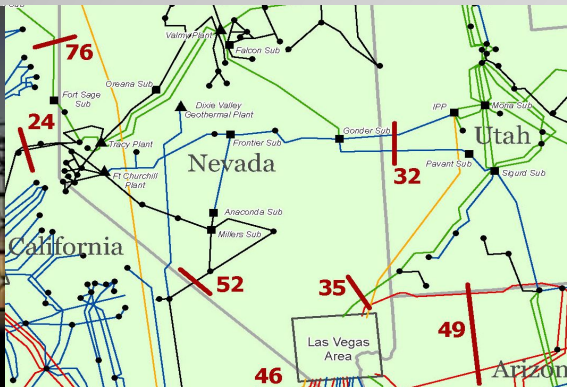


Section 4: Strategic Transmission Discussion



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.

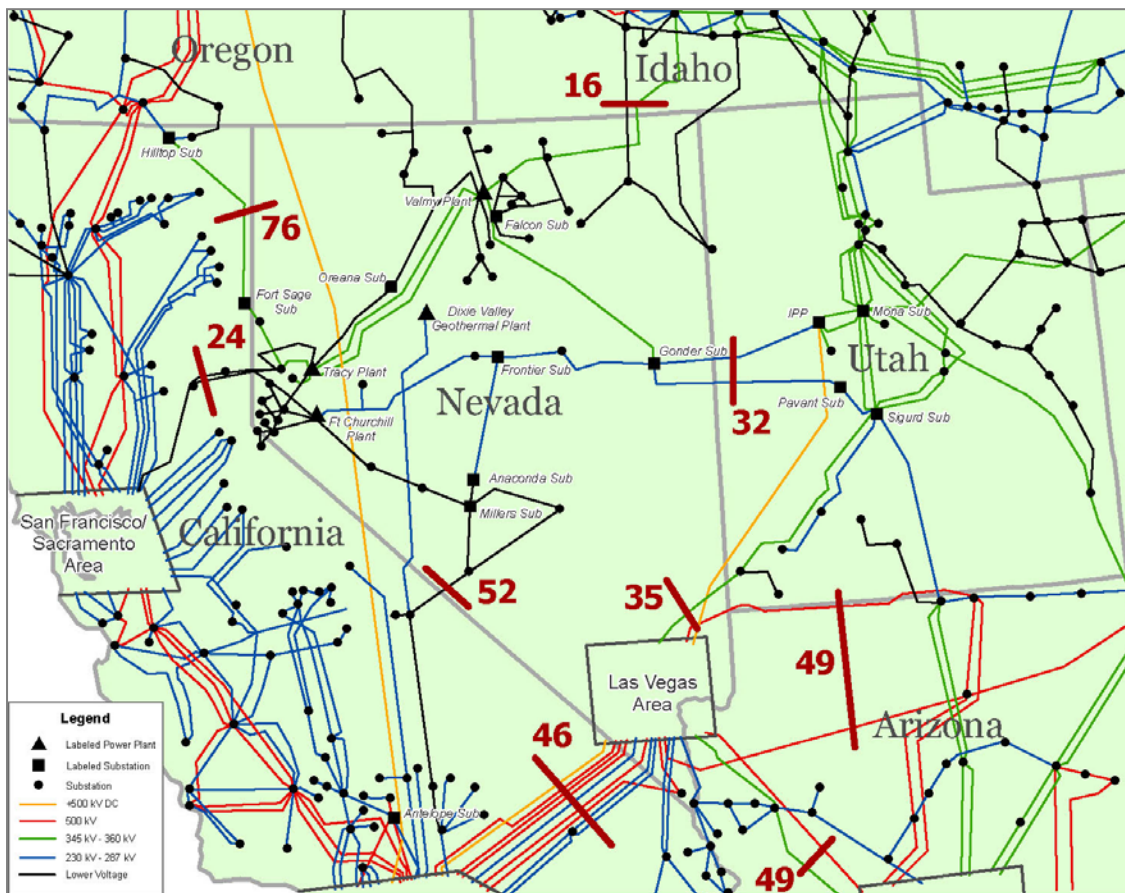


Figure 4.1 – WECC Path Rating Summary Map

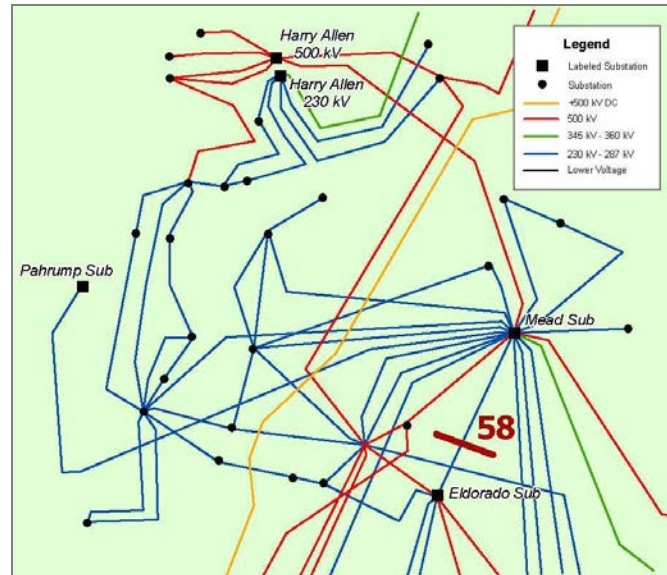


Figure 4.2 – WECC Path 58 Breakout Map

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.

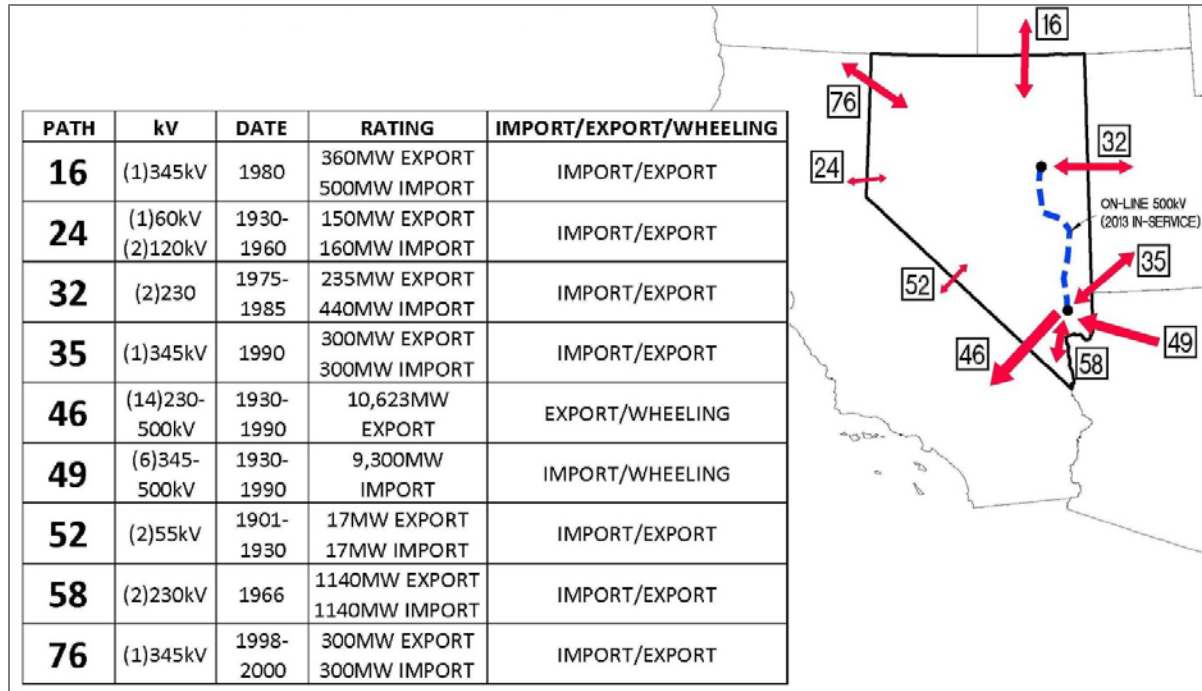


Figure 4.3 – Current System Import/Export Paths in Nevada

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.

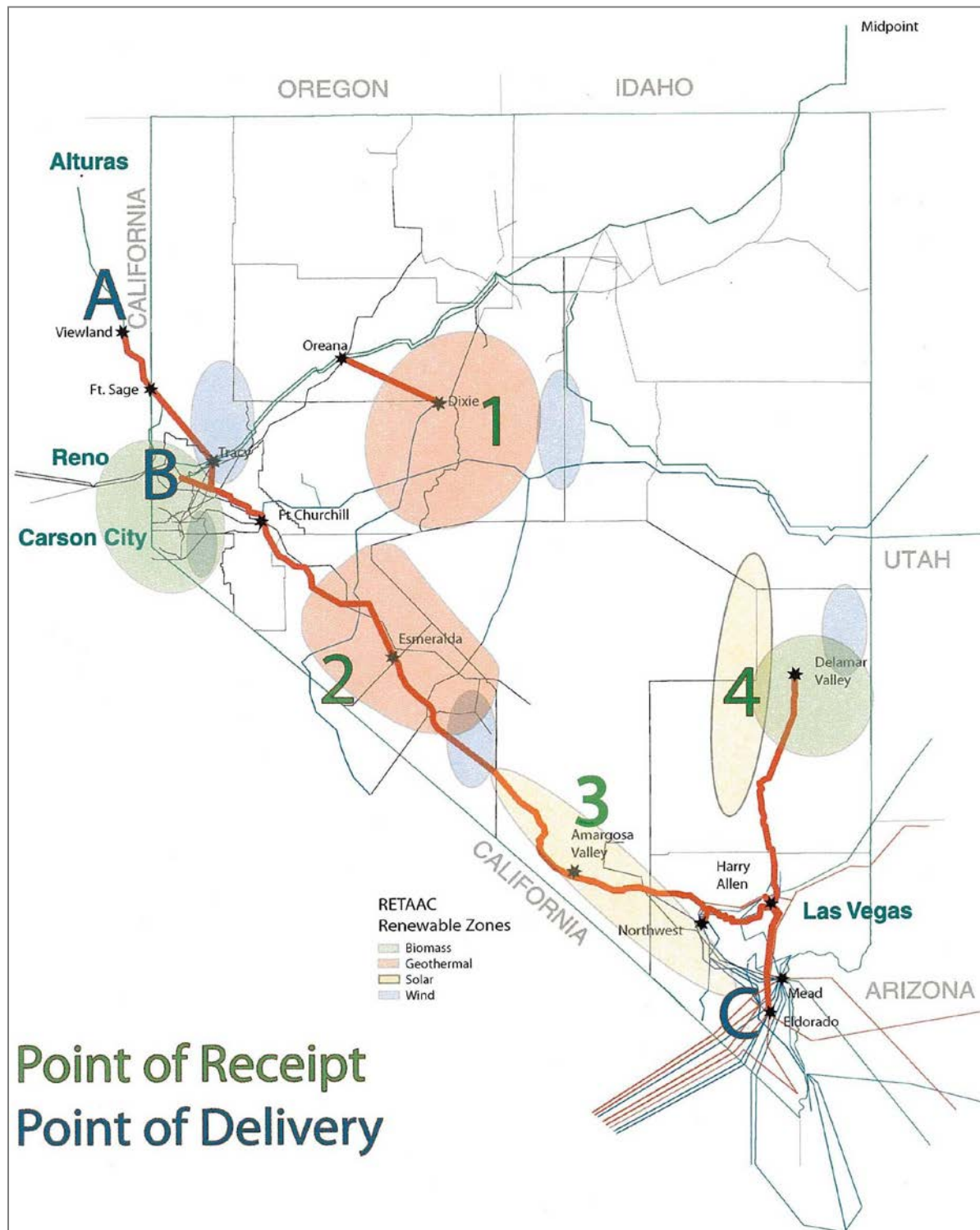


Figure 4.4 – NV Energy Renewable Transmission Initiative

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.