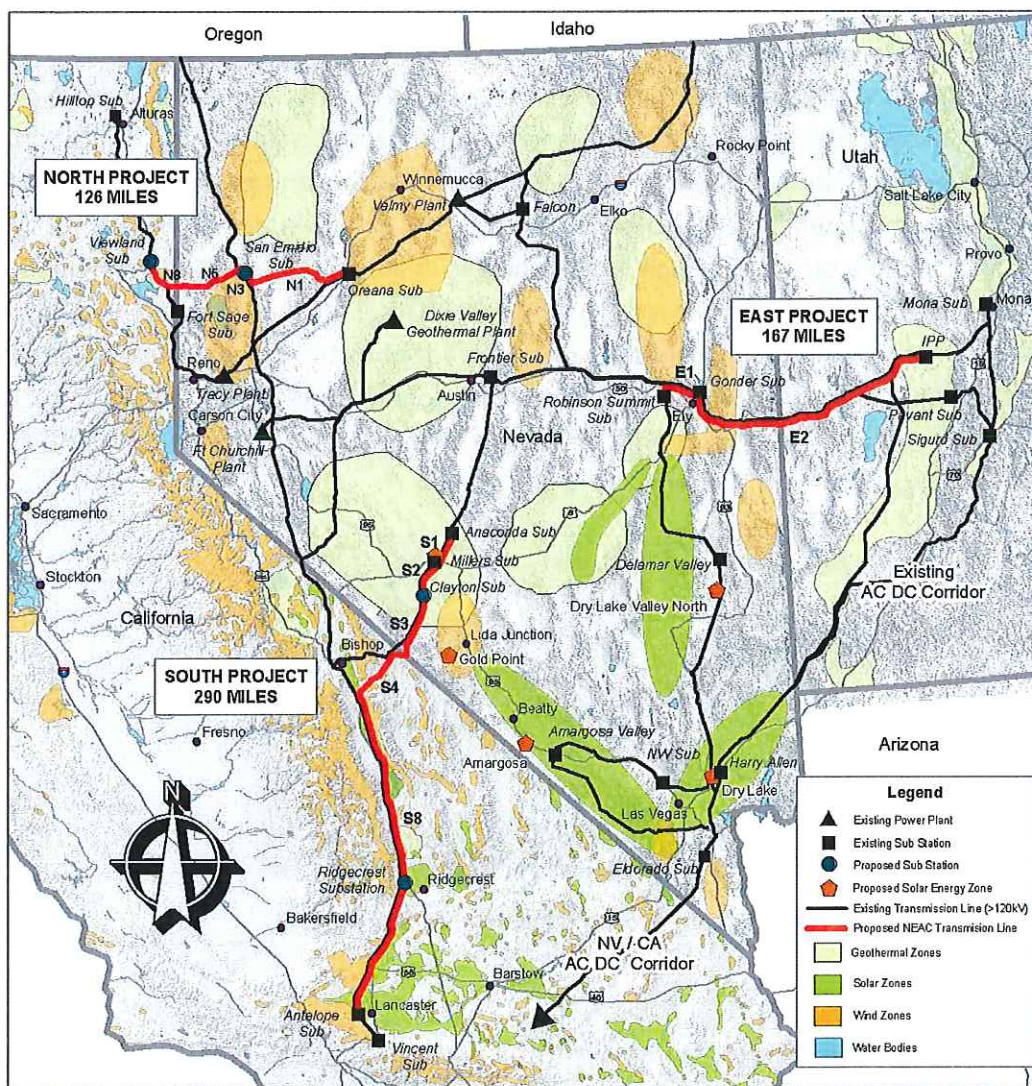


Figure 1.1 – NEAC Proposed Export Route Map

1.3.1 North Project

(500 MW incremental and 1,000 MW total with LMUD project rating, for a cost of \$197,880,000)

The northern project focuses on export into the northern central California market and utilizes the proposed transmission project by Lassen Municipal Utility District (LMUD). This route is proposed as a 345 kilovolt (kV) transmission line that will interconnect into the NV Energy grid at the Oreana Substation, and will terminate into the LMUD proposed Viewland Substation; reference *Figure 1.2 – Preferred North Route (Project)*. This project is highly dependent upon the completion of the LMUD substation and transmission line, and will require immediate coordination with LMUD and the parties associated with the LMUD project.

This northern project is projected to provide 500 megawatts (MW) of incremental export capacity. Coupled with the LMUD project rating of 500 MW, the overall transmission improvements allow for 1,000 MW of total incremental export capacity and collection, and export of power from the northern region of the renewable energy zones. This project specifically will benefit renewable projects near the San Emidio area, the Tribal renewable resources, and multiple other areas rich with resources in northwest Nevada. The line route is 126 miles long and is estimated to cost \$197,880,000. This is the total project cost (i.e. final design, permitting, construction) including the associated substations at each terminus. A third substation (San Emidio Substation) is proposed to be accommodated (but is not included in the cost) midway along the project to support renewable energy collection from renewable energy zones (REZs) north and south of this area.



Figure 1.2 – Preferred North Route (Project)

The proposed North Project will:

- Provide a backbone collector system for Northwestern Nevada.
- Relieve congestion and increase firm transfer capacity of the Alturas tie line.

- Provide another transmission source into the proposed Viewland Substation, facilitating future transmission projects from Northwest Nevada to the Northern California backbone transmission network.

This project is highly dependent on the LMUD proposed project, and as such it is recommended that the most immediate focus be in support of, and in coordination with, the LMUD project development team.

If the Tracy–Fort Sage–Viewland 345 kV transmission project, as proposed by NV Energy’s Renewable Transmission Initiative (RTI), proceeds and is completed, the North Project, as proposed herein, is duplicative in all aspects except it offers better interconnection opportunities for renewable generation locations in Northwest Nevada. The decision to proceed with the NEAC North Project will need to be made once the RTI (Tracy to Ft. Sage) outcome is known.

The North Route evaluation assumed the RTI Tracy to Ft. Sage segment is not constructed, but the RTI portion from Dixie Valley to Oreana is constructed. This assumption was made since this Dixie Valley to Oreana segment provides a strong collection opportunity in the event that the LMUD and North Project proceed.

1.3.2 East Project

(345 kV – 400 to 600 MW for a cost of \$230,570,000, and 500 kV – 750 to 1000 MW for a cost of \$413,740,000)

The eastern project provides an opportunity for Nevada to move power from the north end of the NV Energy ON Line project (interconnecting at Robinson Substation) into central Utah (interconnecting at the Intermountain Power Project (IPP) Substation); reference *Figure 1.3 – Preferred East Route (Project)*. This line would allow for export from Nevada, through Utah, into the southern California utilities that have transmission rights at IPP. Currently, export through the AC (alternating current) transmission network, from IPP to Eldorado Substation in Southern Nevada, is highly constrained. However, as coal sales decrease through this path due to California initiatives to limit coal power purchases, available capacity can be utilized through this route to allow for renewable energy sales into the southern California market.

This eastern project is projected to provide a range of export capacity based on voltage; 345 kV and 500 kV have been considered. If a 345 kV voltage is used the incremental export capacity is estimated to be between 400 and 600 MW. If 500 kV is selected the range of export capacity is projected to be between 750 and 1000 MW. The proposed route would allow power to be transferred into the existing AC/DC corridor that flows into the southern California market. A

preliminary evaluation has shown that the final economic decision of line size will be dependent upon the market demand for the capacity on the line.

The line route is 167 miles and is estimated to cost a total of \$230,570,000 at 345 kV and \$413,740,000 at 500 kV, inclusive of substation expansion costs. The terminal at the western end of the route is the Robinson Summit Substation, which is currently under construction as part of the ON Line Project. The eastern termination is the existing IPP Substation. This IPP substation is an existing hub of power transfer from the coal generation in Utah into the California Market. No new substations, only expansions of existing substations, are proposed for this project. However, the IPP expansion allows for the opportunity to continue east and interconnect into the Mona Substation, which could allow for additional market sales (this could expand the number of southern California buyers). This option was evaluated as part of the East Project, but was not selected as the preferred terminus. Mona can be considered in the future if the market warrants.



Figure 1.3 – Preferred East Route (Project)

The proposed East Project will:

- Allow for the export from Nevada, through Utah, into the Southern California utilities that have rights at IPP.
- Create opportunity for Nevada to capture capacity as it becomes available from the reduction of coal-based power purchases.
- Utilize existing line projects to assist with permitting and land acquisition.
- Support renewable energy interconnection and sales from central Nevada.
- Not require California Environmental Quality Act (CEQA) project permitting review.

The next step for moving this project forward is to further develop an understanding of the market interest of the IPP participants, as well as other California utilities with transmission rights at Mona Substation.

1.3.3 South Project

(750 to 1000 MW for a cost of \$595,310,000)

The South Project is unique in that it provides incremental and new export capacity through a route that is not physically constrained and allows for improved electrical reliability. This route is proposed to be a 500 kV transmission line originating in the Tonopah, Nevada area and terminating in the Los Angeles, California area at the Antelope Substation; reference *Figure 1.4 – Preferred South Route (Project)*. This project will interconnect into the NV Energy electric grid at the existing Anaconda-Moly Substation at 230 kV voltage. The line will continue into a proposed Clayton Substation that will step up to 500 kV voltage. From this point, the line will terminate in southern California at the existing Antelope Substation.

This scenario assumes that the NV Energy RTI is not constructed. This was necessary since the RTI outcome is unknown and is not scheduled for completion until early 2012. Two other scenarios were also considered and are presented for consideration. However, at this point in time, given the status of the RTI, this is the preferred South Project alternative for this NEAC project.

This South Project electric grid connection from Nevada to southern California offers the potential to increase export out of Nevada in a location that can integrate well with existing transmission in Nevada and California, and it has a good possibility of being permitted. The strategic siting of this line allows for interconnections into renewable energy zones in upper Nye County, Mineral County, and west central Nevada. By interconnecting into the Antelope Substation area, the renewable energy export will reach a less constrained segment of the California grid, which is on the northern side of Los Angeles, and also taps into the Southern California Edison (SCE) grid. This route avoids the electrical grid and physical environmental constraints through the Eldorado Substation by establishing a new line route into California, west of the existing Western Electricity Coordinating Council (WECC) Path 46. The WECC Paths associated with Nevada are discussed in more detail in Section 4.

In addition to accommodating renewable energy export, this new transmission line would help to reduce the existing WECC “donut hole” in central Nevada; ultimately opening not only export but a new transmission interconnection with California for other transmission transactions as well.

In addition to the terminations at the north and south ends, a new substation in southern California (Ridgecrest Substation) has been proposed that can be accommodated midway along the California segment. This substation will allow for California resources (if requested) to interconnect on the line, thus functioning as a collector to facilitate additional transfer of renewable energy on the project. The cost associated with the Ridgecrest Substation is not

included in the final cost estimate since a collector substation such as this would be funded by the participating renewable energy developers. However, for reference, a cost estimate has been completed specific to this substation and is included in the project details.

This South Project is projected to provide approximately 750 to 1000 MW of capacity into the southern California market. The line length is 290 miles and is estimated to cost approximately \$595,310,000, including new substation and expansion of existing substations costs.

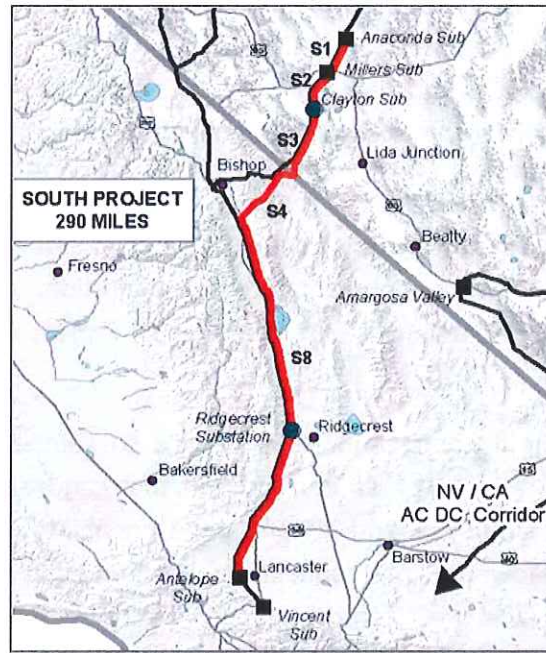


Figure 1.4 – Preferred South Route (Project)

The proposed South Project will:

- Provide incremental export out of Nevada that integrates with existing transmission in Nevada and California.
- Allow for interconnections into renewable energy zones in upper Nye County, Mineral County, and west central Nevada.
- Offer interconnection for California based renewable developments for the renewable energy zones in the Ridgecrest area.
- Connect with Antelope Substation to reach a less congested segment of the existing California grid.
- Avoid the electric grid constraints (electrical and physical) through the WECC Path 46.

The next step for this South Project will be to facilitate meetings with all the affected transmission planning sub-regions and balancing authorities.

1.4 CONTINGENT PROJECT SCENARIOS

The proposed “preferred” project alternatives herein (North, East and South) were identified, planned and routed with the intent of integrating into the existing NV Energy transmission system, taking advantage of existing and planned grid collector lines. Full consideration was given to not only the existing system, but also to the 500 kV ON Line Project that is currently under construction, the proposed Valley Electric Association (VEA) 500 kV project, and the proposed Renewable Transmission Initiative (RTI) that is currently in the planning phase. Due to the early stages of the RTI, consideration was given for both; approval or denial of the RTI project and alternative projects were established that could be included in the southern project to off-set the delay or cancelation of the RTI projects.

Two such South Project alternatives that were identified take into consideration the following scenarios: 1) The South Project being constructed in absence of RTI, but in conjunction with the construction of the VEA proposed 500 kV project; and 2) The South Project being constructed in conjunction with the RTI. Both of these scenarios add an element for additional line work consideration and are presented below.

1.4.1 South Project in Absence of RTI

With the Construction of the Valley Electric Association 500 kV Project (1500 to 2000 MW for a total cost of \$930,650,000)

In the event that the NV Energy RTI project does not proceed, but VEA does construct their 500kV project, the South Project proposed herein should be evaluated to determine if the market warrants expansion to include a 500 kV line from the NEAC proposed Clayton Substation to the VEA Pahrump 500 kV Substation. This proposed line route would utilize the 1964 U.S. Bureau of Reclamation (BOR) DC Transmission Line Alignment, which was never constructed but was mapped and recorded in the BLM archives; reference *Figure 1.5 – South Route Alternative without RTI but with VEA Project*. The Tri Sage team conducted a preliminary review of this route but did not conduct a full constraint evaluation as part of this report.

This Clayton Substation to Pahrump line would allow for the collection of renewable energy resources throughout the Nye County area. It would also tie into the Pahrump 500KV substation. This would open up additional capacity in addition to interconnecting into

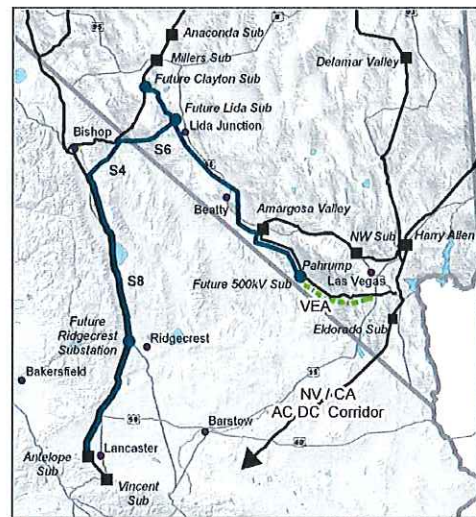


Figure 1.5 – South Route Alternative without RTI but with VEA Project

what will be a 500 kV CAISO (i.e. California Independent System Operator, also California ISO) substation in Pahrump. The total South Project line rating with this addition would potentially be 1500 to 2000 MW, potentially adding 1000 MW to the original South Project rated capacity. The total estimated cost for this expanded South Project would be \$930,650,000.

The details of this South Route Alternative were evaluated to the extent possible, without performing detailed constraint mapping and routing. If this scenario is determined to be viable based on the VEA and RTI project outcomes, the next step will require complete project routing and a preliminary design.

1.4.2 South Project with RTI Built (750 to 1000 MW for a cost of \$517,430,000)

In the event that NV Energy is successful and builds the RTI southeast segment of their proposed project, the South Route should be modified to have the northern termination point at proposed Lida Substation, just north of Lida Junction; reference *Figure 1.6 – South Route Alternative with RTI*. The northern terminus could *electrically* be at either Clayton or Lida Substations. Terminating at Lida Substation offers the benefit of an overall reduced line length. The ultimate decision should be based on the coordination with the RTI location of their designated substation. Note that not only the RTI, but the National Environmental Policy Act (NEPA) process will be a determining factor. The estimated cost associated with the north terminus relocated to Lida is estimated to be \$517,430,000.

The timing of this report conclusion and the release of the RTI findings did not coincide enough to warrant full evaluation of this option. Therefore, similar to the scenario presented in Subsection 1.4.1, if this routing option comes to a point of viability, the next step will require that complete project routing and a preliminary design be done. Before routing and design work can begin however, it will be critical to coordinate with NV Energy to establish the beginning terminus of the line (i.e. Lida or Clayton).

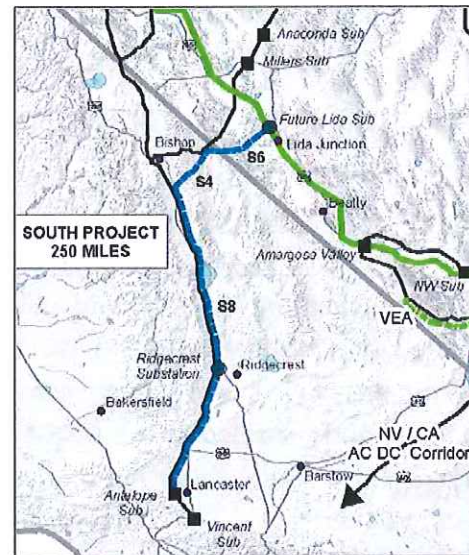


Figure 1.6 – South Route Alternative with RTI

1.5 PROJECTS COSTS AND RATINGS SUMMARY

The following *Table 1.1 – Projects Summary of Costs and Ratings*, has been provided to show a summary of each project, including alternatives that have been studied, along with costing and voltage breakout.

Project & Description	Voltage	Project Mileage	Transmission Estimated Cost ¹	Substation Names	Substation Estimated Cost ¹	Total Project Estimated Cost ¹	Average Total Estimated Cost/Mile ¹	Potential Incremental Path Rating (mw)		Total Cost per kw			Comments	
								Low	High	Low	High			
North Project:														
Oreana to Viewland & No LMUD Assumes partial RTI only (see comments)	345 kV	126	\$172,880,000	Oreana Sub	\$8,900,000								Assumes Viewland Sub is built from a green field site. Assumes that NVE RTI from Ft. Sage to Viewland is not constructed, but NVE RTI from Dixie Valley to Oreana is constructed.	
				Viewland Sub	\$16,100,000									
				Phase Shifter	\$3,200,000									
	Total		126	\$172,880,000		\$28,200,000	\$201,080,000	\$1,596,000		70				\$2,873
or														
Oreana to Viewland & LMUD Assumes partial RTI only (see comments)	345 kV	126	\$172,880,000	Oreana Sub	\$8,900,000								This project combined with the LMUD project, have a combined 1000MW incremental path increase. Same RTI scenario as above.	
				Viewland Sub	\$12,900,000									
				Phase Shifter	\$3,200,000									
	Total		126	\$172,880,000		\$25,000,000	\$197,880,000	\$1,570,000		500				\$396
East Project:														
Robinson Summit to IPP	345 kV	167	\$207,870,000	Robinson Summit	\$13,000,000									
				IPP Sub	\$9,700,000									
Total		167	\$207,870,000		\$22,700,000	\$230,570,000	\$1,381,000	400	600		\$576		\$384	
or														
Robinson Summit to IPP	500 kV	167	\$303,840,000	Robinson Summit	\$17,900,000									
				IPP Sub	\$92,000,000									
Total		167	\$303,840,000		\$109,900,000	\$413,740,000	\$2,477,000	750	1000		\$552		\$414	
South Project:														
Anaconda to Clayton Substation & Clayton to Antelope Substation Assumes No RTI	230 kV	37	\$20,840,000	Anaconda Moly	\$12,100,000								Most of the transfers must come from Tonopah area generation. High-speed transfer tripping required.	
				Clayton Sub1	\$75,350,000									
	500 kV	253	\$476,120,000	Antelope Sub	\$10,900,000									
	Total		290	\$496,960,000		\$98,350,000	\$595,310,000	\$2,053,000	750	1000		\$794		
or														
Anaconda to Clayton Substation & Clayton to Antelope Substation & Clayton to Pahrump Substation Assumes No RTI & with VEA	230 kV	37	\$20,840,000	Anaconda Moly	\$12,100,000								Half the rating increase must be scheduled to Pahrump/Eldorado and half to Antelope. Some high-speed transfer tripping may be required.	
				Clayton Sub1	\$75,350,000									
	500 kV	253	\$476,120,000	Antelope Sub	\$10,900,000									
	500 kV	174	\$299,790,000	Pahrump Sub	\$17,900,000									
Total		464	\$796,750,000		\$133,900,000	\$930,650,000	\$2,006,000	1500	2000		\$620		\$465	
or														
Lida to Antelope Substation	500 kV	251	\$476,230,000	Lida Sub	\$30,300,000									
				Antelope Sub	\$10,900,000									
Total		251	\$476,230,000		\$41,200,000	\$517,430,000	\$2,061,000	750	1000		\$690		\$517	

¹ Costs are rounded

Table 1.1 – Projects Summary of Costs and Ratings

1.6 MARKET EXPORT OPPORTUNITY SUMMARY

Specific to California and their potential interest for import of renewable energy to meet their aggressive RPS, it will be critical for the states of Nevada and California to establish a clear understanding of this policy and how it will be implemented. Once that is addressed, the associated political barriers will begin to open and each of the Projects can be considered for moving forward and ultimately be constructed.

Each Project presented herein provides its own unique opportunity for the California markets. In addition to export opportunity to California, the South Project will facilitate the opportunity for California based renewable energy generation development along the route to interconnect at the proposed Ridgecrest Substation, located in the Ridgecrest/Owens Valley area of southern California.

The North Project provides the opportunity for interconnecting renewable generation in northwest Nevada at the proposed San Emidio Substation near Gerlach, Nevada, for export to the northeast California area.

While the East Project does not have any planned intermediate collection substations, there is opportunity to interconnect at both terminus' but also throughout the NV Energy system tying to the Gonder and Robinson Summit Substations. Moreover, the overall buying market for the East Project is the Southern California utilities utilizing their existing transmission rights at either IPP and/or Mona.

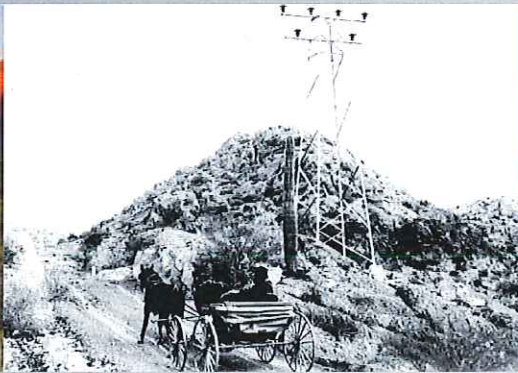
These Projects complement the overall development of renewable energy export resulting in considerable opportunities to the state of Nevada. These opportunities exist in the form of developing intellectual technology as well as actual renewable energy production. All of this is currently limited by the lack of electric transmission infrastructure reaching neighboring states, specifically the most critical market of California. California currently has a 60,000 MW coincident peak load which reflects the potential under their current RPS standard of the total renewable energy demand. Nevada will depend upon the ability to transport electricity from the north, central and southern areas of the state in order to both support the potential California renewable energy need as well as boost economic development within Nevada. This report, along with the efforts completed in support of the report, addresses California's renewable energy need and presents not only export options from Nevada to California, but also discusses the non-tangible political/economic issues facing Nevada.

1.7 BENEFITS TO NEVADA

As NEAC moves forward with the development of the project proponent team and financing structure, it will be critical to maintain clarity that these Projects will have a life expectancy of well over 50 years, and will result in an extensive tax base for the state of Nevada as well as support for the development and enhancement of the technology base for the renewable energy development within the state. These Projects, during the course of planning, design and construction, will create jobs throughout Nevada. Once completed, they will provide a key piece of infrastructure for Nevada, representing not only a new source of renewable energy export but substantially greater reliability and energy diversity for both Nevada and California.

Executive Order #2011-18, issued by Nevada Governor Brian Sandoval on November 21, 2011, was a directive for the development of a new energy industry task force that will focus on many of the issues required to fully vet the merits of renewable generation and the resulting required transmission to the state of Nevada. A copy of this executive order is included in Appendix A for reference. These Projects offer an opportunity for the task force and the State to advance renewable energy export.

Section 2: Project History



SECTION 2: PROJECT HISTORY

2.1 SECTION PURPOSE

The purpose of this section is to provide an overall historic summary of developments that have transpired over the past fifteen years, mostly at the State level, pertaining to renewable energy and associated electric transmission. While these occurrences are not directly associated with the completion of this study, they lay the foundation for what ultimately led to its inception.

2.2 RENEWABLE ENERGY EXPORT HISTORY

The following history has been compiled from multiple sources (as referenced) to provide an overview accounting of what has led to the need for this study and future export transmission development:

- In 1997, the state of Nevada adopted a renewable energy portfolio standard that required one-half of one percent of total energy sales for Nevada's electric utilities be renewable energy. This requirement for the state's public utilities was one of the first renewable energy initiatives. The utilities and developers who supported the use of renewable energy however found that there were many obstacles that needed to be addressed as a result of the new law.¹
- In 2001, the State of Nevada adopted one of the most aggressive renewable energy portfolio standards in the country. It required that five percent of the state's utilities' total energy sales be from renewable resources, commencing in 2003 and increasing every two years by two percent until 2015. By 2015, the renewable energy component was required to be fifteen percent of the total energy sales.
- In 2005, the Nevada Legislature modified this requirement to a three percent increase every two years until the renewable energy component of total energy sales in the state was twenty percent.
- In 2007, the state of Nevada's then Governor, Jim Gibbons, established the Renewable Energy Transmission Access Advisory Committee (RETAAC). This committee was established to "develop recommendations for improved access to the grid system by which renewable energy industries can set up and have market access in Nevada and neighboring states." The committee recommended that the state encourage the construction of transmission

¹ *The renewable energy boom: How Nevada is playing a vital role in this growth market.* Paper/presentation 2, Kummer Kaempfer Bonner Renshaw & Ferrario, Attorneys at Law, on August 15, 2007 at the 2007 UNLV Energy Symposium.

lines and collector systems to enable access for renewable energy development in each of the identified Renewable Energy Zones (REZs). They also recommended the state support the construction of a transmission line to connect the state's northern and southern electric grids. This line was recommended to be of sufficient capacity to provide Nevada Power Company with their non-solar renewable energy requirements from the abundant geothermal and wind resources in northern Nevada, and to provide Sierra Pacific Power Company access to the abundant solar resources in southern Nevada. Lastly, they recommended further study be completed to evaluate the feasibility of export transmission line development and the potential financing mechanisms associated with that development.

- On June 12, 2008, then Governor Jim Gibbons signed an Executive Order creating the second phase of RETAAC to further the committee's initial efforts, as described in the RETAAC Phase I Report, dated December 31, 2007. For Phase II the committee was charged with: 1) determining power potential for the renewable energy zones designated by the first phase; 2) the review of environmental, land use and permitting constraints related to the development of new transmission to accommodate renewable energy transmission; 3) the identification of potential construction corridors that could avoid these constraints; and 4) the review of potential revenue needs for construction, among other duties. A principal development of RETAAC Phase II is a map showing the state's most economically viable renewable energy zones and the transmission necessary to access the electricity believed to be contained within those zones. New transmission lines necessary to export the electricity contained in the zones were also identified. The final principal finding ranked the economic feasibility of the transmission needed to access each prioritized renewable energy zone. This information provided a critical foundation for the work completed herein. For reference, a summary of the key information from the RETAAC Phase II Report, along with associated key maps, has been compiled and is included in Appendix A of this report.²
- In November 2008, concurrent to the RETAAC effort, the West-wide Energy Corridor Final Programmatic Environmental Impact Statement (EIS) was completed, with the United States Department of Energy (DOE) and the United States Bureau of Land Management (BLM) as the lead federal agencies, and the United States Forest Service (USFS), the United States Department of Defense (DOD), and the United States Fish and Wildlife Service as cooperating federal agencies. The PEIS identified proposed Section 368 energy corridors to facilitate future siting of renewable energy development projects and electricity

² Governor Jim Gibbons' Nevada Renewable Energy Transmission Access Advisory Committee, Phase II; Volume I Executive Summary and Report, dated July 1, 2009

transmission and distribution facilities on Federal Lands in the western United States. A multi-modal energy corridor was proposed for southern Nye County, Nevada.³

- On January 16, 2009 then United States Secretary of Interior, Dirk Kempthorne authorized the BLM to establish Renewable Energy Coordination Offices in a further effort to expedite the permitting of wind, solar, biomass, and geothermal projects on BLM-managed lands, along with the electrical transmission facilities needed to deliver the energy from these projects. The offices have been located initially in the states where the greatest interest has been shown in renewable energy development: Nevada, Arizona, California, and Wyoming⁴.
- On July 1, 2009, the RETAAC Phase II Report was released, establishing viable and useful mapping of the REZs in Nevada.
- Also in 2009, responding to the information presented in the RETAAC Phase II Report, and developing legislation that would move the renewable export effort forward, the Nevada State Legislature passed Assembly Bill 387 (AB387), making transmission development to support renewable generation public policy. This bill specifically stated, "The Commission shall require the utility to include in its plan a plan for construction or expansion of transmission facilities to serve renewable energy zones and to facilitate the utility in meeting the portfolio standard established by Nevada Revised Statute (NRS) 704.7821."⁵
- In February 2010, responding to the 2009 legislation, the primary privately owned utility in the state of Nevada, NV Energy, filed a Nevada Power Company (DBA NV Energy) Integrated Resource Plan (IRP) for Transmission Corridor Projects. The Public Utilities Commission of Nevada (PUCN) rejected the plan based on concerns over ratepayer risk and the lack of information regarding developers' true financial commitments.
- In July 2010, Nevada Power Company's sister company, Sierra Pacific Power Company (DBA NV Energy) filed an IRP that proposed a renewable energy conceptual transmission plan to serve REZs filed. This plan was accepted by the PUCN.
- In October 2010, NV Energy broke ground on a new transmission line, the One Nevada Transmission Line Project, now simply referred to as ON Line. This project was approved in accordance with RETAAC I recommendations, and when completed will link the northern and southern electric grids within Nevada. This is the first step in expansion of renewable energy infrastructure. The line will extend approximately 236 miles from the Harry Allen substation, north of Las Vegas, to the new Robinson Substation, just west of Ely, Nevada.

³ *Programmatic Environmental Impact Statement, Designation of Energy Corridors on Federal Land in the 11 Western States (DOE/EIS-0386)*, dated November 2008. Final EIS can be referenced and downloaded at <http://corridoreis.anl.gov/>.

⁴ *The renewable energy boom: How Nevada is playing a vital role in this growth market.*

⁵ Assembly Bill No. 387 (AB387); Second Reprint with amendments, adopted on May 21, 2009.

While this new transmission line creates a critical link inside the Nevada grid, it does not necessarily provide any new export paths into neighboring states.

- In 2011, NV Energy developed a Renewable Transmission Initiative (RTI) to explore a customer-driven approach to renewable development. This plan, as described by NV Energy, provides a mechanism to support customer-driven transmission projects and reduces ratepayer risks. Under this plan, a request for information process was completed and data is currently being evaluated. The plan in summary establishes four specified Points of Receipt (PORs) where developers will deliver energy on the NV Energy system, and three Points of Delivery (PODs) where developers will sell the energy, or use the POD to wheel the energy into other markets. The RTI does not open up any “new” transmission paths, but rather provides intra-state connection to already established (and largely constrained) points of delivery; the main point of delivery focusing on the Eldorado Substation in the Las Vegas area.

2.3 NEVADA ENERGY ASSISTANCE CORPORATION

Responding to State Legislation, market demand, and the desire for developing the diverse resources within the state, Nevada created a non-profit corporation to explore the opportunities associated with the export of renewable power. This Corporation was founded and established in March 2009 as the Nevada Energy Assistance Corporation (NEAC). NEAC was formed as a 501(c)(3) non-profit corporation under the powers given to the Director of the Nevada Department of Business and Industry (B&I). At that time, NRS 232.520.4 set forth that the Director (of B&I) “...may, within the limits of the financial resources made available to the Director, promote, participate in the operation of, and create or cause to be created, any nonprofit corporation, pursuant to chapter 82 of NRS, which he or she determines is necessary or convenient for the exercise of the powers and duties of the Department.”⁶

NEAC is controlled by the State, through the powers of State officials acting in their official capacities to comprise seven of the nine directors. The remaining two directors have been appointed by entities organized to advance the interests of local governments within the state; the Nevada Association of Counties, and the Nevada League of Cities and Municipalities. Currently, NEAC is governed by a Board of Representatives that includes a State Senator and Assemblywoman. The Board is currently chaired by private businessman, Monte Miller.

NEAC was formed by B&I as a non-profit corporation to lessen the burdens of State government by promoting the development of renewable and sustainable energy projects within Nevada.

⁶ Lon A. DeWeese; Historic documentation prepared while acting Chief Financial Officer of Nevada Housing Division and NEAC Board Member

Pursuant to the recommendations of RETAAC and RETAAC Phase II, NEAC was formed to perform the essential functions of conducting feasibility, environmental and engineering studies, and of planning for the construction and operation of transmission lines necessary to connect renewable and sustainable energy generating sites to the state and national power grids. At the time of NEAC's development, then Governor Jim Gibbons stated that he *"...directed the formation of NEAC because the production of electricity from renewable resources within the State is necessary to the economic stability of the State and the financial well-being of its residents and resident businesses. The State has determined that renewable energy facilities will not be developed within the State unless transmission facilities are installed and operated, and the private sector has not evidenced a willingness to engage in such projects. Therefore, the government of the State, through NEAC, must perform this essential function to promote the energy independence of the State."*⁷

The Board of NEAC was clear in their understanding of the potential benefits to Nevada resulting from such electric transmission development. The Board understood that, in order to move the state forward and help to advance its growth, it was critical to understand and promote the state's abundant resources and associated opportunities. The State of Nevada holds some of the richest and diverse renewable energy resources in the Nation. As such, not only is there extensive opportunity for development within the state to support Nevada energy consumption, but the abundance of resources could also help to power neighboring states. Development of renewable energy resources within Nevada would not bring jobs into the state that are associated with the construction and operations of such plants, as well as encourage the development and expansion of intellectual capital associated with this technology. Nevada is already well on its way to being the leader in the technological development of renewable power. Several leading geothermal renewable energy developers are already based in Nevada. However, there is much untapped technological development for all resources that holds great potential for the future. It is one of the goals of the current State administration to wisely develop the state's energy resources by leading the nation in renewable energy production, energy efficiency and conservation, and exportation.

Shortly after the creation of NEAC and the establishment of their direction, the Nevada State Office of Energy (NSOE) was awarded a DOE grant to evaluate several mission-critical aspects of the needs and opportunities associated with the limitation of transmission export capability in Nevada. Subsequently, the NSOE sub-granted the funds for management by NEAC. NSOE contracted with NEAC to manage the performance and delivery of, among other things, in-state and interstate trunk and feeder liner assessments; to manage the creation of transmission line and substation financial feasibility models; to provide technical support for the creation of a bi-

⁷ Lon A. DeWeese; Historic documentation prepared while acting Chief Financial Officer of Nevada Housing Division and NEAC Board Member

state renewable energy transmission development authority; and to research and acquire program/project evaluations and review new technologies. The source of the funding was American Recovery and Reinvestment Act (ARRA) funds provided to the Nevada State Office of Energy (NSOE) by the U.S. Department of Energy's State Energy Program (SEP). The NSOE contracted with NEAC because NEAC, as a state-created non-profit, was uniquely situated to accept the funds allocated for engineering and transmission feasibility studies and could identify the specific studies needed and subsequently procure the needed services using a Request for Proposal (RFP) process. Additionally, NEAC could quickly assume control of the funds to commence identification of the studies required and begin acquisition of the third-party resources needed to perform the studies.⁸

In late 2010, complying with the NSOE mission for renewable energy export, NEAC issued an RFP focused on the evaluation of the current electric grid, and the identification of possible transmission line routes that could provide new capacity to export emerging renewable energy generating power that was either under development currently or planned for development in the coming 5 years.

In February 2011, in response to the RFP proposals submitted, NEAC retained the consulting services of Tri Sage Consulting (a partnered team with Energy Source LLC and US Geomatics) to complete a Renewable Energy Export Transmission study. This analysis was contracted as a "next step" in the state of Nevada's renewable energy development, on the heels of the recent RETAAC efforts.

On March 29, 2011, shortly after the contract was awarded to Tri Sage, the NSOE released a statement that it would provide support and guidance to the NEAC Board and the consulting team in the development of renewable energy export. Specifically, the NSOE stated:

"Nevada has successfully adopted many policies that encourage the development of renewable energy resources. Without access to transmission, developers cannot get their energy to markets within Nevada or to markets in our neighboring states. Energy export to neighboring states is a key component to enabling Nevada to create a viable energy economy. The NSOE and others are actively working on initiatives to work with regional utilities, regional cording committees and the California Energy Commission Renewable Energy Transmission Initiative (RETI) to improve Nevada's energy export potential.

NSOE also has two board positions on the Nevada Energy Assistance Corporation ("NEAC"), a 501(c)(3), non-profit organization, whose mission is to promote the transmission planning and development for renewable energy projects within Nevada. NEAC is working with

⁸ Lon A. DeWeese; Historic documentation prepared while acting Chief Financial Officer of Nevada Housing Division and NEAC Board Member

engineers and business consultants to develop routing and a business plan to develop transmission lines for export of Nevada’s renewable energy resources.

Nevada is rich with both abundant solar, geothermal and natural resources. However, the ability to harness and utilize those resources to expeditiously export power is complicated by the fact that Nevada is 85 percent federally owned and managed. The large amount of federal control makes it difficult for even privately owned lands to be developed for renewable energy production since many sites must be accessed through federal lands. Conversations are on-going with the agencies involved in permitting these lands in order to find the most effective process for approving qualified projects as quickly as possible. “

2.4 THE TRI SAGE TEAM

The Tri Sage team was selected by the NEAC Board to address the state of Nevada’s desire to evaluate several mission-critical aspects of developing an export power grid to utilize emerging renewable energy within Nevada.

It was the approach of the Tri Sage Team to assess the big picture of interstate transmission development to support renewable energy export, which then allowed for a clear approach to address each task and goal comprising this project and report. It is important to understand that an interstate transmission expansion plan of the magnitude discussed in this report requires that the neighboring states and their utilities and electric grid control operators have a mutual desire, commitment and market need to explore the potential opportunities. To this end, Tri Sage established extensive communication and held several strategic meetings with the surrounding utilities and power grid operators, including NV Energy, the California Independent System Operator Corporation (CAISO), Valley Electric Association (VEA), the Lassen Municipal Utility District (LMUD), and the Utah Associated Municipal Power Systems (UAMPS). It was during these meetings that critical information came to light that helped shape the routing approach used by the Tri Sage team for this project.

In brief, determining the feasibility of an “interstate” transmission project required a comprehensive review of possible routes that could interconnect neighboring control areas, based on research and cooperative discussions with developers, neighboring transmission grid operators and purchasing utilities. The work that has been previously performed by the Governor’s task force has identified an order of magnitude of generation potential and the market for that power based on the public policy objectives of each state. This information was used as the foundation for this planning and routing study.

Under the contract with NEAC, Tri Sage was to “develop preferred transmission line routing to allow for: 1) increased export capabilities with neighboring states; and 2) to facilitate the

development of renewable energy collector systems within the state of Nevada.” It was clearly stated both in contractual terms and verbally that of utmost importance was that Tri Sage not duplicate efforts already underway with NV Energy or other neighboring grid authorities or transmission development projects. Nor was Tri Sage to duplicate work performed as part of RETAAC Phase I and Phase II.⁹ The Tri Sage team therefore focused on utilizing existing information to enhance and further expand the export capabilities of Nevada.

Reported herein are the results of all aspects of this effort, including the electric grid interconnection perspectives, the physical line routing, the environmental and permitting constraints, and the proposed line routes to best meet the needs of Nevada for exporting renewable energy.

⁹ Feb 24, 2011; Agreement for Professional Services between NEAC and Tri Sage Consulting.

Section 3: Project Scope



SECTION 3: NEAC SCOPE & PROCESS

3.1 SECTION PURPOSE

The purpose of this Section is to discuss the scope and process of the investigation to route, perform conceptual design, and develop estimated costs for transmission projects that could provide export of renewable energy based generation located in Nevada to electric regional markets. This Section is intended to provide the basic chronological process that is later discussed in detail in the following Sections of this report.

Primary considerations are that the proposed transmission projects should be supplementary to the existing and proposed electric grid in Nevada; be integrated with neighboring interconnected electric grids; and be fully integrated and operated as part of the National American Electric Reliability Corporation's (NERC), Western Electricity Coordinating Council's (WECC) regional transmission grid.

3.2 PROJECT SCOPE

In February of 2011, the NEAC Board issued a contract to the Tri Sage Team to develop two high voltage transmission line routes into the California Market (specifically from the north and south regions of Nevada). In addition, the team was tasked with consideration of collection systems within the transmission line routing development.

The team has completed the original scoped routing, completed a third route to the east, and addressed the collection system requirements throughout the routing of each line. Additionally, the team included routing that would be necessary in the event all or some of the collection system within NV Energy defined as the RTI is not constructed. The details of these routes are presented throughout the report. The following summary highlights the process used to reach these conclusions.

3.3 EXAMINATION OF POTENTIAL EXPORT OPTIONS

The State of Nevada encompasses 110,562 square miles. The Nevada eastern border with Utah is 345 miles in length, the north border with Idaho and Oregon is 306 miles or approximately 153 miles with each Idaho and Oregon, the south border with Arizona is approximately 195 miles and the west border with California is 612 miles. While the breadth of geography is substantial, the options for transmission interconnections with other utility transmission electric grids are primarily driven by the location and electrical capacity of the existing

intrastate and neighboring interstate transmission infrastructure. Examination of the existing western grid is a prerequisite for the preliminary screening of viable new transmission alternatives. Technical review of existing transmission grids is critical to the process and narrowing of options is facilitated by focusing on the logical locations to interconnect with existing substantial electric systems. Section 4 - NEAC Transmission Strategic Discussion, of this report provides the detailed evaluation of the electrical grid implications and the project assumptions.

The existing electric grid in Nevada is presently interconnected with nine separate defined paths based on WECC, 2011 Path Rating Catalog (this issue is fully discussed in Section 4). There are presently five WECC rated and two unrated interconnected transmission paths in NV Energy's northern Nevada transmission system. The northern paths are theoretically capable (but not operationally viable) of providing approximately 1,050 megawatts of non-simultaneous firm export. NV Energy's southern transmission system has four WECC rated paths and is theoretically capable of providing (but not operationally viable) approximately 8,000 megawatts of non-simultaneous export transfer capacity.

The southern transmission paths are complicated by the allocation of existing transmission paths to various transmission subscribers other than NV Energy. In both the north and the south the Available Transmission Capacity (ATC) for new firm export transactions are nominally zero since the paths are already assigned to existing transmission users.

The technical issues regarding line ratings are more fully explained in Section 5 – Electric Grid Evaluation of this report. The ratings of transmission lines is complex and full evaluation will be required prior to initiating permitting or project financing. The purpose of this study is to investigate and recommend projects that would incrementally increase the transmission export capability. Final determination of new path ratings is beyond the scope of this report, but it is recommended that the NEAC Board consider the rating process as a next step.

To incrementally increase the export by routing and constructing new transmission interconnections, or enhancements to existing infrastructure, are options that are considered. Throughout the scope of the investigation effort, general practices of the transmission utility business have been considered. This is imbedded in the work scope of the study to minimize the costs of construction, and maximize electric transport capability for each identified project.

Identification of possible electrical interconnections is performed by initially examining the WECC system maps and online web based grid information, showing major substation and transmission line capacities and characteristics in Nevada and neighboring states. Based on the Tri-Sage team's knowledge of the western transmission grid, logical potential connection points at existing and/or proposed major substations are considered. Once alternatives are identified,

further concentrated evaluation is performed to provide preliminary analysis of potential network improvements provided by the selected proposed transmission projects.

Obtaining formal WECC ratings for any new transmission project is a lengthy and expensive process requiring extensive detailed computer based analysis and should be performed in the latter phases of any transmission development. The scope of this study and report is to offer those projects that should progress to formal transmission analysis and approval. Best evaluation was performed based on available existing information and experience.

The initial process for identifying possible terminus points in Nevada and neighboring transmission grids is a simultaneous evaluation of the technical options, existing constraints and possible routes. This was deliberately done in an iterative manner with the required technical project team members conducting a series of discussions and analysis that resulted in identifying proposed route alternatives. After initial examination and discussion of possible routes, the specific work was performed to conduct the detailed technical evaluation of the electrical system, the required mapping, Geographic Information System (GIS) database development, land use evaluation, detailed physical routing, conceptual design and structure spotting, and cost estimating which ultimately resulted in an evaluation matrix and route weighting. From this the final line route preferences were selected.

3.4 MAPPING & CONSTRAINTS

The identification of the significant constraints to route linear transmission projects to the west of Nevada and interconnected to the California electric systems is a major challenge. The geophysical constraints, land use, environmentally sensitive areas, and urban concentrations greatly limit options for constructing new electric transmission infrastructure. The constraints greatly affect potential options for transmission routing along the entire north to south length of the Nevada/California border. Similar constraints impact routing of transmission lines north, east and south out of Nevada but alternative transmission routes are more prevalent. Constraint mapping was developed and will be referenced and presented throughout this report.

The routing process requires the technical and experienced application of available mapping and information technology to simultaneously consider route alternatives that minimize line lengths and minimize impacts and estimated installed costs.

It was necessary to identify any critical or sensitive area. To establish this constraint data, extensive mapping was necessary to provide both preliminary information for routing avoidance, as well as follow-up mapping to capture the land and environmental constraints. Specific GIS mapping was used to identify specific constraints of avoidance, or mitigation.

3.5 ROUTING

The routing process is iterative and is performed substantially without requiring initial significant field investigation. Subsequent field verification to identify highly restrained sections of the lines is conducted using ground and air vehicles. Land use, land ownership, current constraint identification and topography are all considered when identifying viable line section alternatives. Where possible, environmental constraints, permitting concerns, sensitive land status, and extreme topography are avoided.

3.6 CONCEPTUAL DESIGN AND COST ESTIMATING

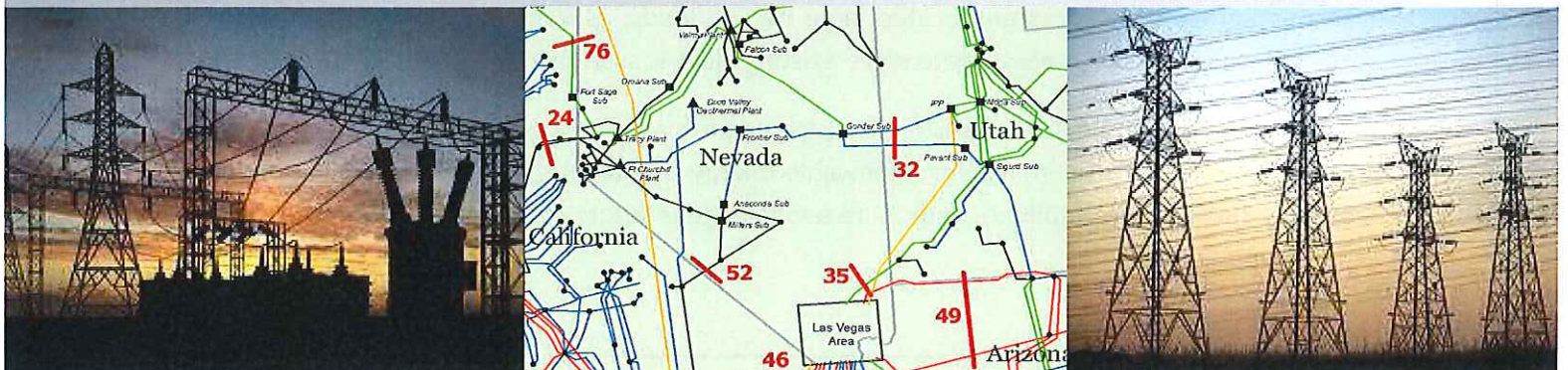
Once project routing and alignment nears completion, conceptual design of transmission structures and transmission line centerline profile provides sufficient data to determine the structure types and spans utilizing PLS CADD (A PC based software application) as a design tool. The installed cost of a transmission line is affected by the number and type of structures. PLS CADD provides a highly efficient means of optimizing the line design. Once the line is designed, the cost estimate is derived and integrated with a matrix of all project parameters to evaluate total estimated installed cost.

The entire process is iterative and requires significant human intervention and professional judgment to effect the final selection of routes, transmission line design, and the resulting estimated cost of installation. The most limiting factor is the electrical capability of the proposed lines and the ultimate effect on the total electric grid capability.

3.7 SUMMARY OF PROJECT COSTS AND MATRIX EVALUATION

In order to develop project costs, the conceptual design, along with route specific constraint data is used to develop the preliminary cost data. This costing is then used to support the final evaluation of each line segment, and ultimately determine which segments will be selected as the preferred routes. The matrix evaluation is a complex weighting that considers land impacts, permitting requirements, right of way acquisitions, and constructability. This evaluation process uses a numerical weighting of each consideration to allow for a levelized comparison of each segment. While this is a numeric process, it is highly subjective in the initial weight assigned to each constraint. This weighting is completed based on the individuals or team's experience with specific agencies, regions, terrain, and similar projects.

Section 4: Strategic Transmission Discussion



SECTION 4: NEAC STRATEGIC TRANSMISSION DISCUSSION

4.1 SECTION PURPOSE

The purpose of this section is to describe and discuss the methodology, rationale, and technical assessments utilized to determine the transmission export projects presented in this report. In order to provide an overall view of the process, this section summarizes the chronological process that was completed to reach the conclusion of the three proposed export transmission routes.

4.2 BACKGROUND

4.2.1 Transmission Historical Development

The existing transmission grid in the state of Nevada has generally been planned, designed, constructed, and operated to transport energy from generators located in neighboring states and generators located in rural locations to serve electric loads principally in urban centers within the state. Historically generators were sized to serve the electric loads for single concentrated urban areas and/or industrial electric customers. It was recognized over time that economies could be obtained by constructing large generation facilities. This required constructing transmission lines for interconnecting the generators with multiple concentrated electric loads ("load centers"). Further development of the transmission grid resulted from interconnecting multiple generation facilities to enhance reliability in the event of outages on the generators.

The state of Nevada does not have indigenous coal, oil, or natural gas to fuel conventional generators. As a result, Nevada must rely on the import of fuels and electrical energy to supply the electric load centers throughout the State. To support this, the existing transmission grid has been constructed to a large extent to import electric energy resources. Since the early 1980's both Nevada Power Company and Sierra Pacific Power Company have imported both coal and natural gas to fuel new electric generation facilities. The electric grid continues to provide imported energy and supports reliable system operation. However, alterations have been made to the electric grid in recent years, resulting from the construction of internal transmission to serve remotely located large mining loads, as well as from interconnections with renewable energy generators to serve existing electric system loads.

A paradigm shift pertaining to transmission planning has recently occurred and is driven by 1) a substantial decrease in demand for Renewable Energy due to the state's Renewable Portfolio Standard (RPS) being fulfilled; and 2) renewable generation resources located in Nevada

becoming more attractive to neighboring electric markets, like California, which have larger RPS requirements to fulfill in the next ten to fifteen years. Historically, Nevada's transmission grid has not been constructed with a focus on exporting electric generation out of the state. Recently however, the focus has evolved to investigate routing, permitting, and constructing interstate transmission lines for the primary purpose of exporting renewable power out of Nevada to neighboring electric markets. This report and the proposed transmission projects discussed herein not only fulfill the desire to export renewable energy out of Nevada, they support state policy intended to stimulate the creation of jobs and economic diversification in Nevada.

4.2.2 Regulatory Summary

The majority of transmission lines in Nevada are owned and operated by investor owned utilities (IOU) and the utilities are obligated to serve their retail customer load. These IOUs are regulated by the PUCN and require extensive review and approval of new projects by the PUCN before the construction of any major transmission lines can begin. While a significant amount of transmission has been constructed to interconnect renewable and conventional generation to the transmission grid, interstate transmission has generally only been constructed when contracted out-of-state energy sources have been approved by the PUCN to serve retail load and/or to provide increased reliability to serve the IOU's customers. There are, however, instances where transmission lines have been constructed in part to serve other wholesale loads in Nevada. Generally when other electric providers, municipalities, rural electric cooperatives (RECs) and other wholesale providers need transmission service, they must reach an agreement with the regional area grid operator(s) (in Nevada, this is the IOU, NV Energy) to construct or enhance existing transmission facilities to accommodate the wholesale supplier's needs. Wholesale requests for transmission services are administered and regulated by the Federal Energy Regulatory Commission (FERC) and are subject to various oversight and regulatory processes by the PUCN as well. The transmission grid operator must balance both State and Federal regulatory requirements. The specific governing procedures to be followed are defined in each Grid Operator's Open Access Transmission Tariff (OATT), filed with and approved by FERC.

The more global issue is that the entire United States transmission system has been developed on substantially the same premise as Nevada's. This is particularly reflected by the Federal structure of the North American Electric Reliability Corporation (NERC) and the NERC subregions, including the Western Electricity Coordinating Council (WECC), which is responsible for coordinating and promoting bulk electric system reliability for the Western United States (i.e. the Western Interconnection). Certain defined transmission owners, designated as Transmission Grid Operators, have the responsibility for operating and coordinating the

transmission systems to allow for “non-discriminatory open access” to all users while ensuring reliability. The process is highly regulated and structured, which makes it difficult to adapt to today’s desire to create more ubiquitous electric markets, particularly as it concerns renewable generation alternatives.

Currently there is an effort by FERC to specifically address these issues. FERC Order No. 1000, issued July 21, 2011, is intended to modify FERC rules to accommodate the changing demands by renewable generation developers for increased transmission service. FERC Order No. 1000 reforms the Commission’s electric transmission planning and cost allocation requirements for public utility transmission providers. It requires that all regional transmission plans include transmission facilities driven by public policy mandates, such as renewable energy requirements. Cost allocation methodologies of such transmission facilities must be consistent within the regional planning area.

In summary, FERC Order No. 1000 requires the following actions:

Three requirements for transmission planning

- Each utility transmission provider must participate in a regional transmission planning process, which produces a single regional transmission plan and satisfies the principles under Order No. 890;
- Each transmission planning process at the local and regional level must consider transmission needs driven by federal or state laws or regulations; and
- Utility transmission providers in neighboring transmission planning regions must coordinate concerning more efficient or cost-effective solutions.

Three requirements for transmission cost allocation

- Each utility transmission provider must participate in a regional transmission planning process, which has a regional cost allocation method for new transmission facilities that satisfies six regional cost allocation principles;
- Utility transmission providers in neighboring planning regions must have a common interregional cost allocation method for new interregional transmission facilities, which satisfies six regional cost allocation principles; and
- Participant funding of new transmission facilities is permitted but is not allowed as the regional or interregional cost allocation method.

Presently, NV Energy’s northern and southern systems both participate in the WestConnect subregional planning group. However, WestConnect is broken up into three subregional planning areas. The northern NV Energy system participates in the Sierra Subregional Planning Group (SSPG), while the southern NV Energy system participates in the Southwest Area

Transmission (SWAT) Subregional Planning Group. The third group, Colorado Coordinated Planning Group (CCPG) doesn't include Nevada. It is currently unclear whether or not FERC Order No. 1000 will allow the three WestConnect subregional planning groups to have different cost allocation methodologies. Upon completion of NV Energy's ON Line 500 kV project, which directly interconnects the northern and southern portions of NV Energy's system, it is anticipated that the combined NV Energy system will be operated as a jointly dispatched, single system, with a single transmission wheeling rate and a single transmission tariff. At that time, the combined NV Energy system may choose to participate in a single larger subregional planning group, rather than the two it participates in today. In the future, a single transmission tariff may require a single cost allocation method for the entire NV Energy system.

4.3 GENERATION COLLECTOR SYSTEMS AND NEVADA GRID EXPANSION

4.3.1 Existing Grid Constraints

NV Energy's existing grid was designed, constructed and operated to principally serve retail load in Nevada. However, because NV Energy also provides wholesale transmission services to other wholesale entities, the electrical grid has been constructed to also accommodate those needs. The existing NV Energy grid currently operates as it was intended, which is to primarily serve the retail load in Nevada and utilize key transmission lines to supplement with needed resources from outside the state for wholesale and retail customers in Nevada. The transmission system can accommodate some export, and has been fully utilized to that means by generators inside and outside of Nevada to export or wheel power through the state. Available conventional generation is also exported on a non-firm basis.

The transmission system in the north is fully subscribed on a firm basis for both import and export of energy. In the south, firm export transmission capacity is also fully subscribed. While firm import transmission capacity is available in the south, the import capacity still available is from California based resources. Economics dictate that there is little demand for purchased power from higher cost California based resources into Nevada. Absent major interstate transmission expansion, little opportunity remains for either wholesale providers to import into the state or for new generation to export to neighboring markets. This is a testament to the efficiency of the existing system in that the load is being served in the state by the in-state transmission system and retail customers aren't incurring excess costs. The need for both additional import and export will require construction of new interconnected transmission systems. Ideally the construction of new lines will serve the incremental needs of out-of-state users with no adverse impacts occurring to existing customers.

4.3.2 Existing Grid Detail Summary

Nevada has multiple electrical interconnections that are utilized for importing or exporting electrical energy into or out of the state. The interconnections are grouped together to form transfer paths. The *WECC Glossary Proposal*¹ defines a “Transfer Path” as:

An element or group of elements (transmission lines, transformers, series capacitors, buses or other pieces of electrical equipment interconnecting control areas or parts of a control area) over which a Schedule can be established.

On a yearly basis, the WECC publishes the *WECC Path Rating Catalog*. It is a collection of discussions on individual path ratings within the WECC system. As defined within the Catalog, a “Path” is composed of an individual transmission line or a combination of parallel transmission lines. A “Transfer Path” may be composed of transmission lines between control areas or internal to a control area, or a combination of both.

The path rating for most paths is dependent on a multitude of electrical system conditions. If the system conditions are favorable, the path rating will increase. Unfavorable system conditions tend to result in a decreased path rating. As a result, path ratings typically vary over a range, from a maximum value to a minimum value. In normal WECC parlance, path ratings fall into one of three categories: non-simultaneous, simultaneous, and/or firm. Non-simultaneous path ratings represent the maximum path rating for the most favorable combination of system conditions. From a probabilistic perspective, only rarely are all the system conditions optimum, so at any point in time, the prevailing “operational” path rating is almost always less than the non-simultaneous rating. The path ratings listed in the *WECC Path Rating Catalog* are non-simultaneous “maximum” path ratings.

Firm path ratings represent the minimum value of the range of a path rating. Firm transmission rights are transmission rights guaranteed to be useable, with the possible exception of transmission line outages or other unusual circumstances or emergency conditions. Transmission providers can sell firm transmission rights up to this value, since the operational path rating is at or greater than this value virtually 100% of the time.

Simultaneous path ratings are an attempt to quantify a path rating that is dependent on varying system conditions. Many times the path rating depends on the flow level on some other transmission line or path. Often the dependency is described graphically with a nomogram (a graphical analog computation figure). Simultaneous path ratings represent the range of path rating values between the non-simultaneous “maximum” path rating and the firm “minimum” path rating.

¹ <http://www.wecc.biz/library/WECC%20Documents/Publications/WECC%20Glossary%2012-9-2011.pdf>

The electrical interconnections between Nevada and the neighboring states are contained in nine WECC-rated transfer paths and two non-rated transfer paths. The following describes the non-simultaneous “maximum” path ratings of these transfer paths, which are physically depicted in *Figure 4.1 – WECC Path Rating Summary Map*, and *Figure 4.2 – WECC Path 58 Breakout Map (Las Vegas Area)*. *Figure 4.2* specifically provides detail of the southern cut path of 58, which is described in the following text.

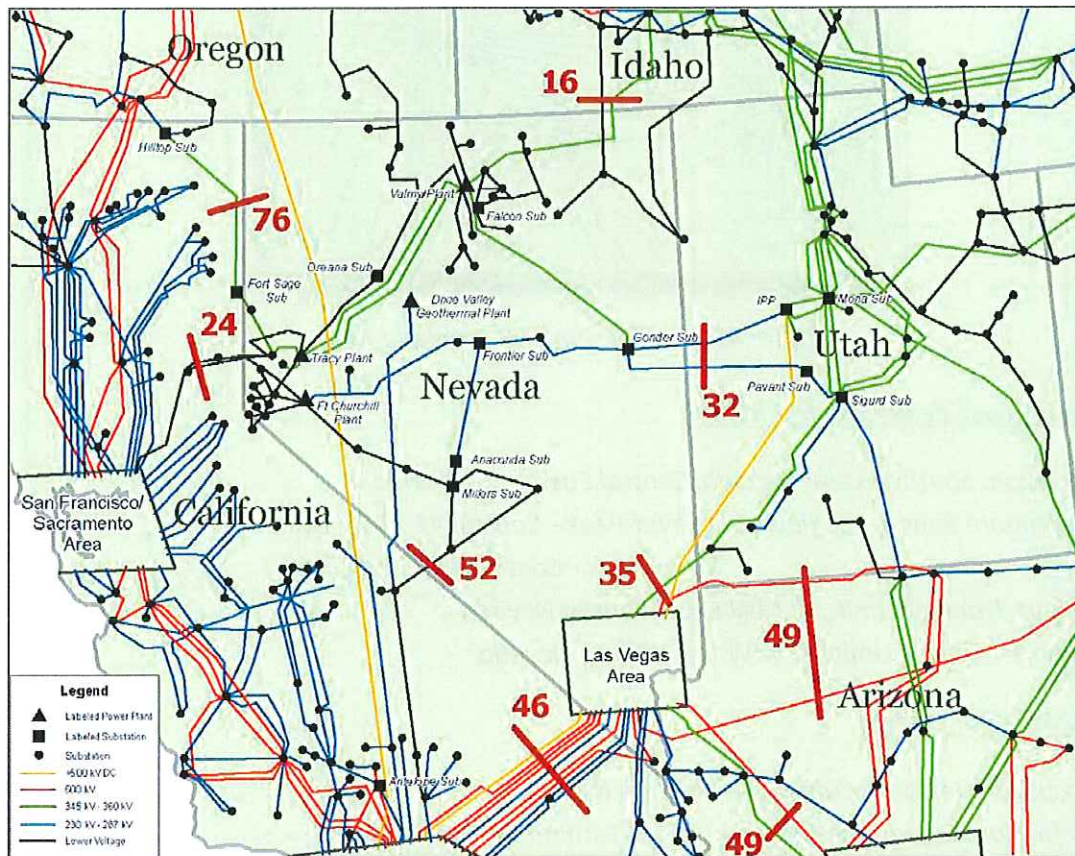


Figure 4.1 – WECC Path Rating Summary Map

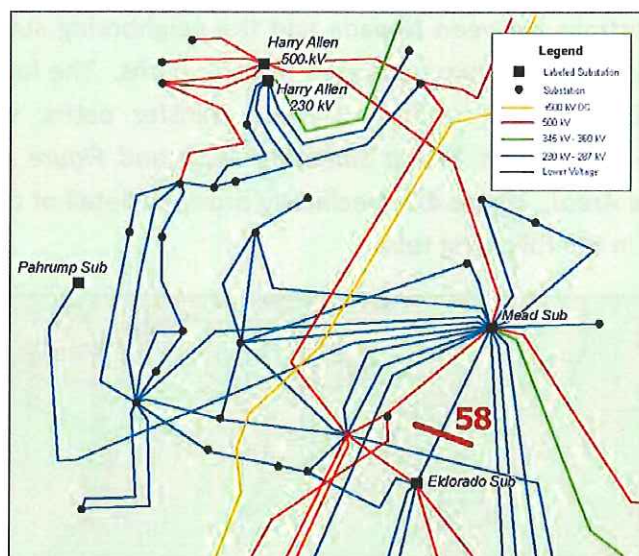


Figure 4.2 – WECC Path 58 Breakout Map

Path 52: Silver Peak - Control 55 kV

Location: Southwestern Nevada/Central Eastern California

Definition: Sum of the flows on: Silver Peak - Control #1 55 kV Line

Silver Peak - Control #2 55 kV Line

Export Transfer Limit: 17 MW Export out of Nevada

Import Transfer Limit: 17 MW Import into Nevada

Path 24: PG&E - Sierra

Location: Northern California/Western Nevada

Definition: Sum of the flows on: Drum-Summit 1 - 115 kV Line

Drum-Summit 2 - 115 kV Line

Drum-Summit 60 kV Line

Export Transfer Limit: 150 MW Export out of Nevada

Import Transfer Limit: 160 MW Import into Nevada

Path 76: Alturas Project

Location: Northeastern California/Western Nevada

Definition: Hilltop-Bordertown-N. Valley Road 345 kV Line

Export Transfer Limit: 300 MW Export out of Nevada

Import Transfer Limit: 300 MW Import into Nevada

Path 16: Idaho - Sierra²

Location: Southern Idaho/Northern Nevada

Definition: Midpoint-Humboldt 345 kV Line

Export Transfer Limit: 360 MW Export out of Nevada

Import Transfer Limit: 500 MW Import into Nevada

Path 32: Pavant - Gonder 230 kV / Intermountain - Gonder 230 kV

Location: Western Central Utah/Central Eastern Nevada

Definition: Sum of the flows on: Gonder-Pavant 230 kV Line

Gonder-Intermountain 230 kV Line

Export Transfer Limit: 235 MW Export out of Nevada

Import Transfer Limit: 440 MW Import Into Nevada

Path 35: TOT 2C

Location: Southwestern Utah/South-East Nevada

Definition: Red Butte-Harry Allen 345 kV Line

Export Transfer Limit: 300 MW Export out of Nevada

Import Transfer Limit: 300 MW Import Into Nevada

Path 58: Eldorado - Mead 230 kV Lines

Location: Near Boulder City in southern Nevada

Definition: Sum of the flows on: Eldorado-Mead #1 230 kV Line

Eldorado-Mead #2 230 kV Line

Export Transfer Limit: 1,140 MW Export out of Nevada

Import Transfer Limit: 1,140 MW Import Into Nevada

Path 49: East of the Colorado River (EOR)

Location: Southern Nevada and Southern California/Arizona

Definition: Sum of the flows on: Six various 500 kV & 345 kV Lines

Export Transfer Limit: Not Rated

Import Transfer Limit: 9,300 MW Import Into Nevada & Southern California

² Simultaneous ratings of Path 16 are dependent on NV Energy's north net control area operations. Seasonal System Operating Limits (SOLs) may be more restrictive for operating South to North.

Path 46: West of Colorado River (WOR)

Location: Southern Nevada and Arizona/ Southern California

Definition: Sum of the flows on: Fourteen various 500 kV & 230 kV Lines

Export Transfer Limit: 10,623 MW Export out of Nevada & Arizona into Southern California

Import Transfer Limit: Not Rated

Marble Interconnection – Not a Rated Path

Location: Western Nevada/North Central California

Definition: 60 kV line between Truckee & Portola California

Export Transfer Limit: Not Rated

Import Transfer Limit: Not Rated

TerraGen / SCE Interconnection – Not a Rated Path

Location: Western Central Nevada/Southern California

Definition: 230 kV line between Dixie Valley, Nevada & Southern California Edison

Export Transfer Limit: Not Rated

Import Transfer Limit: Not Rated

All of the above path ratings are non-simultaneous “maximum” path ratings. These ratings have been determined by “picking and choosing” the transmission system conditions to optimize the path rating for the path in question. While any given transmission system condition may have a positive influence on one path rating, it also may have a negative influence on the rating of a different path. For this reason, it would have been technically inaccurate to sum the non-simultaneous import or export ratings of the individual interconnecting paths of Nevada to try to determine the total import or export capability of the Nevada interconnections. This effort would have provided meaningless information to both the routing process and the State of Nevada.

Any attempt to quantify the total import or export capability of the interconnections of Nevada must be preceded by defining the prevailing transmission system conditions. The study effort to quantify a system limit is separate and distinct from individual path rating study efforts. The path rating study efforts will be required to be completed as a next step of this project.

To simplify the understanding of the current transmission electrical paths in and out of Nevada, the team evaluated all of the above referenced WECC ratings. *Figure 4.3 – Current System Import/Export Paths in Nevada*, is included in the report to provide a high-level summary of the existing Nevada transmission system, including its current abilities and limitations, and to provide some insight into the methodology used for developing the routes proposed herein.

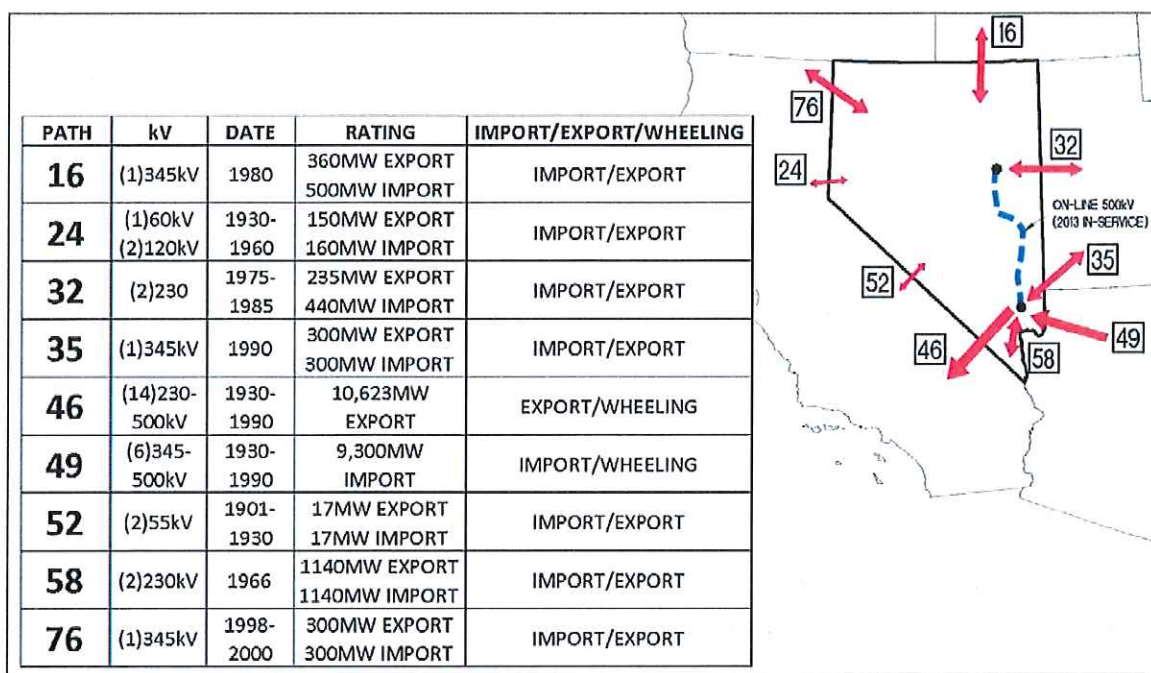


Figure 4.3 – Current System Import/Export Paths in Nevada

This simplified figure of Nevada shows current designated and rated high voltage transmission line paths. The existing transmission lines into the southern California market are robust in rating (path 46) but heavily congested by existing contracts. Paths 76, 24 and 52 provide import/export capacity for the NV Energy North System. The ON Line Project is shown on the map to emphasize that once it is in service (anticipated to be 2013), the total Nevada electrical grid can function as one transmission control area.

While this team did not have the benefit of specific path rating constraints, studies and capabilities, it should be noted that the existing export out of Eldorado Substation, and hence through Path 46 is known to be highly constrained. This information is derived from interconnection studies, transmission studies and professional renewable energy development experience. It is expected that, as California reduces dependency on Coal Generation, capacity will become available through this path. As conditions exist today, export capability into the southern California area is highly constrained. This report endeavors to focus on finding an alternative to this constrained path. The specific details of export capabilities in each region within Nevada (i.e. Northern, Eastern and Southern) are discussed in detail in each subsequent electrical discussion.

The existing interconnections from Nevada to its neighboring states are capable of exporting several thousand megawatts, as reflected in Figure 4.3. However, virtually all of the existing firm export capability is presently committed to existing power purchase or transmission

wheeling transactions. Renewable generation project developers have effectively utilized the Nevada transmission system and contracted for all Nevada firm export transmission capacity in support of existing generation projects. This is evidenced by the current lack of availability of export capacity.

Again, the absence of available transmission capacity is an indicator of an efficient market. The Nevada interconnections were planned, designed, and constructed to optimize the importation of inexpensive purchased power to serve Nevada retail loads. It is not surprising that export capability is scarce and in high demand, when the existing transmission system has not been significantly expanded or optimized for it.

4.3.3 ON Line Transmission Line

The major transmission line grid improvement currently being constructed in Nevada is the NV Energy 500 kV transmission line, from Harry Allen Substation, northeast of Las Vegas, to Robinson Summit, northwest of Ely, Nevada; i.e. ON Line. When put into service, this line will provide a direct interconnection between NV Energy's north and south electrical systems. Once operational, the line will integrate electric generation resources statewide and will allow the transfer of generation north-to-south and south-to-north. The ON Line Project will enhance the intrastate transmission transfer capability, but it does little to satisfy the need for collector systems for in-state renewable resource zones, or to provide meaningful incremental increases in transmission system export capability to neighboring states. In order to truly increase export capacity out of Nevada, it will be necessary to add transmission improvements in the south, between Harry Allen and Eldorado Substations and between Eldorado Substation and southern California.

4.3.4 Grid and Collector System's Expansion

In the past, interstate transmission lines, for the strict purpose of renewable energy export, have not been approved by the PUCN, and consequently have not been constructed. In the 2009 Nevada Legislative Session, Assembly Bill 397 was passed, directing the PUCN as follows:

"The Commission shall require the utility to include in its plan a plan for construction of or expansion of transmission facilities to serve renewable energy zones [which had been identified by RETACC] and to facilitate the utility in meeting the portfolio standard established by the NRS 704.7821".

It should be noted that this policy is intended to meet the needs of the Nevada RPS and does not specifically address a policy for renewable energy export.

NV Energy subsequently initiated the Renewable Transmission Initiative (RTI) in August of 2011. This process will quantify the level of market interest of the renewable energy developers to participate in the studies and development of new transmission facilities and service in Nevada. Agreements for study participation are scheduled to be completed by spring 2012, and the resulting studies are anticipated to be completed sometime later in 2012. This was a fundamental effort to enable the potential development of bulk transmission lines to accommodate the interconnection of proposed generators with the electrical grid and to move the power to major “Points of Delivery” within the combined NV Energy transmission grid. NV Energy proposed significant transmission system expansion internal to Nevada to allow for interconnections with renewable generators to accommodate a large portion of the Renewable Energy Zones (REZs). The NV Energy RTI map that has been submitted to the PUCN and is presented as *Figure 4.4 – NV Energy Renewable Transmission Initiative*, and is intended to provide a reference herein for the RTI projects being considered.

While the transmission improvements outlined in the RTI proposal will significantly increase the transmission system’s capability to move power within the state of Nevada, the RTI provides negligible incremental export capability out of the state. NV Energy’s RTI includes four “Points of Receipt” (PORs, numerically depicted) and three “Points of Delivery” (PODs, alphabetically depicted). For the export of renewable energy to neighboring states, the RTI process is highly dependent on the transmission capability at the designated PODs, indicated as “A”, “B” and “C” in *Figure 4.4*, in order to export. PODs A and B are contingent on transmission projects proposed by other entities, and POD C is dependent on the available export capacity at Eldorado Substation, south of Las Vegas.

Notwithstanding the RTI, which includes interconnection and transmission agreements as part of the process, generators wishing to connect to NV Energy’s electrical grid are required to request a generation interconnection and execute an interconnection agreement. Additionally, when renewable developers designate a point of delivery outside the NV Energy grid, a Transmission Service Request and a Transmission Service Agreement will be required. This is administered as prescribed under the NV Energy FERC OATT.

For purposes of this report it is assumed that the interconnections will be administered through the established FERC OATT and will be processed by NV Energy to transport energy from the renewable generator location to the interconnection points within the NV Energy grid. Also, transmission service requests and agreements will be processed through the same FERC and NV Energy process, but will be from the point of interconnection to the transmission grid interfaces with other utilities. To a large extent, absent the construction of a substantial portion of the transmission included in the RTI, the proposed export projects in this report would require the

construction of similar transmission facilities, as described in the RTI, to be functional for the system to be fully integrated.

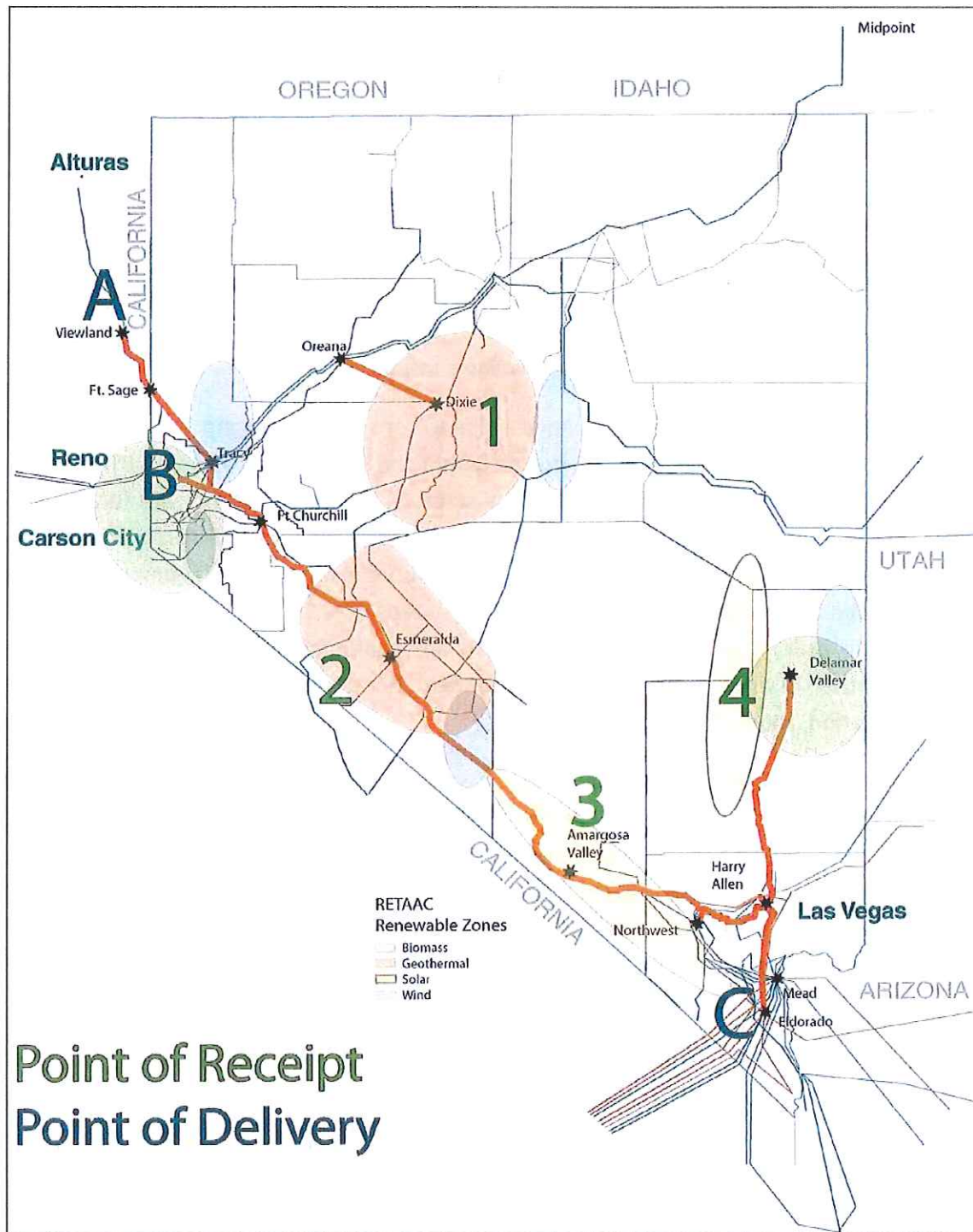


Figure 4.4 – NV Energy Renewable Transmission Initiative

It was specifically stated in the original scope of this project to not duplicate the process and responsibilities of NV Energy. However, a market solicitation similar to the RTI may ultimately be necessary prior to development of any one of the transmission projects proposed herein. The projects as described in this report, and some portion of the facilities described in the RTI are necessary to have a robust ability to export the substantial renewable generation potential identified in Nevada. If all the transmission considered in the RTI were constructed, the intrastate electric grid would be robust and might well allow for the connection of *any* generation in the state, as well as provide the opportunity for export assuming the generation source was located relatively close to a major substation. It should be noted that this report did consider the potential impacts if the RTI is not implemented. Possible alternatives, both with and without the construction of RTI, are discussed later in this report.

Section 5: Electric Grid Evaluation



SECTION 5: ELECTRIC GRID EVALUATION

5.1 SECTION PURPOSE

This section presents the assumptions, considerations and limitations that were all factors in the evaluation of the electric grid. Additionally, it contains the planning and technical references necessary to reach the proposed preferred routing in this study. Note that while much of this language is highly technical, it is necessary to capture in order to support future studies and evaluations as the projects proceed.

The evaluations presented in this section were necessary to arrive at a fundamental level of assumptions that would be used to establish the termination points of the transmission line routes. It was critical that the termination points be located such that they support the most physically viable routes (physical element) as well as establish the most viable interconnections to the power market (electrical element). The term “routing” is used throughout this report in discussions pertaining to both electric grid evaluation as well as physical constraints and mapping evaluation. It is a broad representation of many aspects of work and analyses that were performed to ultimately arrive at the preferred transmission line projects presented in this report.

5.2 INITIAL TRANSMISSION EXPORT REVIEW AND ANALYSIS PROCESS

5.2.1 Existing Information Review

In order to fulfill the requirements to assess and recommend two to three transmission options that would provide additional export of renewable energy production out of Nevada to potential electric markets, an evaluation of the existing transmission grid and proposed projects that have been evaluated by NV Energy, the PUCN, and other regional transmission alternatives proposed by private transmission entities or other utilities were considered. As part of the overall evaluation process, a good deal of time was invested in a stakeholder collaborative process in Nevada in order to understand the regional renewable generation transmission needs. As discussed previously, RETAAC conducted extensive reviews and assessments pertaining to this very issue, and the resulting completed reports were fundamental in the initial process of this evaluation. The pertinent RETAAC mapping referenced for this study is included for reference in Appendix A.

The state of Nevada regulatory process requires that the state’s two investor owned utilities (IOUs), Sierra Pacific Power Company (SPPC, DBA as NV Energy) and Nevada Power Company (NPC, DBA as NV Energy), develop and file for review and approval Integrated Resource Plans

(IRPs) on a triennial basis. This process has been in place since the 1980's and requires filing of significant transmission projects necessary to serve the customer loads in their respective service territories, as well as filing of transmission service for other wholesale customers as defined and administered by FERC.

The most recent IRPs filed with the PUCN are NPC's 2010-2029 Resource Plan, assigned docket #10-02009, and SPPC's 2011-2030 Resource Plan, assigned docket #10-07003. A full review of these filings was conducted and particular attention was focused on the "Renewable Conceptual Transmission Plan" section that was requested by the Nevada Legislature and filed as part of Docket #10-07003.

5.2.2 Electric Routing Objectives

Based on a thorough evaluation, incorporating knowledge of the existing system, technical transmission grid experience, and regulatory understanding, the following objectives were established:

- Identify specific transmission projects or improvements that would make optimum use of existing transmission facilities to fully utilize export from Nevada.
- Explore and evaluate new interstate transmission options that would significantly improve export paths directly or indirectly to California electric buyers.
- Identify the routing of transmission that would also provide key integration of transmission/distribution collector systems for renewable energy resource zones identified by the RETAAC initiative and reports.
- Give full consideration to transmission projects that can enhance the reliability of the transmission system and benefit overall transmission operation.

The work performed by RETAAC regarding renewable energy zone (REZ) descriptions and estimated resource generation values provided a strong place from which to start for this study. To the degree that NV Energy had provided transmission solutions in RETAAC, and filed IRPs, including the Renewable Conceptual Transmission Plan, the focus for this effort was to utilize and incorporate that existing planning information, apply a "fresh look" at the overall transmission planning picture, and ultimately select those projects that would yield the most expedient solutions to improving export out of Nevada to other electric markets for renewable generation.

Several projects, particularly in southern Nevada, that would relieve transmission congestion to allow transport of energy to the existing Alternating Current (AC) and Direct Current (DC) transmission corridors south of Las Vegas were not approved to proceed by the PUCN at this time, due primarily to the prioritized need at the time to focus on service to retail customers.

Load growth in the greater Las Vegas area, however, has not materialized as previously projected. Therefore, though a good deal of effort has been expended exploring and recommending solutions by the Grid Operators, no certainty to completion of proposed projects is assured.

In northern Nevada, Great Basin Energy Development, LLC Transmission has proposed a HVDC underground project from Tracy Substation to O'Banion Substation, south of Yuba City, California; and Lassen Municipal Utility District (LMUD) has proposed a project from Susanville (Viewland Substation) to Olinda Substation in North Central California. These projects are proposals by developers other than NV Energy (Grid Operator). Both of these projects are not directly influenced by any Nevada based transmission entity. The dilemma is that the transmission grid operator has no authority to construct for export and under FERC guidelines; a transmission project request requires contract commitments of the requesting party or parties. The nature of the development of renewable resources is incremental and not necessarily coincident in timing to provide aggregated need and commitment to solidify enough demand to move forward on proposed projects. It is a "catch 22" situation for all involved. This study effort is only the first part of the longer term solution. The business case for moving forward on the proposed projects will need to be developed once proposed project routes are determined.

Transmission projects proposed in this investigation focus on taking advantage of existing transmission facilities, as well as already proposed projects internal to the Nevada grid, which can help to accelerate the process of constructing interstate transmission improvements. The proposed projects in total will provide integration of renewable resources located in Nevada to the electric grid, as well as provide export paths to the neighboring electric markets.

5.3 ROUTING RATIONALE FOR ELECTRIC EXPORT AND GRID CONNECTIVITY

5.3.1 Renewable Energy Zones and Geographic Constraints

A major consideration for routing transmission lines from Nevada to California is the limited available possibilities to route and permit new transmission lines along the entire Nevada/California border. The fundamental problem is the extent of existing constraints. Geographically, these include the Sierra Nevada mountain range, extensive National Parks, Wilderness Areas, Wilderness Study Areas, highly sensitive land uses, and a sizeable concentration of Urban Areas that limit possible interstate transmission options. Taking these constraints into consideration, the Tri Sage team's focus for this study was to concentrate on examining alternatives that could avoid the obvious barriers yet have the greatest chance of being permitted. The following *Figure 5.1 - Physical Constraints Map of California-Nevada*

Border, provides a visual depiction of the extent of constraints along the Nevada-California border. As indicated, all identified constraints are shown in red, and represent the areas that would have either no, or extremely limited, opportunity for crossing.

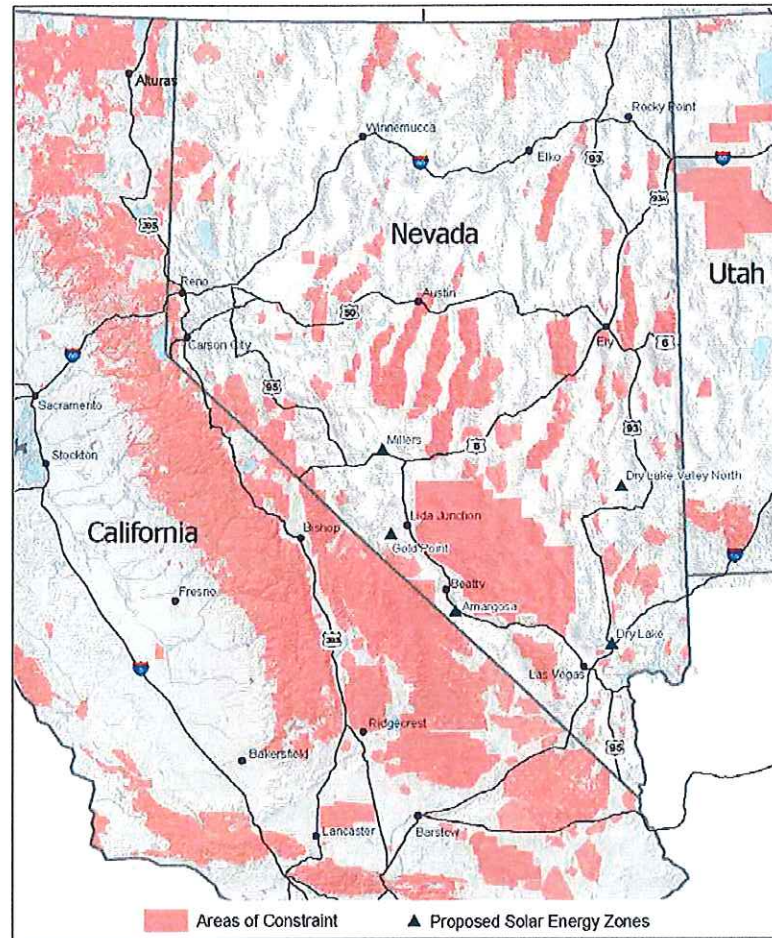


Figure 5.1 – Physical Constraints Map of California-Nevada Border

In addition to understanding the physical routing constraints along the Nevada-California border, it was critical to also understand how the REZs in the state are positioned so that they could be accessed to the greatest extent possible to allow for export of renewable energy into California. Again, taking advantage of work already performed and presented in the RETAAC Phase I & II Reports, the team reviewed the REZ mapping and overlaid the information onto the constraints mapping for this project. This combined mapping, shown in *Figure 5.2 – Physical Constraints with Renewable Energy Zones*, helps to show how the physical constraints impact the ability to develop transmission export from the REZs, particularly along the west and southwest borders of Nevada.

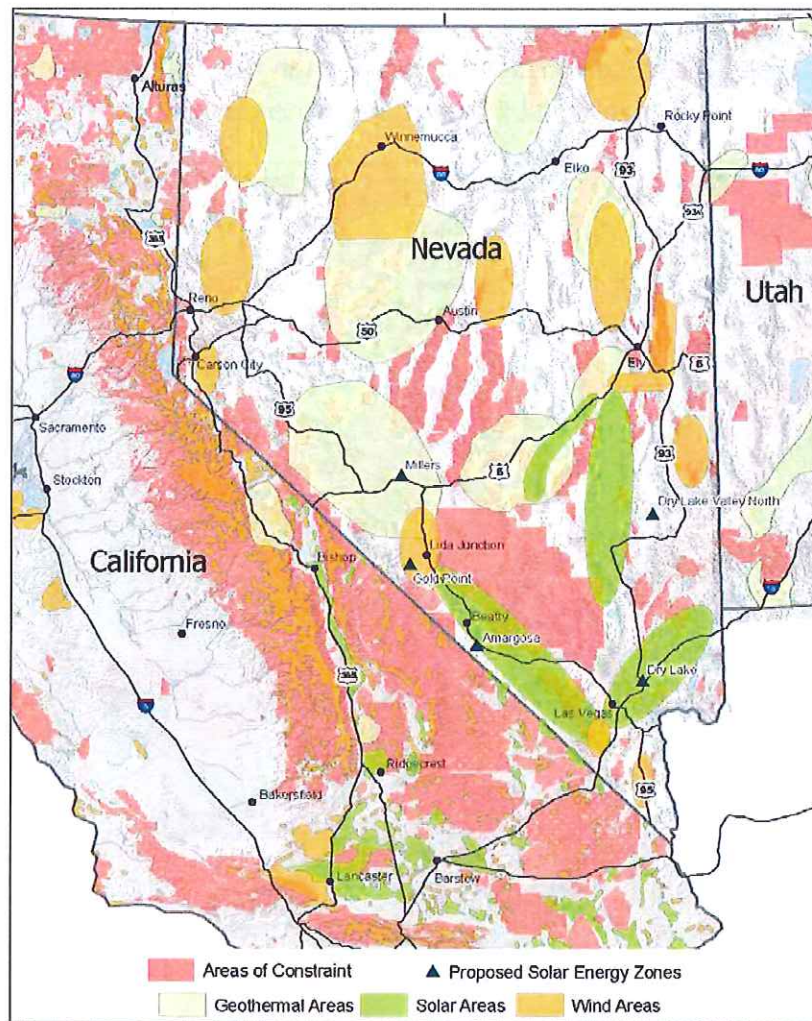


Figure 5.2 – Physical Constraints with Renewable Energy Zones

5.3.2 AC versus DC Export Consideration

In addition to physical constraints, consideration was also given to Alternating Current (AC) versus Direct Current (DC) for export lines. The evaluation of electric transmission lines generally considers the merits of designing and operating them as AC or DC, including the associated installed costs. DC transmission is an option that can provide superior benefits in some cases, primarily in underground or underwater long distance applications. The total line capacity for a given structure, conductor size and right-of-way width can be greater for DC operation. The line losses as a consequence of heat dissipation and corona effects are reduced for DC operation. The total installed cost can be evaluated between the two alternatives (DC or AC). The cost of the DC to AC converters at each terminal point adds significant additional costs to the DC alternative. The economics of reduced transmission losses and reduced cost/mile for

DC must be compared to the increased cost of converter stations and the potential impacts and mitigation of transmission interruption. In general, DC and AC systems are cost equivalent for lines of 500 miles in length. DC lines are generally a considered option when large generation capacity center output to large load centers are being transported over long distances. In many cases ideal utilization of DC configuration results when both ends of the line have large robust generation and loads tied to the other terminus that have similar electric generation and loads. This allows for optimum use of the transmission line for seasonal and operational exchanges of energy. It is critical that the transmission facilities at both ends are supported by strong AC systems, which provide technical and reliable operation of the interconnected transmission grid.

DC system integration can have serious system impacts to the AC interconnected systems. When the DC power transfer is interrupted, severe frequency and voltage problems can occur on the interconnected AC system at each end. This may require the interconnected systems to shed load to prevent damage to transmission components.

It is becoming more prevalent that DC transmission lines are constructed and operated with an intermediate three terminal electric configuration. Three terminal operation is where the transmission line has line terminals and DC-to-AC converters at both ends, and another terminal and converter intermediate to the line. This adds some intermediate interconnection capability but adds significant operational considerations.

AC transmission can readily be tapped with lower voltage interconnections at multiple points. This allows for the integration of renewable generation and service to new loads along the selected transmission path at reasonable costs. In the case of the proposed transmission projects in this report, the following discussion summarizes the merits for each project.

5.3.2.1 North Project

The North Project is approximately 126 miles in length and is proposed primarily to enhance the existing AC grid capability. Additionally, the North project is routed to provide the capability to act as a bulk collector for renewable resource generation interconnections.

5.3.2.2 East Project

The East Project is approximately 167 miles in length and could potentially be connected to the north end of the AC system that also includes an existing DC interconnection and line, from the Intermountain Power Project (IPP), near Delta, Utah to the Los Angeles, California load center. The proposed East Project does not have large concentrated generation, or a large load center at the west terminus; therefore, the additional project construction and operational costs of DC would not balance the increased potential line capacity benefits. Moreover, the potential of

ease of interconnection with other generation and transmission facilities along the line route could be practically accommodated if operated as AC.

5.3.2.3 South Project

The South Project is approximately 290 miles in length and has neither a large load center nor large concentrated generation at the north end of the project. Assuming a coincident collection of significant renewable resources at the north terminus (proposed Clayton Substation) could potentially provide some incentive to consider DC operation. However, a key consideration of the project was to allow for the ability to interconnect renewable resources located geographically near the proposed project route. The flexibility of AC transmission facilities over DC will add a more regional acceptability and support by stakeholders in both Nevada and California.

5.3.2.4 Summary

Though DC design, construction and operation were evaluated, the applicability to any of the proposed projects is not considered to be viable. Given the dispersed location and size of renewable generation, and the need for flexibility of operation, the projects herein are proposed as AC transmission facilities.

5.4 PROPOSED ELECTRIC INTERCONNECTION POINTS

Based on the above evaluation of physical constraints, locations of the viable REZs, AC versus DC transmission, and general experience in the region, the team identified nine possible routing options for crossing from Nevada into California that would allow for export into the California market. These routes were analyzed for both physical and electrical constraints. *Figure 5.3 - Possible Export Routes into California Market*, highlights these possible opportunities.

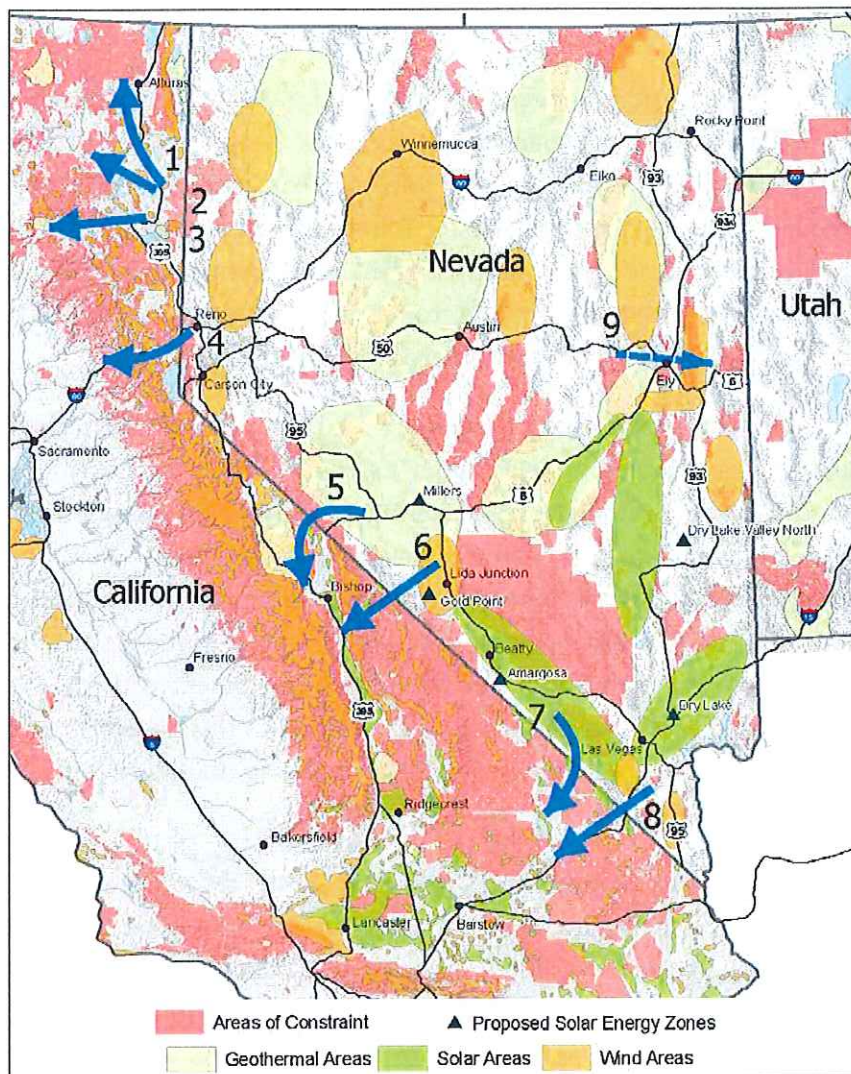


Figure 5.3 – Possible Export Routes into California Market

These nine routes were identified based on considerations of viability of permitting, strength of the interconnection into California, and physical limitations. From these identified possible routes into California, two viable routes were selected as proposed projects crossing the Nevada-California border. A third viable route was included that reaches the California market by way of going east out of Nevada into Utah. These three projects are discussed below as well as in the subsequent sections of this report. Section 6.4 specifically discusses the narrowing of the nine route opportunities to the three selected projects.

5.4.1 North Project

Based on identified transmission congestion around the Reno load center, the existing transmission lines from Tracy Power Plant located east of Reno, to the northern California-southern Oregon border (Reno-Alturas 345 kV line) are considered to be limited in export capability. Moreover, two projects, the Lassen Municipal Utility District (LMUD) proposed project from near Susanville, California directly west to north central California, and the Great Basin proposed high voltage direct current line from Tracy Generating Station to North central California offer potential solutions for increased export from Nevada.

Taking the transmission congestion issues in the Reno area into consideration, coupled with the possibility of building a significant project to act as the keystone for interconnection with identified REZs in northwest Nevada, a possible route was identified for constructing a new 345 kV transmission line, beginning north of Fernley, Nevada with interconnection into the existing 345 kV line that goes from Valmy Generating station, in north-central Nevada, to Tracy Generating station. The new interconnected line would then proceed north and northwest, and would terminate at a new substation proposed to interconnect with the existing Reno-Alturas 345 kV line, located northeast of Susanville at Viewland. This new proposed substation, Viewland Substation, is the beginning point of LMUD's proposed double-circuit 230 kV line; the termination point is Olinda Substation in north-central California.

In June 2011, NV Energy filed a request with the PUCN, assigned as docket #11-05002, which included proposals to build significant new transmission line projects to meet the need to interconnect renewable generation resource areas to the existing transmission grid (i.e. the RTI). One of the projects proposes construction of a new substation at Oreana, northeast of Lovelock, which would provide an opportunity to connect a 345 kV line from Oreana to Viewland, and this report reflects consideration of another possible North Project route alternative. This consideration resulted in the evaluation of two eastern terminus points for the northern route: North Fernley Substation and Oreana Substation.

5.4.1.1 North Project Objective

One of the goals of this transmission improvement is to integrate the generation of Wind Zone 6 & 7¹ and Geothermal Zone 2 generation. The possible MW potential generation in Geothermal Zone 2 is estimated at 108 MW². The RETAAC Phase II study did not estimate the possible wind generation production for the wind zones. However, Wind Zone 6 did have 712 MW of projects in the SPPC Transmission Interconnection Study Queue in Sept. 2008³. On

¹ See RETAAC Phase II Study, page 33, for a map of Renewable Energy Zones.

² See RETAAC Phase II Study, page 40, for a table of possible generation values.

³ See RETAAC Phase II Study, page 40, for a table of possible generation values.

October 17th, 2011 the SPPC Interconnection Study Queue contained approximately 750 MW of wind generation projects, which were judged to potentially benefit from the development of the North Project.

In summary, the objectives of the North Project are three-fold, in that it will:

- Provide a backbone collector system for northwestern Nevada renewable resources;
- Relieve congestion and increase firm transfer capability of the Alturas tie-line; and
- Provide another transmission source into Viewland Substation, facilitating future transmission projects from northwest Nevada to the northern California backbone transmission network.

5.4.1.2 North Project Technical Discussion

The North Project is a 345 kV transmission line originating from the Fernley or Lovelock area and terminating at Viewland Substation (approximately 40 miles NE of Susanville) on the Alturas Intertie. The following *Figure 5.4 - North Project Segments*, shows the proposed North Route broken into line segments. The electrical routing details are presented in this section, and the physical routing details are presented in Section 6. The following discussion presents the electrical grid issues that were considered to support this line route.

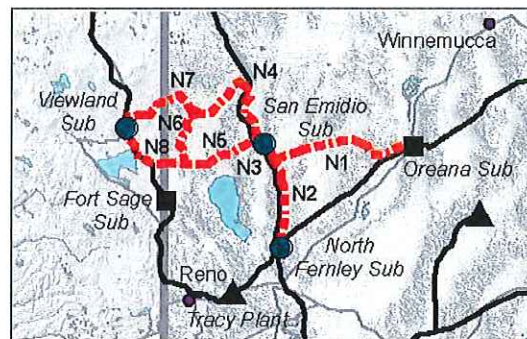


Figure 5.4 – North Project Segments

With 345 kV facilities present at both termini of the project, a 345 kV transmission line is a natural choice. Due to anticipated routing difficulties, the assumed line route will not traverse the valleys north of the Truckee Meadows and south of the Pyramid Lake Indian Reservation. While three alternatives were initially investigated regarding the southern/eastern terminus of the line, the alternative which involved the termination of the line at East Tracy Substation was abandoned due to congestion problems around East Tracy, leaving only two viable alternatives (North Fernley Substation and Oreana Substation).

The potential transmission interconnection locations (Substations) were initially considered based on improving transmission export out of northwest Nevada into California. Since it is known that LMUD is considering a new transmission project that interconnects with NV Energy's existing Alturas 345 kV line at Viewland, it was obvious to focus on constructing a project to that location. The other terminus was not as quickly identified. In the following discussion the alternatives are considered.

The North Project was initially studied with a new 345 kV substation in the area north of Fernley where the Pacific DC Intertie and the Valmy-Tracy 345 kV lines cross, at which point one or both of the Valmy-Tracy 345 kV lines could be "folded" into the new substation, referenced as North Fernley Substation. This alternative requires construction of a new 345 kV line from the North Fernley Substation north to the Gerlach area then northwest to the Viewland Substation in California.

The previously mentioned NV Energy PUCN Docket # 11-05002 describes a potential transmission addition of 39 miles of 345 kV transmission line from Dixie Valley to the existing Oreana Substation and then interconnecting with the existing Valmy-Tracy 345 kV transmission lines⁴. The Tri Sage team also considered an alternative that builds on these transmission additions by constructing a 345 kV transmission line from the proposed Oreana 345 kV Substation to the Gerlach area. This alternative, like NV Energy's line, also proposes to proceed west from the Gerlach area to the Viewland Substation. While both the North Project and LMUD's Project bring benefits on a stand-alone basis, the complementary nature of the projects would result in a significant multiplication of benefits if both were completed.

Surprise Valley Electric (SVE) is headquartered in Alturas California and has service territory in California, Oregon and northwestern Nevada. The southeastern portion of their service territory is only a few miles north of Gerlach, Nevada. Renewable resource development in SVE's service territory could be facilitated by utilizing the North Project to provide transmission services; another potential benefit of this Project.

5.4.1.3 Existing Alturas Intertie Capabilities

The Alturas Intertie is designated WECC Path 76⁵. The Alturas Intertie presently has a non-simultaneous import capability of 300 MW and non-simultaneous export capability of 300 MW⁶. SPPC's import nomogram posted on their Open Access Same-Time Information Site (OASIS), has Alturas flow on the horizontal axis. The flows for the Alturas Intertie range from

⁴ See PUCN Docket #11-05002, page 5, paragraph 11a.

⁵ See SPPC Integrated Resource Plan V10, page 62, for a paragraph description.

⁶ See SPPC Integrated Resource Plan V10, page 62, for a paragraph description.

300 MW import to 50 MW export on the import nomogram⁷. Maximum system import is typically achieved with the Alturas Tie-line importing approximately 200 MW.

5.4.1.4 Existing Export Limitations

Operational limitations are usually the result of transmission system performance criteria being violated following N-1 single contingency transmission outages. Typical violations include: thermal overloads of remaining transmission elements, voltage falling below acceptable levels, the change in voltage exceeding the maximum acceptable voltage change, similar voltage problems only in the high direction, and cascading outages. When the Alturas Intertie is at or near its export capability limit, transmission flows are heavy in the east to west direction, from East Tracy Substation toward the Valley Road Substation in northwest Reno. For this condition, the worst single contingency is the loss of the East Tracy - North Valley Road 345 kV transmission line. Following the line trip, the power that was flowing on the 345 kV line redistributes to all remaining paths, with most of the power shifting to the most direct paths; in this case, the underlying 120 kV lines between East Tracy and Valley Road. When the underlying 120 kV lines reach their thermal overload rating, following the 345 kV line trip, that is the maximum reliable east to west transfer limit. *Figure 5.5 - System Overload Scenario A*, is a simplified one-line diagram of the Reno area transmission system, which depicts this scenario.

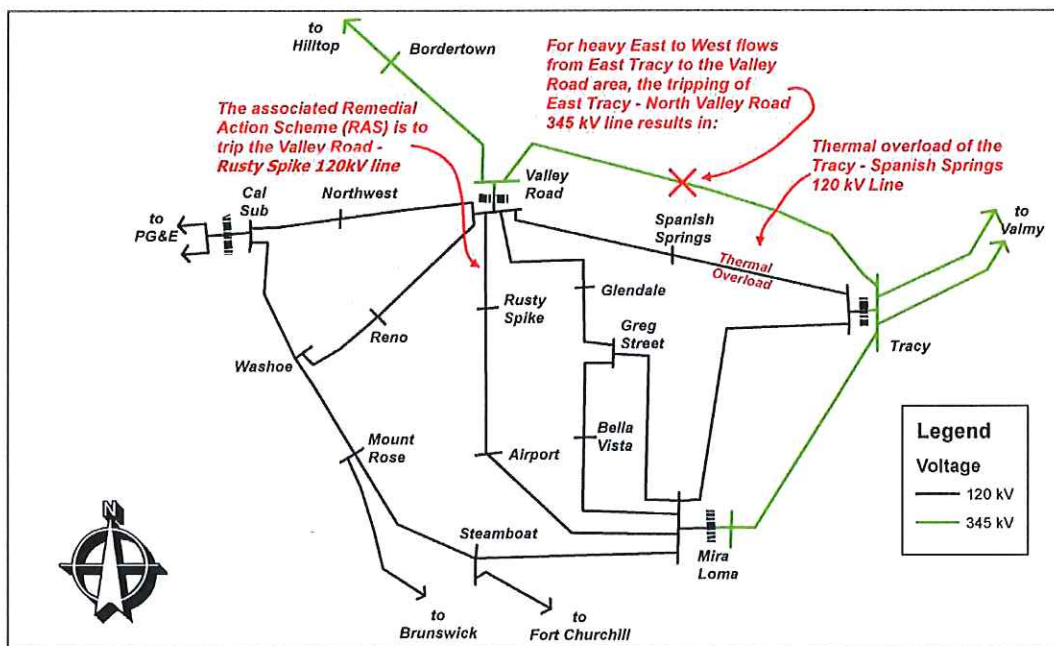


Figure 5.5 – System Overload Scenario A

⁷ http://www.oatioasis.com/SPPC/SPPCdocs/Import_Nomograms_Scheduling_Summer_2004.xls

A remedial action scheme (RAS) is a course of action taken to relieve violations of the transmission system performance criteria. The RAS for tripping of the East Tracy-Valley Road 345 kV line for heavy east to west flows is to open the Valley Road-Rusty Spike 120 kV line. This action relieves the thermal overloads on the East Tracy-Spanish Springs-North Valley Road 120 kV line.

The SPPC IRP considers the Bordertown-Cal Sub 120 kV line an “initial” transmission solution⁸. With increasing loads, the IRP recommends the West Tracy-Ft. Sage 345 kV line as a solution. The North Project 345 kV line will have much the same effect.

5.4.1.5 Additional Modifications to Existing Grid

The existing Alturas Intertie has a 345 kV 300 MVA phase shifting transformer (i.e. a phase shifter) located at Bordertown Substation. Both the NV Energy-proposed West Tracy-Ft. Sage 345 kV Project and the North Project will require the relocation of the phase shifter to a point on the intertie north of the new Projects’ termination points⁹. Without phase shifter relocation, the addition of either line would create a relatively low impedance loop around the Bordertown phase shifter, reducing its effectiveness and creating circulating power flow around the loop, increasing system losses unnecessarily.

5.4.2 East Project

Much like the opportunities offered by the proposed Valley Electric Association’s (VEA) 500 kV project, an opportunity exists to move power from the north end of the ON Line project to central Utah allowing for export from Nevada to the southern California utilities that have transmission rights at IPP Substation and Mona Substation. The IPP participants include 36 independent entities that are all party to Intermountain Power Agency (IPA). There are specifically six southern California entities out of the 36 participants. To the degree that California utilities wish to displace existing resources (primarily coal based) in order to ship renewable energy south to southern California markets, Nevada based renewable project owners could execute contracts with southern California buyers and transport through the existing grid and out of the state, from Robinson Summit to IPP and Mona Substations.

Today, two 345 kV transmission lines connect the IPP substation to Mona Substation. Both were constructed as part of the IPP project, and as a result, are owned by the IPP project participants. It is our understanding that participants in the Utah energy markets indicate firm transmission capacity is currently available on these lines. Existing transmission rights at IPP and Mona are complicated making it unclear if it is necessary initially to build additional

⁸ See SPPC Integrated Resource Plan V10, page 65.

⁹ See SPPC Integrated Resource Plan V13, pages 17 & 18.

transmission facilities between IPP and Mona. This report performs limited analysis of an additional IPP to Mona transmission line for future construction as needed.

5.4.2.1 East Project Objective

One of the goals of this transmission improvement is to create additional export capability for the generation of Wind Zones 1, 2, & 3, Geothermal Zones 4 & 5, Biomass Zones 2 & 3, and Solar Zones 2 & 3¹⁰. The possible MW potential generation in Geothermal Zones 4 & 5 is estimated at 36 MW¹¹. In the RETAAC estimates, the generation resources estimated from these zones range from 1,250 MW to 1,600 MW. As of April 15, 2010, interconnection requests indicate generation project developers' interest totaling approximately 1,060 MW of new generation¹².

In summary, the primary objective of the East Project is to:

- Provide unencumbered export capacity from eastern Nevada to Utah, ultimately to the California participants in the IPP.

5.4.2.2 East Project Description

The East Project can be either a 345 kV or 500 kV transmission line, originating at Robinson Summit Substation and terminating at IPP Substation. *Figure 5.6 - East Project Segments*, shows the proposed East Route broken into line segments. The following discussion presents the electrical grid issues that were considered to support this line route.

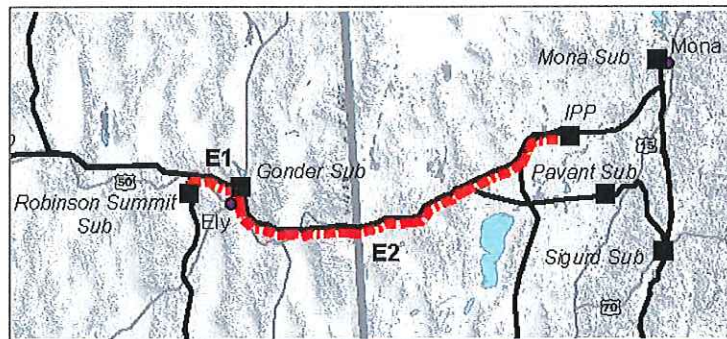


Figure 5.6 – East Project Segments

Following the completion of the ON Line project, Robinson Summit will have both 500 kV and 345 kV busses. Today, IPP does not have a 500 kV AC buss, but it does have a 345 kV AC buss.

¹⁰ See RETAAC Phase II Study, page 33, for a map of Renewable Energy Zones.

¹¹ See RETAAC Phase II Study, page 40, for a table of possible generation values.

¹² See RETAAC V13, page 14.

The buss voltages anticipated to be available at the substations suggest two possible alternatives. The lower cost/lower capacity project is a 345 kV line from Robinson Summit to IPP. The higher cost/higher capacity project is a 500 kV project, comprised of a 500 kV line from Robinson Summit to IPP, and a 500/345 kV transformer at IPP. Additional transformer capacity may be required between the Fort Churchill Substation 230kV and 120 kV busses, and the Gonder Substation 345 kV and 230 kV busses to maximize the benefits of this project.

5.4.2.3 Existing Path 32 Capabilities

WECC Path 32 includes two transmission lines: Gonder-Pavant 230 kV & Gonder-Intermountain 230 kV lines. Total flow is rated at 440 MW in-bound and 235 MW out-bound¹³. The *WECC Path Rating Catalog* describes two different transformer overloads, following single contingency transmission outages, as the basis for the export limitation of 235 MW. Following the outage of the Valmy-Coyote Creek 345 kV line, an overload can occur on the Gonder 345/230 kV transformer. *Figure 5.7 - System Overload Scenario B*, depicts this line outage and resulting transformer overload.

¹³ See SPPC Integrated Resource Plan V10, pages 61 & 62.

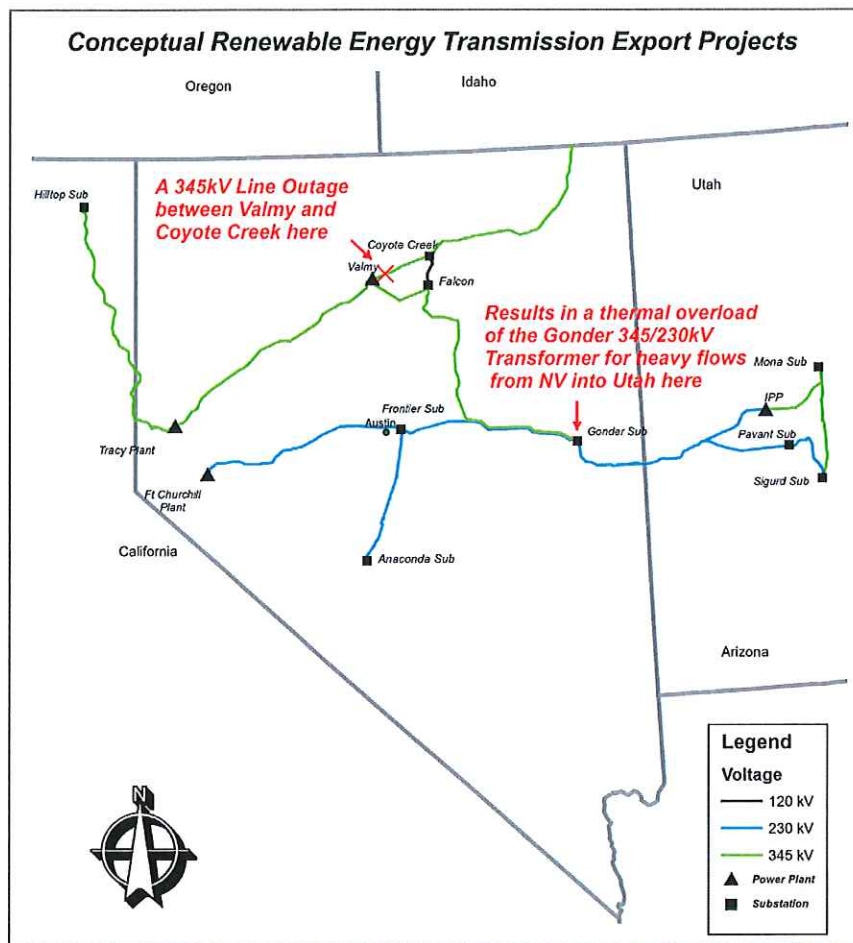


Figure 5.7 – System Overload Scenario B

Similarly, the outage of the Falcon-Gonder 345 kV line can result in the Fort Churchill 230/120 kV transformer being overloaded. *Figure 5.8 - System Overload Scenario C*, depicts this line outage and resulting transformer overload.

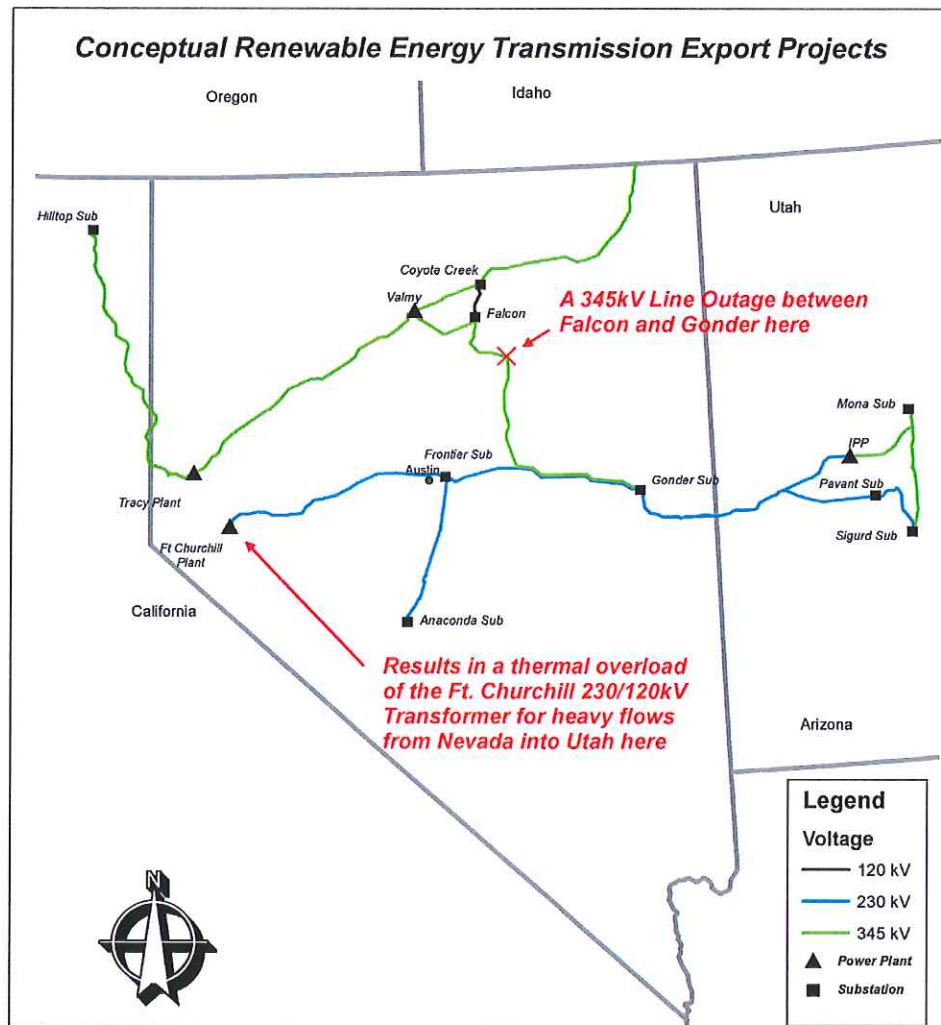


Figure 5.8 – System Overload Scenario C

5.4.2.4 Future Capacity Considerations

Any cursory attempt to quantify the increase in the export capacity of Path 32 following the addition of the East Project is very difficult and somewhat suspect for several reasons. While the existing Path 32 capabilities are known, NV Energy has not provided information describing the impact of the ON Line project on Path 32 ratings. In addition, today's export ratings are limited by the effects of electrically remote single contingency line outages resulting in transformer overloads on distant transformers not normally associated with Path 32 facilities.

5.4.3 South Project

The identified REZs located in west central and southwest Nevada in Nye, Esmeralda and Mineral Counties have little transmission capability to transport the magnitude of potential

generation resources. Significant effort has been made by Nye and Esmeralda counties, along with Inyo County in California, to pursue options for developing the renewable resources. The lack of transmission export options has hampered renewable generation development schedules. However, recent efforts, such as that by Valley Electric Association (VEA) to construct a double-circuit 230 kV line connecting with NV Energy's Northwest Substation will help to enable interconnect solutions for generation resources in lower Nye, Esmeralda and Inyo counties. Additionally, VEA announced their intent to construct a 500 kV line from Pahrump to Eldorado Substation with direct interconnect to existing California utilities. It is the understanding at the time of this report preparation that VEA has requested inclusion of the 500 kV substation near Pahrump into the CAISO. These significant projects will provide opportunities for development of Nevada based renewable generation projects within, or in close proximity to, the VEA service territory. This direct connection with California utilities provides access to California electric markets, which is dependent on the appetite of the California utilities to displace other energy purchases moved from the existing Eldorado Substation to the southern California transmission path (Path 46, as defined in the *WECC Path Rating Catalog*) and move the renewable energy output to California buyers.

The South Project is a solution for significant additional net export out of Nevada by way of a new high voltage transmission line from western Nevada south to southern California. This electric grid connection offers advantages to increase export out of Nevada in a location that can integrate well with existing transmission in Nevada and California and has a good possibility of being permitted. The siting of this line strategically allows for interconnections into renewable energy zones in upper Nye County, Mineral County, and west central Nevada. It also offers interconnections for California based renewable resources on the south California-Nevada border.

5.4.3.1 South Project Objective

One of the objectives of this southern transmission improvement is to integrate the generation of Wind Zone 8¹⁴ and Geothermal Zone 3 generation into the western grid. Integration of the generation of Solar Zone 1 can also be accomplished with construction of either the RTI's Fort Churchill to Harry Allen transmission project or a transmission line, as proposed herein, from the Tonopah area to the VEA system. The possible MW potential generation in Geothermal Zone 3 is estimated at 288 MW¹⁵. On October 17th, 2011 the SPPC Interconnection Study Queue contained 110 MW of wind generation projects located in Nye or Esmeralda counties

¹⁴ See RETAAC Phase II Study, page 33, for a map of Renewable Energy Zones.

¹⁵ See RETAAC Phase II Study, page 40, for a table of possible generation values.

(Wind Zone 8). The possible MW potential generation in Solar Zone 1 is estimated at 4,168 MW¹⁶.

An additional objective of this southern transmission improvement is to provide additional export capability from southern Nevada into the Los Angeles, California area. This could include energy transactions with the Los Angeles Department of Water and Power (LADWP) and Southern California Edison (SCE). Due to their geographic proximity, both Geothermal Zone 1 and Wind Zone 4¹⁷ may benefit from the South Project. The possible MW potential generation in Geothermal Zone 1 is estimated at 362 MW¹⁸. On October 17th, 2011 the SPPC Interconnection Study Queue contained no wind generation projects located in Lander or Eureka counties (Wind Zone 4).

In summary, the objective of the South Project is to:

- Provide a backbone collector system for Nevada renewable resources statewide that can be viably interconnected and transported on NV Energy's system.
- Provide additional export capability from southern and central Nevada into the Los Angeles area.
- Capture California renewable generation along the southern California-Nevada Border.

5.4.3.2 South Project Transmission Technical Discussion

The South Project is proposed to be a 500 kV transmission line originating in the Tonopah, Nevada area and terminating in the Los Angeles area. The following *Figure 5.9 - South Project Segments*, shows the proposed South Route broken into line segments. The electrical technical routing details are presented in this Section, and the physical routing details are presented in Section 6. The following discussion presents the electrical grid issues that were considered to support this line route.

¹⁶ See RETAAC Phase II Study, page 40, for a table of possible generation values.

¹⁷ See RETAAC Phase II Study, page 33, for a map of Renewable Energy Zones.

¹⁸ See RETAAC Phase II Study, page 40, for a table of possible generation values.

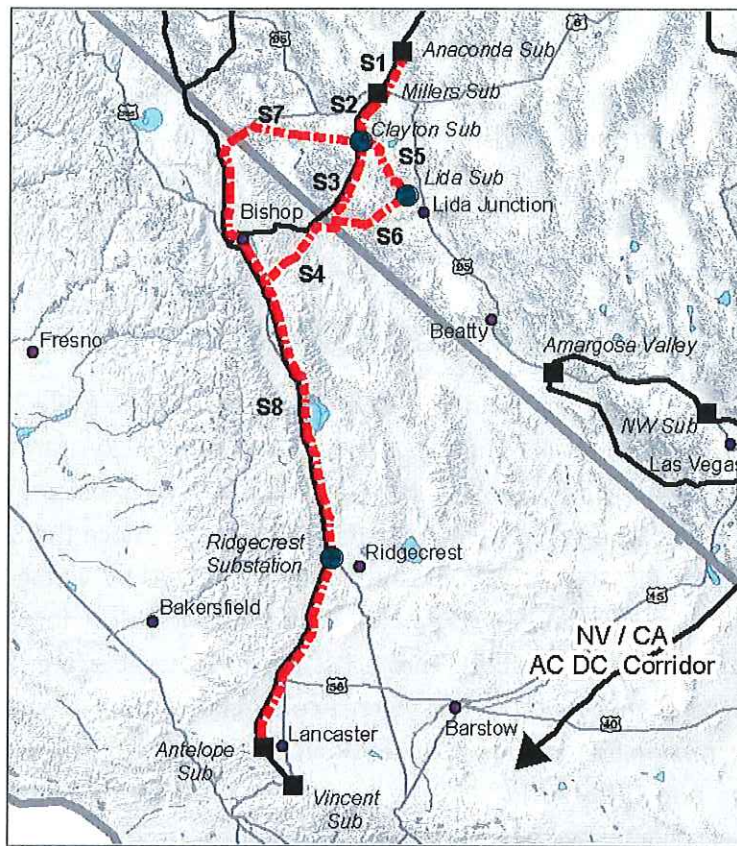


Figure 5.9 – South Project Segments

Initial consideration was given to a prospective interconnection location within the NV Energy transmission system and a sufficiently robust grid location in the southern California transmission system. It was critical to first consider the electric market opportunities and electrical grid strength, and also consider the critical aspects of potential physical routing.

In PUCN Docket #11-05002, NV Energy describes 498 miles of potential transmission improvements associated with their Renewable Transmission Initiative (RTI).¹⁹ The transmission projects proposed in RTI will be dependent, as fully described in the RTI documentation, on the level of market interest. The proposed South Route herein offers not only new export for Nevada but would also enhance the RTI export opportunity. Several northern terminus alternatives exist for the configuration of this proposed route. These alternatives address the uncertainty surrounding the RTI “West Tie-South” project, specifically from Ft. Churchill Substation to the Harry Allen Substation.

¹⁹ See PUCN Docket #11-05002, page 5, paragraph 11b.

Northern Terminus if the “West Tie-South” is Completed

If the RTI “West Tie-South” project is constructed, the northern terminus of the South Project should be located at the proposed Lida Substation, south of Tonopah. The proposed location of Lida Substation is approximately 9 miles northwest of the junction of State Route 266 and U.S. Highway 95. If the West Tie-South project is a 345 kV project, a 345 kV to 500 kV transformer will be required to interconnect the two projects.

Northern Terminus if the “West Tie-South” is not Completed

If the RTI “West Tie-South” project is not constructed, the Anaconda-Moly 230 kV Substation is the most southern location of NV Energy’s existing northern 230 kV transmission facilities. For this reason, Anaconda-Moly 230 kV Substation is the obvious location to interface the South Project with the existing NV Energy transmission system. Since the South Project is a 500 kV project terminating at a 230 kV substation, a 500 to 230 kV voltage transformation will be required. The Clayton Substation is a prudent location for the 500/230 kV transformer. If the RTI “West Tie-South” project is constructed at a later date, the 500 kV South Project can interconnect with no low voltage connections to reduce transfer capability. A new 230 kV transmission line from Anaconda-Moly Substation to Clayton Substation will be required. This line and the existing 120 kV system in the Miller’s Substation area have potential to serve as collector systems for renewable resources in the area.

It should be noted that presently the TerraGen 230 kV transmission line and the Ft. Churchill-Austin 230 kV line cross in this area without any interconnection. While the South Project as described in this report does not contemplate an interconnection with this TerraGen line, potential interconnection benefits should be investigated during the WECC rating and final design phase. This line upgrade was not investigated during this study due to the associated extensive system upgrade requirements in the SCE system. In addition, based on previous experience with this facility, such an interconnection (including all associated upgrades) would only increase export capacity by a small amount compared to the proposed South Route.

Clayton was established as a northern 500kV termination point. The process then focused on the possible southern termination point(s). Consideration was given to include potential collector substations near the southeast California-Nevada border to serve renewable energy zones in that area.

The southern terminus of the line is flexible; however, the Antelope Substation (approximately 8 miles west of Lancaster, California) was identified as a probable choice. By interconnecting into the Antelope Substation area, the renewable power export will reach a less constrained segment of the California grid, which is on the northern side of Los Angeles

and also taps into the SCE grid. The Antelope Substation includes two existing 500 kV and three 230 kV transmission lines connected to the load centers. Under separate cover, the Tri Sage team has presented the process that is necessary to complete the transmission planning studies required to substantiate the viability of this substation as the southern terminus. This should be considered a next step action.

With the South Project endpoints established to be the northern Los Angeles and Tonopah, Nevada areas, the most promising routing for the line was thought to be parallel to the existing transmission lines in the Owens River valley.

In the absence of the RTI “West Tie-South” project, a future expansion of the South Project should be considered as a 500 or 230 kV line, from Clayton Substation to the VEA system, since VEA has announced plans to extend 500 kV from Eldorado Substation northwest to the Pahrump area. A discussion of the routing details is presented in Section 6.

Project Benefits

The benefits of this proposed line alternative are multi-fold. Specifically, this line will:

- Increase reliability to both the CAISO and NV Energy grids;
- Open up a new path for renewable energy export from Nevada; and
- Allow for interconnections mid-line in California.

5.5 PRELIMINARY TECHNICAL PARAMETERS

Once the termination points were established, and it was confirmed that viable routes existed for the interconnections, a high level evaluation was conducted to consider the thermal ratings of each proposed project alternative. Thermal rating is the rating of the physical line considering the conductor type and other physical line components. The conductor configuration chosen is on the smaller end of the spectrum for thermal rating purposes but large enough to support the projected export path ratings. Once a specific project is chosen and it enters into a detailed evaluation and design phase, a detailed conductor study, in conjunction with a detailed structure study, should be undertaken to compare the various alternatives against the overall project economics. This detailed conductor study would also include the effects of line losses, corona, radio interference, etc. on the final conductor configuration chosen.

While the thermal rating provides the capacities available on the various lines, another rating is also required. WECC requires that, prior to allowing any transmission line to be energized, it must receive a line rating from the applicable WECC Subregional Planning Group. In the case of these lines, this group is the Sierra Subregional Planning Group (SSPG). This WECC rating is

required in order to allow the planning groups the opportunity to evaluate the impact of a proposed transmission line on the entire western electric grid. As such, the thermal rating of a line is usually higher than the WECC rating of a line.

The final WECC ratings are issued after an extensive rating process. This process should be considered by NEAC as one of the next steps for this project. For reference purposes, basic assumptions have been made by the team and estimated ratings have been established to provide a guideline of the opportunity for export on these proposed transmission lines. It is critical to note that this information is preliminary and subject to the final WECC review and approval process.

The following tables and associated notes provide the details for the proposed projects. A summary of this data is provided in *Table 1.1 – Projects Summary of Costs and Ratings*, of Section 1, Executive Summary, and is discussed further in Section 8, Report Conclusions and Recommendations.

Proposed North Project – Oreana to Viewland

Approximate Line Length	Voltage	Conductor Configuration	Thermal Rating	Projected Export Path Rating
126	345 kV	2 - 954 MCM	1240 megawatts	70 megawatts ⁽¹⁾
LMUD/WAPA Project Only				500 megawatts ⁽²⁾
126	345 kV	2 - 954 MCM	1240 megawatts	1000 megawatts ⁽³⁾⁽⁴⁾

Table 5.1 – Thermal Rating Summary for North Project

Notes & Clarifications:

- 1) Proposed Project or RTI Proposed Project **Completed** & LMUD/WAPA Double Circuit 230 kV Project **Not Completed**.
- 2) LMUD/WAPA Double Circuit 230 kV Project **Completed** & Proposed Project or RTI Proposed Project **Not Completed**.
- 3) LMUD/WAPA Double Circuit 230 kV Project **Completed** & Proposed Project or RTI Proposed Project **Completed**.
- 4) Either the completion of the Proposed RTI or Proposed North Projects has significant internal grid system benefits. The proposed North Project route will reduce the collector system transmission requirements for serving the Renewable Energy Zones in northwest Nevada and northeast California.

Proposed East Project – Robinson Summit to IPP (1)

Approximate Line Length	Voltage	Conductor Configuration	Thermal Rating	Projected Export Path Rating
167	345 kV	2 - 954 MCM	1240 megawatts	400-600 megawatts
167	500 kV	3 - 954 MCM	2690 megawatts	750-1000 megawatts

*Table 5.2 – Thermal Rating Summary for East Project***Notes & Clarifications:**

- 1) This proposed project is highly dependent on Available Transmission Capacity (ATC) being available for potential buyers at IPP. It is likely that once the California Renewable Portfolio Standard is fully implemented many southern California buyers who hold the ATC will be interested in taking deliveries at IPP.

Proposed South Project – Anaconda-Moly to Clayton Substation to Antelope (no RTI)

Approximate Line Length	Voltage	Conductor Configuration	Thermal Rating	Projected Export Path Rating
253 ⁽¹⁾	500 kV	3 - 954 MCM	2690 megawatts	750-1000 megawatts ⁽⁴⁾
37 ⁽²⁾	230 kV ⁽³⁾	1 - 954 MCM	410 megawatts	N/A

*Table 5.3 – Thermal Rating Summary for South Project (Anaconda-Clayton-Antelope) - No RTI***Notes & Clarifications:**

- 1) The line from Clayton Substation to Antelope Substation is approximately 253 miles long.
- 2) The line from Anaconda-Moly Substation to Clayton Substation is approximately 37 miles long.
- 3) Proposed Project includes the 230 kV transmission tie from Anaconda-Moly Substation to Clayton Substation but the path rating will be dependent on the 500 kV from Clayton to Antelope Substation.
- 4) This would require some level of high-speed transfer tripping of the connected generation on the line to support the rating.

Proposed South Project – Anaconda-Moly to Clayton Substation and Antelope; includes segment from Clayton to Pahrump 500 kV Substation (no RTI)

Approximate Line Length	Voltage	Conductor Configuration	Thermal Rating	Projected Export Path Rating
253 ⁽¹⁾	500 kV	3 - 954 MCM	2690 megawatts	1500-2000 megawatts ⁽⁵⁾
174 ⁽²⁾	500 kV	3 - 954 MCM	2690 megawatts	Included Above
37 ⁽³⁾	230 kV ⁽⁴⁾	1 - 954 MCM	410 megawatts	N/A

Table 5.4 – Thermal Rating Summary for South Project (Includes Segment to Pahrump) – No RTI

Notes & Clarifications:

- 1) The line from Clayton Substation to Antelope Substation is approximately 253 miles long.
- 2) The line from Clayton Substation to Pahrump Substation is approximately 174 miles long.
- 3) The line from Anaconda-Moly Substation to Clayton Substation is approximately 37 miles long.
- 4) Proposed Project includes 230 kV transmission to tie from Anaconda-Moly Substation to Clayton Substation, but the path rating will be dependent on the 500 kV from Clayton to Antelope Substation & the 500 kV from Clayton to Pahrump 500 kV Substation.
- 5) This would require some level of high speed transfer tripping of the connected generation on the line to support the rating & would likely require that approximately 50% of generation be scheduled to Antelope and 50% to Pahrump 500 kV Substation, and then to the Eldorado Substation.

Proposed South Project – Lida Substation to Antelope (with RTI) (1)

Approximate Line Length	Voltage	Conductor Configuration	Thermal Rating	Projected Export Path Rating
251	500 kV	3 - 954 MCM	2690 megawatts	750-1000 megawatts ⁽²⁾

Table 5.5 – Thermal Rating Summary for South Project (Lida-Antelope) – With RTI

Notes & Clarifications:

- 1) This could be Clayton to Antelope as well, since the line mileages are comparable. There are other reasons to consider locating the substation at Lida.
- 2) This would not likely require high speed transfer tripping of the connected generation on the line to support the rating.