19-06010
Public Utilities Commission of Nevada
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representative of the signer(s) and
NPC and SPPC
November 13, 2020

Ms. Trisha Osborne
Assistant Commission Secretary
Public Utilities Commission of Nevada
1150 East William Street
Carson City, Nevada 89701-3109

RE: Docket No. 19-06010 – Rulemaking to amend, adopt, and/or repeal regulations in accordance with Senate Bill 358 (2019).

Dear Ms. Osborne:

Enclosed please find the *Net-Zero Carbon Dioxide Emissions Goal Report* prepared by Nevada Power Company d/b/a NV Energy and Sierra Pacific Power Company d/b/a NV Energy (“NV Energy” or the “Companies”). NV Energy is providing the Report in accordance with Procedural Order No. 5 and Procedural Order No. 8 issued in the Docket. The Report outlines NV Energy’s vision for transitioning the Companies and the State of Nevada to a net-zero carbon dioxide emissions future.

Should you have any questions regarding this filing, please contact me at (775) 834-3470 or roman.borisov@nvenergy.com.

Respectfully submitted,

/s/ Roman Borisov  
Roman Borisov  
Senior Attorney
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SECTION I – EXECUTIVE SUMMARY

The state of Nevada has made considerable strides towards a clean energy future and is well positioned to continue the further integration of renewable energy resources to reduce carbon dioxide emissions in Nevada. Carbon dioxide emissions from electricity generation in Nevada have already declined by approximately 50 percent since 2005.\textsuperscript{1} In 2019, the Governor’s Office of Energy stated a mission “to position Nevada to lead the nation in renewable energy production, energy conservation, the exportation of energy and transportation electrification.”\textsuperscript{2} In that same year, Senate Bill 358 (“SB358”), codified at NRS 704.7820, stated that it is the policy of the State to:

1. Encourage and accelerate the development of new renewable energy projects for the economic, health and environmental benefits provided to the people of this State;

2. Become a leading producer and consumer of clean and renewable energy, with a goal of achieving by 2050 an amount of energy production from zero carbon dioxide emission resources that is equal to the total amount of electricity sold by providers of electric service in this State; and

3. Ensure that the benefits of the increased use of portfolio energy systems and energy efficiency measures are received by the residents of this State. Such benefits include, without limitation, improved air quality, reduced water use, a more diverse portfolio of resources for generating electricity, reduced fossil fuel consumption and more stable rates for retail customers of electric service.

Subsection 2 of SB358 sets a state-wide net-zero carbon dioxide emissions goal. Referencing the goal, the Public Utilities Commission of Nevada (“Commission”), in Docket No. 19-06010, tasked Nevada Power Company (“Nevada Power”) and Sierra Pacific Power Company (“Sierra,” and together with Nevada Power, the “Companies” or “NV Energy”) as follows:

For the Commission to fully evaluate the best path(s) forward regarding the goals laid out in Section 8 of SB358, the Commission needs more information from NV Energy and other interested persons. Therefore, on or before WEDNESDAY, NOVEMBER 4, 2020, NV Energy shall submit to the Commission a report containing planning information consistent with a net-zero carbon emissions goal by 2050. The report should include information regarding resource options, cost projections, reliability considerations, potential infrastructure constraints, and any other information that is useful for the Commission to meaningfully evaluate paths toward a net-zero carbon emissions goal by 2050. NV Energy may include in its report a discussion of any changes to the integrated resource planning process that

\textsuperscript{1} Clean Air Markets Database, U.S. Environmental Protection Agency.

it believes are necessary to achieve the objectives delineated in Section 8 of SB 358.

In this Report, NV Energy examines its role in the state’s path to a net-zero carbon dioxide future. As stated above, the net-zero carbon dioxide goal of SB358 is a state goal that NV Energy looks forward to advancing. Its purpose is to increase production from zero-carbon dioxide emission generating resources to match total in-state sales of electricity. Nevada already has a sizeable portfolio of zero-carbon dioxide emitting resources. NV Energy’s current portfolio alone has 39 projects consisting of 429 megawatts (“MW”) of geothermal, 894 MW of solar, 151 MW of wind and 20 MW of smaller renewable projects (waste heat, hydro). Most recently in 2018, NV Energy received approval to acquire 1,001 MW of solar photovoltaic (“PV”) generation coupled with 100 MW of storage. Just a year later, in 2019, NV Energy requested and received Commission approval to acquire an additional 1,190 MW of solar PV resources with 590 MW of co-located storage. Following this pattern, in 2020, NV Energy filed for approval to acquire 478 MW additional MW of solar PV with 338 MW of co-located storage. Besides NV Energy’s ever-growing fleet of renewable projects, either owned or contracted for, Nevada is home to a growing number of renewable energy plants owned by independent producers (“IP”) supplying electricity in and out of state. Renewable distributed generation is another segment of renewable energy production in Nevada. NV Energy has over 61,000 customers with roof-top solar generation contributing to the energy portfolio used to meet the energy needs of Nevada. Besides these renewable resources, Hoover Dam is a major zero-carbon dioxide emitting resource located on the Nevada-Arizona border and as such also contributes towards the state goal.

NV Energy is the state’s largest electricity provider serving approximately 89 percent of the state’s electric consumption. Consequently, NV Energy’s progress towards net-zero carbon emissions is inextricably tied to the state’s net-zero carbon goal. NV Energy is not the only load-serving entity in the state, however. Providers of new electric resources, electric cooperatives, and municipal entities also supply power to businesses and residents of Nevada and, thus, are indispensable to the state’s goal of achieving net-zero carbon emissions. Notably, NV Energy does not have access to these other providers’ load data and generation mix. Similarly, NV Energy possesses no ability to model zero-carbon resources not controlled by it such as IP-owned renewable generation and Hoover Dam. Accordingly, in responding to the Commission’s request, NV Energy evaluated NV Energy-owned or controlled resource mixes, as well as interconnected renewable distributed generation, that would progress the Companies towards a 2050 net-zero carbon dioxide emissions goal. Figure I-1 illustrates the sources of zero-carbon generation NV Energy would rely on to serve native load in achieving a net-zero goal. Achieving the state’s goal of net zero carbon emissions will require a concerted effort from the state’s policymakers, every load-serving entity operating in the state, and the renewable energy development sector.
FIGURE I-1
ZERO-CARBON RESOURCES TO MATCH NV ENERGY’S NEVADA SALES

<table>
<thead>
<tr>
<th>Energy Production from Zero Carbon Dioxide Emission Resources (MWh)</th>
<th>Electricity Sold by NV Energy (MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NV Energy-owned Nevada renewables</td>
<td>NV Energy net sales in Nevada</td>
</tr>
<tr>
<td>In-state renewables under contract with NV Energy</td>
<td>(from all sources including renewables, fossil, EIM, market)</td>
</tr>
<tr>
<td>Out-of-state renewables under contract with NV Energy</td>
<td></td>
</tr>
<tr>
<td>Distributed renewable generation in NV Energy's service territory</td>
<td></td>
</tr>
</tbody>
</table>

The recently filed Fourth Amendment to the 2018 Integrated Resource Plan (IRP 4th Amendment), Docket No. 20-07023, shows a system in transition. The Companies have made great strides to move away from a fossil-based system to a significantly “greener” energy supply and recognize there is more work to be done, especially to maintain a reliable system for all customers throughout and beyond the transition. The plan transitions the Companies from just over 2,000 MW of renewable generation in 2021 to nearly 9,000 MW, coupled with the addition of 6,100 MW of battery energy storage systems (“BESS”), by 2050, with solar PV resources constituting the majority of the renewable generation. Figure I-2 presents the growth in zero-carbon resources — including BESS — over time, showing operating resources, resources approved by the Commission, resources that are not yet approved, and placeholder resources in the IRP 4th Amendment Preferred Plan.
FIGURE I-2
NV ENERGY’S GROWTH IN ZERO-CARBON RESOURCES

Achieving Net-Zero Carbon Dioxide Emissions

Achieving a net-zero carbon emissions goal while maintaining low costs and reliability for customers will require a balance of diverse resources, both in-state and out-of-state, both zero-carbon and low-carbon, a solid transmission infrastructure, managed electrification of various sectors of the economy, and a demand side management plan attentive to load-shaping. To that end, the foundational components of NV Energy’s net-zero carbon plan are:

- Diversity of Resources
- Transmission Infrastructure
- Electrification
- Demand Side Planning

1. Diversity of Resources

As explained in the Effective Load Carrying Capability (“ELCC”) report and Zero Carbon Findings and Analysis by Energy + Environmental Economics (“E3”)³ in the IRP 4th Amendment and described in Section IX of this report, the ELCC of a variable resource represents its contribution to a system’s peak load. A variable resource’s contribution to the system peak is not equal to its capacity rating. ELCC is essentially a way of expressing the output of a variable resource.

³ Docket No. 20-07023, Technical Appendices ECON-5 and ECON-6, respectively.
resource in terms of a comparable amount from a firm resource, such as a combustion turbine. As explained in the E3 reports and in Section IX of this report, increased penetration of any one type of variable resource diminishes its ELCC, thus, diminishing its value to the system. In short, in order to achieve a reliable energy supply utilizing renewable resources, which are variable in nature, it is critical to have a diverse resource mix to ensure there is always a resource available to meet the needs of customers. To rely predominantly on one type of variable resource introduces a reliability risk for customers if that variable resource were not available at a given point in time. While Nevada has an abundance of solar resource potential, for example, reliance solely on solar resources, even when combined with energy storage, will not create a cost-effective or reliable system. A mix of renewable resource types will be needed to serve Nevada in this net-zero carbon emissions future.

Nevada’s and other states’ push towards zero carbon would greatly benefit from a regional approach. A diverse mix of resources (e.g., solar, wind, geothermal, hydro) can best be achieved when each state is contributing the renewable resources that are most cost-effective in their locale and then distributing those resources across the region. Importing energy from renewable resource types that are more cost-effective when built elsewhere will help to keep customer energy rates low in Nevada while advancing the net-zero goal. In addition, the ability to export surplus renewable energy, such as solar or geothermal, from Nevada will be key in achieving a net-zero carbon outcome, as renewable resource output does not always match the load demand. In addition, this creates the opportunity for economic development and job creation, especially in some of the rural areas of Nevada. Nevada has an abundance of solar resource potential and significant geothermal potential – energy from these resources could be exported to states with less of these particular types of resource if adequate transmission connections existed.

Similarly, energy storage will weigh heavily in a highly decarbonized resource mix, allowing surplus renewable energy in one hour to be stored for use in a later hour when the load requires it. These clean energy technologies work well together, as energy storage mitigates some of the variability and uncertainties of renewable energy. More flexible products such as pumped storage and other longer duration storage technologies will be highly valued and will be needed to ultimately achieve a carbon-neutral position.

In addition, maintaining reliability in a decarbonized system will require a small but core footing of firm resources. These firm resources will be essential as the penetration of renewable resources increases to a point when few resources remain that can be dispatched to manage the variability of solar and wind energy. The state will ultimately need cost-effective zero-carbon firm resources, but technology must evolve before these will be readily available. For the near term, natural gas-fired and geothermal units will continue to serve this need. Geothermal plants are already providing NV Energy with firm energy, and under the right commercial arrangements, geothermal is already technically capable of dispatchable, load-following operations. Gas-fired combustion
turbines may operate at low capacity in the future but will be required until alternatives are available. Evolving technology is allowing for a much wider range of operation for combustion turbines, with faster startups and ramping than ever before. Developments such as use of hydrogen fuel, which has no carbon emissions and can be created through electrolysis, can serve as storage for renewable energy while lowering or even eliminating the carbon footprint of combustion turbines.

2. Transmission Infrastructure

The addition of large amounts of renewable resources to NV Energy’s system will require a corresponding level of transmission infrastructure to access and transport this energy and bring it to the loads. Similarly, increasing electrification in the state will require new transmission infrastructure to ensure sufficient capacity exists to meet the needs of customers. Failure to put appropriate transmission infrastructure in place will not only prevent the achievement of carbon reduction objectives but will also interfere with future economic development in the state due to limitations on available energy supply. A regional transmission approach to access diverse markets outside of Nevada will allow the sale of Nevada’s excess renewables — largely solar and geothermal — and purchase of other state’s complimentary renewable energy, such as wind and hydropower. This facilitates the balanced renewable portfolio described above.

Senate Bill 254 (“SB254”) was passed into law on June 5, 2019, requiring the Nevada State Department of Conservation and Natural Resources (“NDCNR”) to submit an annual report that includes a statewide inventory of greenhouse gas (“GHG”) emissions and a projection of annual emissions for the next 20 years. While the requirement of this report is clearly to drive the reduction of GHG emissions in the state, it also provides policies to support that direction. From the Companies’ perspective, some of the most important policy areas discussed in the 2019 report are integrated resource planning and grid modernization. These two areas are interdependent, and, in fact, grid modernization is a pre-requisite to accommodate the net-zero carbon emissions goal. NDCNR’s 2019 report discusses resiliency, flexibility, reliability and foremost renewable integration. These factors can only be achieved through an interconnected grid that has the ability to share diverse resources over a vast geographic area. In the electric industry, this is achieved through the development of transmission infrastructure both within Nevada and interconnecting Nevada to other regional energy hubs. It is impossible and cost prohibitive to meet the goals of the state without strategic transmission infrastructure on both a state and regional level.

Resource diversity and transmission infrastructure each play a key role in allowing the Companies to achieve these state policy goals. While Nevada has abundant solar and geothermal resource potential, high-quality wind and hydro resources are nearly absent within the state. Further, while battery technology continues to evolve, the zero carbon findings and analysis by E34 demonstrates

3 Docket No. 20-07023, Technical Appendix ECON-6.
that solar PV and energy storage alone will not accomplish the aggressive decarbonizing goal established for the state. A balance must be created between resource types and the availability of those resources as the sun rises and sets through each day.

The best way to gain access to diverse renewable resources is through an interconnected western grid. Nevada’s geographic location provides the opportunity to be a key player in the development of that grid and a key renewable energy provider in the west. At this point, the missing piece is the lack of transmission infrastructure in Nevada. The transmission infrastructure proposed in the Greenlink Nevada plan in Docket No. 20-07023 builds a foundation for the state to have the internal transmission infrastructure that could then lead to the development of interconnections to a broader regional transmission system that would increase the transfer of energy between Nevada and the developing western grid and truly position Nevada to achieve a net-zero energy supply. Several regional projects in the western grid are already under development and propose connections to or through the state of Nevada which could greatly aid in Nevada’s decarbonizing efforts.

3. Electrification

Electrification is expected to progress in several sectors in Nevada, including transit, rail, mining, and buildings, with much change in the two former categories occurring in the next decade. NV Energy has a significant role to play to ensure a reliable cost-effective transition to renewable energy. Electrification policies that the State is contemplating in the Nevada Statewide Greenhouse Gas Emissions Inventory and Projections, 1990-2039, are outlined in Section VII, Electrification, of this report.

While the specific impact electrification will have on the Nevada economy is unknown, national studies have modeled the load projections though 2050. In Electrification Futures Study: Scenarios of Electric Technology Adoption and Power Consumption for the United States, completed by the National Renewable Energy Laboratory ("NREL"), the following industry highlights were identified:

- The transportation sector will experience the greatest technology transition toward electric vehicles;
- The buildings and industrial sectors generally see less potential for transformational change nationwide, but electrification in these sectors could acutely affect certain regions and end uses;
- Electrification has the potential to significantly increase overall demand for electricity.

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The estimation for Nevada load growth by NREL in the high electricity consumption scenario of the Electrification Futures Study is 11 terawatt-hours (“TWh”) for the transportation sector and 2 TWh for buildings by 2050.

NV Energy has long understood the value of matching electrification load to excess capacity through tariffs and control technology. As the generation profile changes, this will be no different. Flexible loads that can operate and charge during periods of high renewable resource output could greatly aid in decarbonizing the state. This must be comprehensively managed through carefully planned load control technologies, rate design and infrastructure deployment. NV Energy’s goal is to maximize the ability for load shaping, ensuring, where possible, that electrification load is designed to be both flexible, to follow excess renewable energy through tariff or control technology, and demand response capable to respond immediately to reliability and/or market issues.

4. Demand Side Planning

Increasing the penetration of renewable resources will change the dynamic of balancing supply and demand, making balancing efforts on the demand side more important for the Companies to reach the 2050 net-zero carbon emissions goal. As mentioned in the electrification discussion, load shaping will be critical to the State’s decarbonization. While renewable resources are typically not dispatchable and cannot easily be shaped to match load, NV Energy can increase focus on shaping the load to more closely match the resources, encouraging more flexible demand in the relative absence of flexible resources. Demand side planning and load shaping will be a component for NV Energy to assist the State in mitigating climate affects, reducing GHG emissions, and achieving a net-zero carbon energy vision. This vision can be supported by programs such as adoption of renewables, DSM – energy efficiency and demand response, integrating resources, energy management tools, increasing the penetration of Distributed Energy Resources (“DERs”) – battery storage utilization from electric vehicles (“EV”) and PV, and grid modernization. A key component of this vision is successfully managing the appropriate energy assets and DERs. Additionally, it requires that the Companies investigate innovative grid operations in an environment of increasing demand- and supply-side renewable energy production and storage.

NV Energy is actively pursuing options to expand, advance, and encourage demand response, energy efficiency, and clean energy programs, such as load shaping energy-efficient measures and tools, demand limiting devices, non-wires alternatives, battery storage, electric transportation, solar, and charging stations. Traditionally DSM has focused on energy efficiency measures, which have been in place for decades. As DSM evolves through market saturation and/or stricter codes and standards, along with public adoption of more energy efficient products and practices, it limits the amount of energy savings that can be achieved. The market potential for 2021 is 1.2 percent of
NV Energy retails sales. Thus, NV Energy will be actively pursuing options to encourage load shaping activities. Energy efficiency, demand response, DERs and clean energy programs are important resources that are integral to a balanced portfolio; they give customers tools to reduce and/or adjust their energy consumption during times of peak demand or throughout the day or year. As customers become more aware of their energy usage and change consumption patterns as a result of time-of-use rates, NV Energy, its customers, and the State will continue to realize energy savings and carbon reductions.

**Closing the Gap on Achieving Net-Zero Carbon Emissions**

This report shows NV Energy’s contribution towards the State’s net-zero carbon dioxide emissions goal and illustrates changes that are anticipated and progress that will be necessary to ensure a cost-effective and reliable solution to achieving net zero for Nevada. In Section X – Clean Energy Future, two Illustrative Cases are developed that incrementally add more renewables and storage to the IRP 4th Amendment Preferred Plan to progress NV Energy dramatically towards the goal. Table 1-1 shows the progression towards the goal through the addition of developable in-state renewable resources modeled in the two Illustrative Cases.

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<tbody>
<tr>
<td>NV Energy Retail Sales (GWH)</td>
<td>28,877</td>
<td>33,927</td>
<td>34,237</td>
<td>34,237</td>
<td>34,237</td>
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<tr>
<td>NV Energy Owned and Contracted Zero-Carbon Generation</td>
<td>Native Load Service (GWH)</td>
<td>6,213</td>
<td>12,892</td>
<td>19,874</td>
<td>25,127</td>
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<td></td>
<td>Sales of Excess (GWH)</td>
<td>0</td>
<td>820</td>
<td>2,259</td>
<td>3,354</td>
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<td>Excess Output from Rooftop Solar (GWH)</td>
<td>26</td>
<td>92</td>
<td>92</td>
<td>92</td>
<td>92</td>
</tr>
<tr>
<td><strong>Goal Progress</strong></td>
<td><strong>22%</strong></td>
<td><strong>41%</strong></td>
<td><strong>65%</strong></td>
<td><strong>83%</strong></td>
<td><strong>84%</strong></td>
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<tr>
<td><strong>Incremental Amount Required to Achieve Net-Zero (GWH)</strong></td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>12,000</td>
<td>5,700</td>
<td>5,500</td>
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</table>

Both of these Illustrative Cases demonstrate that additional resources are required to close the gap on a full net-zero achievement. Each case includes nearly 9,000 MW of solar PV and over 6,000 MW of BESS from the 4th Amendment Preferred Case, which is pushing the bounds of the diminishing returns expected from incremental resources due to a declining ELCC, as discussed in Section IX. Illustrative Case A adds an incremental 1,300 MW of geothermal resources, which may be at the limit of known developable resources in the state, and 500 MW of BESS. Illustrative Case B builds on Case A, replacing a small portion (150 MW) of geothermal resources with an

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incremental 300 MW of developable wind resources in Nevada and maintaining 500 MW of BESS. Notably, the increasing levels of renewables in the Illustrative Cases are not flexible resources, therefore, the dependence on fossil-fueled generating resources does not differ significantly from the Preferred Case. It is highly likely that a regional perspective is required to achieve further decarbonization. Complimentary solutions to fill this gap will evolve over time, and may include:

- Ability to export NV Energy’s excess solar and geothermal energy through new transmission connections to states that have fewer of these resources;
- Access to more diverse out-of-state renewables through new transmission connections;
- Developments in storage technology, such as pumped storage hydro, that would provide longer duration storage solutions;
- Developments that reduce the carbon dioxide emissions of traditional fossil resources, such as use of hydrogen fuel.
SECTION II - INTRODUCTION TO THE COMPANIES

Nevada Power and Sierra Described

Nevada Power and Sierra are fully regulated “public utilities,” subject to the jurisdiction and oversight of the Commission and the Federal Energy Regulatory Commission (“FERC”). Jointly, Nevada Power and Sierra provide approximately 89 percent of Nevada’s electrical power.7 Nevada Power and Sierra provide all-in electric service to residential, commercial and industrial customers in northern and southern Nevada at rates and under terms and conditions reviewed and approved by the Commission. Nevada Power and Sierra also provide distribution-only service to very large commercial customers that have received permission to procure their own energy through an alternative energy provider. Distribution-only service is provided to these large commercial customers at rates and under terms and conditions reviewed and approved by the Commission. Finally, Nevada Power and Sierra provide transmission service to customers who interconnect directly to the transmission system, or who use the transmission system to import or export energy into and out of Nevada. Transmission service is provided to transmission customers at rates and under terms and conditions reviewed and approved by the FERC.

The nearly 2,500 employees of Nevada Power and Sierra support the generation, transmission and distribution of electric energy to over 1.3 million bundled customers statewide, covering approximately 45,000 square miles. Together, Nevada Power and Sierra serve peak loads of 7,871 MW with capacity primarily sourced from a combination of more than 50 Nevada renewable resources, a small fleet of Nevada-based modern, clean-burning natural gas facilities, and market purchases. Between 2005 and 2019, the Companies began transitioning away from coal and into renewable energy, reducing Nevada’s carbon emissions from electric production by approximately 50 percent. The companies have one remaining coal facility set to retire in 2025.

Residential, commercial and industrial customers have been clear that they want Nevada Power and Sierra to serve them with more renewable energy without impacting the costs they pay. Nevada Power and Sierra have listened, as demonstrated by their recent filings.

A map of Nevada Power’s and Sierra’s electric service territories, as well as the bulk transmission system that delivers energy into and out of Nevada is set forth in Figure II-1 on the following page.

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Figure II-2 on the following page shows all renewable facilities contracted to Nevada Power and Sierra.
FIGURE II-2
NV ENERGY'S CLEAN ENERGY COMMITMENT

RENEWABLE ENERGY PROJECTS

NAMEPLATE MEGAWATTS AC

<table>
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<tr>
<th>Project</th>
<th>MW</th>
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<tr>
<td>1. Battlecreek Solar</td>
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<td>2. Navy Solar</td>
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<td>3. Arrow Canyon Solar Project</td>
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<td>4. Battle Mountain Solar</td>
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<td>5. Boulder Solar 1</td>
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<td>7. Copper Mountain Solar 1</td>
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<td>9. Dry Lake Solar Project</td>
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<td>10. Eagle Shadow Mountain Solar</td>
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<td>11. Fish Springs Ranch Solar</td>
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* In development or under construction.
** Priorities R&D assessed

RENEWABLE ENERGY PROJECTS

NAMEPLATE MEGAWATTS AC

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<th>Project</th>
<th>MW</th>
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<td>3. Arrow Canyon Solar Project</td>
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** Priorities R&D assessed

ENERGY EFFICIENCY

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* In development or under construction.
** Priorities R&D assessed

Updated: 08-25-2020
Resource Planning Described

Beginning in 1983, the Legislature gave the Commission oversight authority over the long-term planning for energy resources. Every three years, Nevada Power and Sierra formulate and present a Preferred Plan for meeting the long-term needs of customers. The Joint Integrated Resource Plan ("IRP") begins with projections of customers’ load requirements and the resources the Companies have under contract or own, with which they can serve customers’ load requirements. The Companies then prepare a long-term plan in which they lay out in detail their proposal for filling projected needs with programs that reduce energy consumption, long-term contracts for the purchase of new energy resources, and requests to build generation and/or transmission.

As the resources in the Companies’ portfolio move increasingly away from the historical cadre of firm dispatchable fossil resources towards ever-increasing amounts of variable renewable resources, resource planning will continue to evolve as well. System resources will be called upon to perform in significantly different ways. Changes include:

- Dramatic adjustments to the dispatchability of the resources
- Requirement for more flexibility from available dispatchable resources
- Variability in hourly and seasonal availability as natural resources vary
- Concentrated periods with multiple days of low output from renewable resources
- Decreases in hourly output that correspond to increases in demand, such as when cloud cover dramatically reduces solar PV output simultaneous with increased demand from buildings with rooftop solar which is similarly shedding load
- Expansion of transmission system
- The addition of energy storage to shape the output of the variable renewable resources

Evaluation techniques will also have to change to keep up with advancements and new requirements of variable renewable resources. Resource planning tools will be updated to better model the performance, reliability and cost of high renewable penetration scenarios.
SECTION III - STATE POLICY

Various Senate Bills, Assembly Bills, and Executive Orders have been enacted in Nevada over the years regarding renewable energy, energy efficiency and conservation, distributed generation, electric vehicle infrastructure, and decarbonization goals and policies. Nevada’s Renewable Portfolio Standard (“RPS”) has evolved from a 5 percent goal in 2003 (enacted in SB372 in 2001) to the current goal of 50 percent by 2030.

On March 12, 2019, Nevada joined the US Climate Alliance, a bipartisan coalition of twenty-three governors, committed to reducing greenhouse gas (“GHG”) emissions consistent with the goals of the Paris Agreement, with goals of reducing GHG emissions 28 percent below the 2005 levels by 2025, 45 percent below the 2005 levels by 2050, and net-zero emissions by 2050. In alignment with the goals of the Paris Agreement, SB254 set forth economy-wide GHG reduction goals and established a requirement that the state’s report of Nevada’s GHG emissions be generated annually and include a statement of sector-specific policy options to achieve GHG reductions. This Senate Bill and the Governor’s Executive Order 2019-22 also require a State Climate Strategy be developed by December 1, 2020. The State of Nevada Climate Initiative, a team of state agencies working on this strategy, asserts that it “will provide a framework designed to evaluate the alignment of policies with the timelines and benchmarks necessary for Nevada to achieve its GHG emission reduction goals.”

Indeed, it will be important to ensure that evolving state policies regarding electricity generation and other sectors are in alignment with decarbonizing objectives, as policies could be complementary or could inadvertently conflict with one another. RPS targets, in particular, can run counter to decarbonizing goals. For instance, high RPS targets generally do not encourage other low- or zero-carbon resources and can actively discourage them. A cost-effective low-carbon resource could be passed over for a more expensive renewable resource due to the push to meet an RPS goal. In addition, development of technologies to decarbonize existing fossil resources, which have an important role as firm dispatchable resources, could be negatively impacted by RPS targets. The need to curtail or downward dispatch renewable resources in order to ensure reliability in a highly decarbonized system would run counter to an RPS target. High RPS targets can also lead to negative market pricing during periods of oversupply, which has been seen at times in the California Independent System Operator’s (“CAISO”) Energy Imbalance Market (“EIM”). These negative market prices arguably result from RPS policies and erode the value of existing carbon-free resources. Nuclear and older hydroelectric generation are most likely to be impacted by the latter effect, and while they do not feature prominently in Nevada’s resource mix, they are a valuable contributor to resource adequacy in the region as a whole.

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While RPS targets have served Nevada well, in the future, the state’s decarbonizing efforts may benefit from a transition away from RPS targets in favor of decarbonizing policies to avoid conflict and increase impact across more sectors of the economy.

Also, policies designed to wholly eliminate fossil fuel-fired electricity generating sources could undermine reliability in a decarbonized system. As explained in Section IX, resources that can be dispatched at will to serve load when renewable resources’ output fluctuates or drops off the system entirely will continue to be a fundamental component of a reliable system. While use of fossil-fueled resources can be optimized and their emissions minimized, they will be required until advancing technology presents an alternative firm, dispatchable, cost-effective resource.

Similarly, policies to limit the carbon dioxide intensity from gas-fired generating units could run counter to the requirement for these units to start often, ramp quickly, and operate at low loads to mitigate the variable output from renewable resources in a highly decarbonized system.

In addition, energy efficiency goals, such as those set in Senate Bill 150 (“SB150”) and Assembly Bill 223 (“AB223”), may conflict with decarbonizing objectives by requiring energy efficiency without providing any load shaping, potentially encouraging an impact that is counterproductive to decarbonizing goals.

Future state policymaking in the areas of electrification in various sectors and demand management are likely. Nevada has not yet adopted electrification policies, while many other states have. Policy in both of these realms could greatly aid in efforts to meet the state’s net-zero carbon emissions goal, if done in such a manner as to encourage load shaping. While renewable resources are rarely dispatchable and cannot easily be shaped to match load, focus can be placed on shaping the load to more closely match the resources, incentivizing flexible demand in the relative absence of flexible resources. Flexible loads that can operate/charge during periods of high renewable resource output could greatly aid in decarbonizing the state.

Careful policymaking has the potential to help Nevada achieve its net-zero carbon emission goal while also maintaining a cost-effective and reliable electric supply.
SECTION IV - FORECAST OF GROWTH

NV Energy recently filed a forecast in the IRP 4th Amendment. For the period 2021 through 2050, the Compounded Annual Growth Rate (“CAGR”) of the coincidental peak for NV Energy is 0.7 percent. Nevada Power is forecasted at 0.8 percent CAGR, and Sierra is forecast at a slightly lower rate of 0.5 percent CAGR. Sierra will experience slower growth in the forecast period due to one large customer that is expected to switch to distribution-only service. While Nevada Power lost a considerable amount of load in recent years to distribution-only service, there are no known new customers that are expected to become distribution-only service customer in the forecast period. The table below shows the peak demand by company.

<table>
<thead>
<tr>
<th>TABLE IV-1</th>
<th>FORECASTED PEAK BY COMPANY (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2021</td>
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<td>NPC</td>
<td>5,726</td>
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<tr>
<td>NVE1</td>
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</table>

1) Due to diversity adjustment, the combined peak is less than the sum of individual peaks.

Methodology Framework

NV Energy provides a load forecast for its service area as part of the IRP process. The forecast is updated, if appropriate, and approved by the Commission in subsequent amendments. The forecast relies on a statistically adjusted engineering (“SAE”) framework, which includes the effect of structural changes, such as household stock of appliance and the intensities at which those appliances are utilized. Specifically, the forecast models are based on econometric models that employs historical sales, forecasted economic conditions, weather, and other relevant data.

The forecast utilizes the most up-to-date data and assumptions. The primary drivers of the forecast are the population forecast which drives customer growth, economic forecasts, large customers’ growth forecast, normal weather assumptions, demand side management programs, rooftop solar, and electric vehicle forecasts. In preparing the various IRP scenarios, the Companies also consider pessimistic and optimistic economic conditions and present high and low forecast scenarios in the IRP. The discussion below provides a brief summary of how certain items are currently addressed in the load forecast.

Demand Side Management

The demand side management portfolio currently targets energy conservation through its direct install and residential lighting programs, and demand response programs provide targeted load
shaping through smart thermostats. The Companies’ forecast incorporates the reductions in load from both types of programs. In the most recent forecast, energy reductions are based on a goal of 1.1 percent (including demand response) of forecasted retail sales for each company.

**Rooftop Solar**

NV Energy continues to experience growth in rooftop solar. In 2019, 107 MW of rooftop solar was installed in the NV Energy’s service area, 95 percent of which was in the Nevada Power’s service territory. The forecast includes reductions in system demand and energy requirements to account for energy produced from the private generation (i.e., behind-the-meter solar PV) that is used by the customer at their premise. The forecast includes a reduction from both rebated and non-rebated (i.e., outside of the Solar Generations program) rooftop solar.

The forecast is informed by analyzing the historical growth. The Companies continue to see new rooftop solar installations even as the state no longer offers Solar Demonstration Program rebate incentives to customers. The forecasting group is continuously monitoring the market conditions related to rooftop solar and will make appropriate changes based on evolving market conditions.

**Distributed Battery Storage**

NV Energy made no adjustments to the IRP 4th Amendment forecast for energy storage. Currently, with fewer than 500 customers with storage as of August 2020, there is not enough data to determine the peak and hourly load impacts, given the limited adoption of energy storage devices. The impacts will be immaterial until the adoption rates increase significantly. Adoption rates are expected to increase, and NV Energy will make appropriate adjustments necessary to reflect the market conditions.

**Electric Vehicle Infrastructure**

Currently, the penetration of EVs is very low in Nevada. Auto Alliance, an industry trade group, estimates that in 2019, battery EV accounted for only 0.9 percent of the total new registrations in Nevada. This is due to several challenges such as the high cost of EVs, range anxiety, the currently available market mix of EV, and inadequate charging infrastructure. The Companies assume that the popularity of EVs will increase over time as consumers gain awareness and confidence in the

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9 Assembly Bill 405 established four tier-based retail rates for net excess energy on a first-come, first-serve basis. The rate structure is set to decrease over time when the combined installed capacity reaches 80 MW for each of the first three tiers. As of October 29, 2020, the first tier is closed, tier two and three are subscribed, but remain open, any new installs are processed in the fourth tier. Additionally, Federal Tax credits are ramping down to 22 percent in 2021 and are eliminated for residential properties in 2022.
technology and governments enact policies to promote EVs.\textsuperscript{10} As such, the forecast assumes that the new EVs registrations will gradually increase to 6.1 percent of total new car registrations by 2030 and will stay at that level through 2050.

**High and Low Economic Scenario**

The high and low economic scenarios are developed from optimistic and pessimistic economic conditions forecast developed by IHS Global Insights, an economic forecasting vendor, for the Companies’ service territories. Additionally, NV Energy also adjusts large customer forecasts for different scenarios. The high and low economic scenario affects the sales, energy, and peak demand. In the IRP 4\textsuperscript{th} Amendment forecast, no optimistic or pessimistic assumptions of DSM, demand response (“DR”), or Solar PV are included in this analysis.

**Future Development**

The load forecast process has evolved over the years to address the challenges of new technologies. Currently, NV Energy does not have a comprehensive electrification plan, which can significantly impact the load forecast. As such, the current load forecast does not include any load impact from electrification. An appropriate adjustment will be made when an electrification plan is formalized.

NV Energy routinely holds informal workshops with the Commission’s Staff and Bureau of Consumer Protection to present and discuss the load forecast. NV Energy values the feedback it receives from all stakeholders and has modified the forecasting methodology based on their feedback. NV Energy aims to continue this practice going forward.

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\textsuperscript{10} On June 22, 2020, the Nevada Division of Environmental Protection started the rulemaking process to evaluate adoption of low emission and zero-emission standards for light-duty vehicles.
SECTION V - RENEWABLE ENERGY

Current Renewable Energy Mix

NV Energy’s current renewable generation consists of more than 50 individual generators utilizing several different types of technology including hydroelectric, biogas, concentrated solar, PV, geothermal and wind. Please see Tables V-1 and V-2 below for the current generation mix. The Companies’ early renewable projects were mostly contracted geothermal and small hydroelectric. Additions to the renewable mix were primarily driven by Nevada’s RPS and were presented to the Commission only as needed to meet RPS compliance because the cost of such projects increased the cost to serve customers. More recently, the addition of projects was also driven by large customer demand for the Companies’ Nevada GreenEnergy Rider (“NGR”) tariffs. The NGR program enabled customers such as Apple a means to achieve their sustainability goals while avoiding increased costs to non-participating customers. NGR demand was responsible for the addition of six projects totaling nearly 500 MW of new PV generation. In the last 2-3 years, the increase in major customer demand and the lower price of PV have combined to drive the Companies’ rapid addition of new projects, far exceeding the current RPS need. Rather than proposing the bare minimum to maintain compliance, the Companies have brought forward projects to improve system costs, meet customer demands for green energy, and represent major strides towards meeting Nevada’s long-term sustainability goals.

| TABLE V-1
| NV ENERGY’S CURRENT GENERATION MIX |
|---|---|---|
| Fuel Type | MW | Percentage |
| Natural Gas | 5,735.0 | 72.17 |
| Renewable Energy | 1,764.7 | 22.21 |
| Coal | 435.0 | 5.47 |
| Diesel | 12.0 | 0.15 |
| Total | 7,946.7 | 100.00 |

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Boulder Solar II (50 MW), Techren II (200 MW), Switch Station 1 (79 MW), Switch Station 2 (100 MW), Fort Churchill Solar (20 MW) and Turquoise Solar (50 MW).
TABLE V-2
NV ENERGY’S CURRENT RENEWABLE RESOURCES MIX\textsuperscript{12}

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<th>Renewable Mix</th>
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<td>Hydro</td>
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<td>Wind</td>
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<td>Biogas</td>
<td>15.2</td>
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<td>Waste Heat</td>
<td>5.0</td>
<td>0.28</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,764.7</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

**Technology Options**

To increase the level of renewable generation in its portfolio, NV Energy can rely on the following clean energy options:

1) Energy Storage: The ability to store intermittent solar and wind energy for later use will play an increasingly important role as the reliance on those resources increases. NV Energy has been actively engaging the developers of several types of energy storage in anticipation of this need.

   a) Battery Energy Storage Systems ("BESS"). The Companies took an early and aggressive position on battery energy storage including three solar with storage projects in each of its last three Integrated Resource Plan filings\textsuperscript{13}. This was done for numerous reasons including to address capacity open positions, cost-effective shifting of solar generation to evening peak hours, mitigating potential future excess generation during solar hours, and meeting the load-following requirements of a specific data center customer\textsuperscript{14}. Currently, the Companies have received approval for 690 MW (2,700 MWh) of energy storage with another 338 MW (1,352 MWh) pending before the Commission. With approval of the three pending projects, the Companies will have met the energy storage target established by the Commission in accordance with Senate Bill 204 (2017)\textsuperscript{15}.

\textsuperscript{12} In service as of September 2020.
\textsuperscript{13} Docket No. 18-06003 includes Battle Mountain Solar (25 MW BESS), Fish Springs Ranch (25 MW BESS), Dodge Flat Solar (50 MW BESS). Docket No. 19-06039 includes Southern Bighorn Solar (135 MW BESS), Arrow Canyon Solar (75 MW BESS) and Gemini Solar (380 MW BESS). Pending Docket No. 20-07023 includes Boulder Solar III (58 MW BESS), Chuckwalla Solar (180 MW BESS) and Dry Lake Solar (100 MW BESS).
\textsuperscript{14} Terms of the Google Energy Supply Agreement filed in Docket No. 19-12017 include a temporal match of renewable energy which necessitates significant BESS paired with storage from the Chuckwalla Solar and Dry Lake Solar projects.
\textsuperscript{15} LCB File No. R106-19, Approved Regulation of the Public Utilities Commission of Nevada filed on June 8, 2020; Docket No. 17-07014.
b) Pumped Storage Hydro ("PSH"): PSH is a promising alternative to BESS in that: 1) the technology is mature, such facilities have been operating for several decades; 2) there are potential PSH facilities in Nevada, not far from existing transmission routes; 3) the facilities have a long lifespan relative to BESS and capacity degradation does not need to be managed as closely as batteries. The Companies are actively monitoring the progress of PSH in Nevada.

c) Hydrogen: Hydrogen has potential as a storage medium for renewable energy, to be released when needed to fuel combustion units without carbon emissions or recombined with oxygen in a fuel cell to create electricity for return to the grid. No developers have bid a hydrogen facility into any of the Companies’ renewable RFPs or into its all-source capacity RFPs. The technology may hold promise in the future but currently is not cost-competitive with alternatives, at least at the scales requested by the Companies in its recent procurements.

d) Emerging Storage Technologies:

i) NV Energy has been approached by several developers of innovative, non-traditional methods of storing energy. These include various configurations of electric motor-generators that use excess energy to lift heavy masses, converting electrical energy into mechanical potential energy, and then holding those masses until the energy is needed. At a later time, the masses can be lowered such that the motor-generator converts the stored potential energy into electrical energy returned to the grid.

ii) Thermal storage: There are several technologies to store thermal energy. The heat energy source may be concentrated solar (e.g. Crescent Dunes), waste heat from combustion sources, or heat pumps powered by renewable or other electrical energy. The heat energy storage medium could be molten salt (e.g., Crescent Dunes) or some other liquid heat transfer fluid or could be stored by heat solids such as rock or sand. NV Energy’s experience with thermal energy storage is limited to Crescent Dunes.

iii) Cold storage: The Companies’ large fleet of combustion turbines relay on cooling the turbine inlet air to enhance power output. Most of the fleet uses evaporative water cooling however the Chuck Lenzie station’s four turbines use a water chilling system to cool the inlet down to 45°F, greatly enhancing the output of the facility during of high demand, most importantly during summer peak hours. However, none of the Companies’ units are able to store chilled water for later use. Chilling the water is energy intensive so while Chuck Lenzie station is producing additional energy when using chilled water, it is also expending significant energy to chill that water at the same time. If the water could be chilled during times of low energy cost and demand, or better yet, chilled using renewable energy while the combustion units were offline, a station such as Chuck Lenzie could respond even
better during peak hours. To date, the cost-benefit analysis does not support this as the equipment is capital and O&M intensive. However, as the generation portfolio shifts to higher intermittency it will critical to maximize the capabilities of the remaining turbine fleet. At some time in the future, the cost-benefit balance of retrofitting combustion turbines with inlet chilling systems and cold storage, perhaps powered by renewable energy, could be an important facet of reducing overall fleet carbon emissions.

iv) Compressed air storage: This technology would use renewable energy to power air compressors. The compressed air would be stored in large tanks or underground caverns. When energy is needed, the compressed would be released to power turbine generators to create electricity. NV Energy has no experience with the technology and has never received a proposal utilizing compressed air storage.

2) Solar: Solar PV pricing of NV Energy projects has dropped more than 68 percent between 2014 and 2016.\textsuperscript{16} Since then the price of PV has dropped almost another 50 percent to less than $25/MWh.\textsuperscript{17} Improvements in solar panel yield and reductions in plant costs have driven contract pricing to the point where adding new projects makes good sense for business reasons, not just RPS compliance. As the investment tax credit ("ITC") steps down from 26 percent in 2020, to 22 percent in 2021 and eventually to 10 percent in 2022, the Companies cannot say with certainty pricing will continue to decline in the short term. Concentrated solar projects have not been proposed recently, with one exception, likely due to their continued high cost, unable to achieve the same cost reductions as observed in the solar PV realm. Nevada Solar One is a 69-MW concentrating solar project using parabolic troughs to focus sunlight on a pipe containing heat transfer fluid.\textsuperscript{18} That fluid then boils water to create steam that drives a turbine generator. This project was contracted in 2007 and performs well. The Companies’ other concentrating solar example, Crescent Dunes, was unable to produce reliably and the contract was terminated as a result. It does not appear this technology will comprise a part of the Companies’ near- or mid-term procurement. Solar PV has been the sole renewable generation technology added to the Companies’ resource mix since 2012.\textsuperscript{19}

3) Solar with Storage: PV with Li-Ion BESS has comprised the majority of the Companies’ procurement spanning the last three years.\textsuperscript{20} The Companies’ addition of BESS has been robust as the technology provides cost-effective, carbon-free capacity while mitigating potential excess solar generation such as that experienced in California on an increasing basis. In other

\textsuperscript{16} Ace Searchlight, commissioned in 2014, is priced at $143.99/MWh and escalates 1 percent per year. Boulder Solar I, commissioned in 2016, has a flat price of $46.00/MWh.
\textsuperscript{17} Examples include Boulder Solar III at $22.46/MWh, Chuckwalla Solar at $23.35/MWh, Eagle Shadow Mountain at $23.76/MWh and Dry Lake Solar.
\textsuperscript{18} Nevada Solar One, commissioned in 2007, is currently priced at $201.77/MWh and escalates 1 percent per year.
\textsuperscript{19} Spring Valley Wind.
\textsuperscript{20} 2018 Joint IRP, 3rd Amendment to 2018 Joint IRP, and 4th Amendment to 2018 Joint IRP.
words, the Companies are proactively, prudently and cost effectively managing the impact of increasing PV generation on its system.

4) Wind: Nevada has one 150 MW wind project, Spring Valley Wind, at $120/MWh with an average capacity factor of approximately 24 percent since 2013. For comparison, projects in Idaho can attain capacity factors in the mid to high 30 percent range and projects in other locations such as Wyoming, can achieve even higher capacity factors. The wind resource is relatively poor in Nevada (see Figure V-1) which translates into less energy delivered per wind turbine generator and resultant energy pricing that does not currently compare favorably to solar. Despite this, NV Energy is actively seeking wind projects as the generation profile is generally complementary to solar. To date, the known projects are all outside Nevada and either the cost of transmission into the state makes the projects too expensive or transmission is unavailable at any price. Only one wind project bid into NV Energy’s spring 2018 RFP and none bid into the fall 2018 RFP. Wind turbine efficiency improvements, greater transmission access within Nevada, and greater transmission import capability could soon lead to wind energy playing a greater role in Nevada’s green energy future.
FIGURE V-1
NREL WIND RESOURCES AND TRANSMISSION LINES

The remaining states use data from the 1987 "Wind Energy Atlas of the United States".

Wind Resources and Transmission Lines

Wind Power Classification

<table>
<thead>
<tr>
<th>Wind Power Class</th>
<th>Resource Potential</th>
<th>Wind Power Density at 50 m</th>
<th>Wind Speed at 50 m</th>
<th>Wind Speed at 50 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Marginal</td>
<td>200 - 300</td>
<td>0.4 - 0.6</td>
<td>6.6 - 6.4</td>
<td>12.5 - 14.3</td>
</tr>
<tr>
<td>3 Fair</td>
<td>300 - 400</td>
<td>0.6 - 1.0</td>
<td>6.4 - 7.0</td>
<td>14.3 - 15.7</td>
</tr>
<tr>
<td>4 Good</td>
<td>400 - 500</td>
<td>0.7 - 1.5</td>
<td>7.0 - 7.5</td>
<td>15.7 - 16.5</td>
</tr>
<tr>
<td>5 Excellent</td>
<td>500 - 600</td>
<td>0.8 - 2.0</td>
<td>7.5 - 8.0</td>
<td>16.9 - 17.9</td>
</tr>
<tr>
<td>6 Outstanding</td>
<td>600 - 800</td>
<td>0.9 - 2.5</td>
<td>8.0 - 8.6</td>
<td>17.5 - 18.7</td>
</tr>
<tr>
<td>7 Superb</td>
<td>800 - 1000</td>
<td>0.6 - 11.1</td>
<td>8.6 - 11.1</td>
<td>19.7 - 24.6</td>
</tr>
</tbody>
</table>

*Wind speeds are based on a Weibull k value of 2.0

Source: POWERmap, powermap.platts.com
©2007 Platts, a division of the McGraw-Hill Companies

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National Renewable Energy Laboratory

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5) Geothermal: Traditional flash and binary: Nevada is second only to California in the nation for geothermal energy production as shown below in Figure V-2.  

<table>
<thead>
<tr>
<th>State share of total U.S. geothermal electricity generation</th>
<th>Geothermal share of total state electricity generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>71.2%</td>
</tr>
<tr>
<td>Nevada</td>
<td>23.5%</td>
</tr>
<tr>
<td>Utah</td>
<td>2.8%</td>
</tr>
<tr>
<td>Oregon</td>
<td>0.9%</td>
</tr>
<tr>
<td>Hawaii</td>
<td>0.7%</td>
</tr>
<tr>
<td>Idaho</td>
<td>0.5%</td>
</tr>
<tr>
<td>New Mexico</td>
<td>0.4%</td>
</tr>
</tbody>
</table>

NV Energy currently has 15 geothermal facilities totaling 448.1 MW of capacity. All of these facilities are located in Sierra’s territory and all are under long-term energy contracts. These plants provide clean, renewable energy to both Nevada Power and Sierra customers. The newest plant, McGinness Hills, declared commercial operation in June 2012. Geothermal has been a primary source of Nevada renewable energy since the utilities filed their very first renewable portfolio compliance report in April 2004. At the time, Sierra had 13 geothermal facilities under long-term contract totaling 111.56 MW of capacity. Since then, there have been many changes with several new geothermal facilities declaring commercial operations while the majority of the original 13 facilities are now retired and/or repowered.

Although geothermal developers have participated in recent company RFP events, PV with its low cost, coupled with advancements in battery storage, is eclipsing geothermal as the primary source of renewable energy in Nevada. With that said, geothermal energy will continue to play a vital role as the Companies progress towards carbon-free generation. Progress will require a diverse portfolio approach as each renewable type has its own strengths and weaknesses. The predictable, weather-independent generating profile provided by geothermal facilities becomes increasingly attractive as they avoid exacerbating the PV generating peak. A diverse collection of renewable portfolios with diverse generating profiles will be required in a zero-carbon future.

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6) Emerging geothermal: The same geological advantage that feeds Nevada’s many existing geothermal facilities makes the state a prime location for Advanced Geothermal Systems ("AGS") and Enhanced Geothermal Systems ("EGS").

Unlike conventional flash and binary geothermal technology which draws pressurized hot water from the ground to the surface, AGS uses a closed-loop design which circulates a sustainable heat transfer fluid through underground pipes. The fluid absorbs the earth’s heat and returns that energy to the surface to power turbine generators. This technology does not require as high an underground temperature of other designs and does not require as precise drilling to strike productive geologic features, potentially making it more broadly viable across Nevada than traditional geothermal generation.

EGS does not rely on naturally occurring trifecta of heat, water and high porosity underground conditions. Rather EGS injects high pressure water into hot, less porous earth through one or more wells. The high-pressure injection creates fractures in the earth allowing the injected water to flow from the injection wells to a second set of production wells where the heated water is returned to the surface to power a turbine generator. Like AGS, EGS is less dependent on the rare combination of geologic features that conventional flash and binary geothermal generation rely upon, therefore, there is potentially broader viability across Nevada.

7) Biomass: The Companies have no biomass generation. One 50 MW biomass project bid into the Companies’ spring 2018 RFP and was not selected primarily due to the high price. It was again bid into the Companies’ fall 2018 RFP as a 100 MW project with a moderate price decrease; however, it still was not competitive. However, with a reliable fuel supply, biomass could perform on par with geothermal economically and provide many of the same system ancillary services. It is important to note that biomass generation involves combustion of carbon containing biological waste products and, therefore, creates carbon emissions during the process. However, “the plants that are the source of biomass for energy capture almost the same amount of CO2 through photosynthesis while growing as is released when biomass is burned, which can make biomass a carbon-neutral energy source.”

8) Biogas: The Companies have two biogas facilities under contract delivering energy and a third from which the Companies purchase renewable energy credits. The first two entered service in 2012 and are priced well above that of geothermal energy. The 12 MW Apex Landfill project located at the landfill north of Las Vegas has a capacity of 12 MW, is priced at more than $100/MWh and is fueled by the methane produced by the decomposition of the city’s garbage. Working on the same principals as the Apex project, the 3.2 MW Lockwood Landfill project, owned by Waste Management, is located at the Lockwood Landfill in Sparks, NV. It is priced

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at more than $85/MWh. Like biomass and geothermal, if the facility has a reliable fuel source, the generating profile can be stable around the clock. The price of energy from such facilities is more expensive than geothermal and the options to contract within Nevada are very limited – the Companies have not received any biogas proposals in any of the recent RFP events. It is important to note that biogas generation involves combustion of methane produced in the landfill and, therefore, creates carbon emissions. Biogas generation, however, converts methane, a major greenhouse gas, into energy and prevents it from being released into the atmosphere. On balance, though not directly contributing to lower carbon, this technology contributes greatly towards the same carbon reduction – that of slowing the greenhouse effect.

9) Waste Heat: Waste heat facilities capture the hot exhaust from combustion, that would otherwise be released directly into the atmosphere, to boil a heat transfer fluid that can then power a turbine generator. The Companies own one such generator, the 5 MW Goodsprings facility located in Goodsprings, NV. The facility makes use of the waste heat from natural gas compressor turbine engines (owned by Kern River) to power its turbine generator. No waste heat projects have been proposed in any of the Companies’ recent RFPs and the Companies are not aware of any waste heat projects in development in Nevada.

Guiding Principles to Achieving a Greater Renewable Generation in NV Energy’s Resource Mix

As NV Energy continues to increase the portion of renewable generation in its resource portfolio, it must aim to maintain system reliability, avoid internal system constraints, maintain affordability, and integrate diverse renewable resources. The following paragraphs address each of these guiding principles.

System reliability
NV Energy must always first consider system reliability when considering retirements from and additions to its generating portfolio. NV Energy is aware of the intermittent nature of the solar PV resources it has procured and understands it must balance the competing goals of delivering reliable energy, helping to attain Nevada’s sustainability goals and providing the services customers need at affordable prices.

Internal system constraints
As mentioned in other sections of this filing, transmission system constraints:
- Limit the ability to import high capacity factor wind and hydroelectric energy from other states, thereby narrowing the cost-effective renewable options to solar PV and, to a lesser extent, geothermal and wind projects located within Nevada
- Limit the ability to export excess solar generation to neighboring states which helps reduce the cost to integrate intermittent renewable resources such as solar and wind (the alternative being curtailment or the investment in energy storage technologies).

- Limit the ability to connect new generators to load centers. This closes off much of Nevada’s vast solar and geothermal potential simply because potential project sites must be near major transmission routes or substations. This also means higher competition and higher prices for those sites and projects that benefit from their proximity to major transmission routes.

- Much of the existing transmission system, especially in Sierra’s territory, is unable to accept even one more utility-scale generator without triggering the need for major transmission upgrades. Momentarily looking beyond the cost to improve the infrastructure, these network upgrades could take seven or more years to construct once approved. The lack of a robust infrastructure will continue to challenge the expansion of a geographically and technology diverse renewable portfolio.

**Affordability**
NV Energy’s path to delivering affordable carbon-free energy will require flexibility and adaptability in response to changing technology, regulatory and market forces. The Companies expect to employ a procurement strategy that:

- Tests the market periodically via RFP
- Seeks opportunities to increase resource technology and geographic diversity
- Continuously evaluates existing projects and emerging generation and storage technologies for opportunities to expand the renewable portfolio
- In the near term, 1-3 years, will likely result in more PV paired with Li-Ion BESS
- In the mid-term may result in the addition of grid-tied storage, continued PV+BESS and, as generation needs outside solar hours increases, alternatives to PV such as geothermal and wind
- In the long term, alternative grid-tied storage technology (for example PSH). Look for improvements in wind capacity factors, geothermal yields and other technologies that complement the PV generation profile

**Diversity**
The value of geographic and resource technology diversity will increase as PV penetration increases. The ability of the grid to accommodate additional solar is already diminished, and continued addition of intermittent resources requires expensive measures and alternatives to PV.

- Transmission infrastructure: As discussed in Section VI, improved and expanded transmission is needed to enable the export of excess solar, the exchange of renewable
resource types between states, to provide geographic diversity for PV resources, and to unlock previously stranded geothermal, wind and solar sites.

- Energy storage: Energy storage systems, regardless of technology type only add to the average cost of energy. Storage will become even more important in the future to smooth and shape generation profiles
- Alternatives to PV: Addition of more expensive generation technologies such as geothermal may at some point be a more cost-effective means to add green energy than PV or wind with storage and possible transmission upgrades.

Renewables procurement efforts will be increasingly integrated with Resource Planning and Transmission Planning to determine the optimal mix of generation, storage and transmission investment that supports continued carbon reductions

**Moving Forward**

NV Energy’s procurement strategy will continue to test the market periodically via RFP, seeking opportunities to increase resource technology and geographic diversity. The Companies will continue ongoing evaluation of existing and proposed projects through frequent engagement of renewable and storage developers to assess emerging generation and storage technologies. In the near term, 1-3 years, it is likely that more PV paired with Li-Ion BESS will be the lowest cost means to integrate additional renewable energy. Mid-term plans may show an increase in the value of grid-tied storage, and, alternatives to PV, such as wind or geothermal, may begin to look favorable. In the long term, alternative technology and longer duration grid-tied storage (for example PSH) could play an important role in continued renewables penetration. Improvements in wind capacity factors, geothermal yields and other technologies may lead to a shift from PV. And as PV penetration increases, the value of resource geographic and technology diversification increases, both of which are enabled by the build-out of transmission infrastructure.
SECTION VI - TRANSMISSION AND SYSTEM RELIABILITY INFRASTRUCTURE

The replacement of firm thermal generation resources with intermittent renewable resources will require significant transmission infrastructure improvements to allow variable energy sources to reach load even when accounting for state-of-the-art energy storage and load shaping technologies. In addition, load forecasts indicate that NV Energy service area will experience steady growth in the future which will require additional regional transmission capacity to access new sources of renewable energy.

SB254 was passed into law on June 5, 2019, requiring the NDCNR to submit an annual report that includes a statewide inventory of GHG emissions and a projection of annual emissions for the next 20 years. While the requirement of this report is clearly to drive the reduction of GHG emissions in the state, it also provides policies to support that direction. Two important policy areas discussed in the 2019 report are Integrated Resource Planning and Grid Modernization. These two areas are interdependent and in fact, Grid Modernization is a pre-requisite to accommodate the 30-year resource plan envisioned. NDCNR’s 2019 report discusses resiliency, flexibility, reliability and foremost renewable integration. These factors can be more cost effectively achieved through an interconnected grid that has the ability to share diverse resources throughout the state of Nevada. It is impossible to meet the state’s net-zero carbon emission goal without strategic transmission infrastructure.

Resource diversity and transmission infrastructure each play a key role in allowing the Companies to achieve the state goal. While Nevada has abundant solar and geothermal resource potential, high quality wind and hydro resources are nearly absent within the state. Further, while energy storage technologies continues to evolve, the Zero Carbon Findings and Analysis by E3 demonstrates that solar and energy storage alone cannot accomplish the aggressive decarbonizing goal established by the state.24 First and foremost, intrastate transmission must be pursued to prioritize Nevada-based zero carbon sources and energy storage resources, but it is clear that transmission to external energy hubs will be necessary to both export excess solar production and import energy during low-production to meet resource adequacy needs. A balance must be created between resource types and the availability of those resources to deal with cloud cover and as the sun rises and sets each day.

The only way to gain access to diverse renewable resources is through increasing transmission access to the western grid, specifically the Pacific Northwest and Rocky Mountain regions that offer complimentary resources to Nevada’s solar and geothermal sources. Nevada’s geographic location provides the opportunity to be a key player in the development of the next-generation transmission grid and a key renewable energy provider in the west. At this point, the missing piece is the lack of transmission infrastructure in Nevada. Several regional projects in the western grid

24 See Docket No. 20-07023, Technical Appendix ECON-6.
are already under development and propose connections to or through the state of Nevada. The transmission infrastructure proposed in the Greenlink Nevada plan builds a foundation for the state to access diverse resources and increase the transfer of renewable energy between Nevada and the developing western grid.

**Guiding Principles to the Transmission Infrastructure Development**

*System reliability*
NV Energy is committed to ensuring that customers have access to reliable, safe, and competitively priced electricity. In addition, NV Energy is obligated to ensure that its bulk power system meets North American Electric Reliability Corporation (“NERC”) reliability standards. Current system analysis tools and methodologies allow NV Energy to determine transmission system deficiencies with varying load and dispatch of mostly firm, thermal resources. Future system analysis tools are being researched and developed to determine transmission system deficiencies with both varying load and varying non-firm renewable generation. In addition, energy storage technologies are currently being investigated as a means of addressing the additional complexity of balancing intermittent renewable resources.

Generally, investment in additional transmission assets is positively correlated with increased reliability. The extent to which new transmission investments increase reliability is a function of the following factors:

- Does the proposed asset increase access to diverse, complimentary variable energy resources and/or energy storage sites?
- Does the proposed asset increase redundancy in the system allowing for multiple paths for generation to reach load?
- Does the proposed asset increase the import and export capability of the system with surrounding systems?

*Future market access*
Nevada has an abundance of solar and geothermal power development potential. However, the potential for in-state development of complementary sources of renewable energy including hydropower, wind, and biofuel remain minimal with current technologies. As a result, a net-zero carbon emissions energy supply will require increased transfer capability with neighboring energy markets that are likely to have excess energy from these sources. States that are likely to have excess hydropower, wind, and/or biofuel energy available include Oregon, Washington, Idaho, Montana, Wyoming, and Utah. Conversely, California and the desert southwest are forecasted to have solar dominant portfolios (with the major exception potential for California offshore wind

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generation), and thus do not offer the same diversity benefits. The easiest way to reach the diverse markets will be increasing the transmission capacity between the northern system and these markets and then strengthening the transfer capability between the northern and southern Nevada systems to allow that generation to serve all NV Energy customers.

**Internal system constraints**

NV Energy’s southern transmission system is well networked as evidenced by consistently reaching top decile performance in reliability. Certainly, some marginal improvements should be made to mitigate the remaining troublesome areas and increase solar generation penetration, however, in the near term, the Companies identified that transmission investment will be needed in the northern Nevada system. The Greenlink Nevada project solidifies the backbone transmission into northern Nevada and is the first step in reinforcing the state.

The northern system requires additional reinforcements for two reasons:

- The northern system reliability metrics are consistently below the reliability performance of the southern system. This is due primarily to the northern system consisting of much older equipment and the geographical remoteness of much of the area;

- The northern system has more geographically diverse generation potential spread out throughout the territory, which requires additional reinforcements to provide paths for that generation to reach load predominantly growing in the western Nevada areas (i.e. Reno, Carson City, and Storey County).

**General Strategy**

Conceptually, it is clear that increasing the transmission capacity directly between the major nodes both in NV Energy’s system and with surrounding States’ systems will increase the reliability, resource diversity, and access to competitively priced energy for NV Energy customers. These nodes include:

**Northern Nevada:**

- Mira Loma
- Bordertown
- Tracy/Storey County Area
- Ft. Churchill
- Valmy
- Robinson Summit
- Falcon
Southern Nevada:
- Harry Allen/Crystal
- Northwest
- Bighorn

Non-NV Energy:
- Midpoint (Idaho)
- Clover (Utah)
- Eldorado (Southern California Edison)
- Captain Jack (Oregon)
- Hilltop (California)

Near-term (10-year time horizon) projects undergo extensive analysis to determine the most effective means of increasing transfer capability between these nodes. This work includes powerflow analysis, engineering feasibility, permitting feasibility, cost estimating, and resource planning analysis. The analysis tools available to transmission system planners continue to improve and refine the accuracy of determining these factors and will be continuously used to evaluate projects as they enter the 10-year planning horizon.

The 30-year plan relies more on a conceptual evaluation of transmission investments that will be needed following implementation of the 10-year plan. The timing and final design of these projects will be improved upon over time as markets and infrastructure develop. However, there are several transmission projects that while not yet needed in the 10-year time horizon will likely be needed over the next 10-30 years. The details of those projects are provided, but in-service dates and final termination points may vary.

**NV Energy’s 10-Year Planning Horizon**

*Greenlink Nevada*

NV Energy has analyzed various transmission options with interconnections into northern Nevada. This analysis included system impacts on import, renewable integration, Nevada joint dispatch, relief of congested paths, directly facilitating retirement of conventional generation, ability to serve load, and ability to construct. The results of this analysis identified the need for the Ft. Churchill to Robinson 525 kV line named “Greenlink North” and the Ft. Churchill to Harry Allen 525 kV line named “Greenlink West” as the preferred backbone projects for Nevada. Both of the preferred projects also include 345 kV connections between Ft. Churchill and the major Reno load pockets to accommodate load service and increased import.
Ft. Churchill to Northwest to Harry Allen 525 kV line (Greenlink West)
This project would provide a new line within the NV Energy system by providing a strong path between Northern and Southern Nevada. This interconnection would not access new electric resources outside of the state, but would support additional solar development in the state. It will also increase the transfer capability between the two systems, create a redundant path to enable reliable efficient dispatch of resources statewide, and put in place the necessary infrastructure to better distribute new market access and diverse renewable sources between the north and south.

This line route is adjacent to three Bureau of Land Management identified Solar Energy Zones that currently have no significant transmission for interconnection. These Solar Energy Zones are Millers, Gold Point and Amargosa Valley. Over 29,000 total acres have been identified as developable through this designation process at these sites.

Ft. Churchill to Robinson 525 kV line (Greenlink North)
This 235-mile project would provide a second parallel line from the NV Energy system into Robinson Summit substation, effectively strengthening the existing ON Line 525 kV project. This line will position NV Energy to access diverse renewable resources in combination with other regional projects that have been proposed to connect to Robinson Summit. Additionally, it will increase the transfer capability between the two systems, establishing a more robust path for the two areas to exchange variable renewable energy resources.

The current project estimate for both Greenlink West and North is $2.11 billion.

The Greenlink projects are the first step toward creating the required increase in import capacity to meet current and future network load growth and to lay the foundation for future access to diverse resources and the overall networking of the entire Nevada transmission grid within the western region.

While the Greenlink projects not only increase import capacity but increases export capacity as well. With vast access to solar resources across Nevada, the state will have the opportunity to harness this energy as a net exporter to the western grid, a benefit that is currently hindered by limited transmission access to renewable development.

Regional Transmission Plans
The Western US has several major transmission plans underway, some of which have significant impact on the Nevada transmission system:

Cross-Tie (Clover – Robinson Summit 525 kV)
Cross-Tie is a proposed 525 kV line between Clover Substation in central Utah and Robinson Summit substation in Nevada. It is proposed to be approximately 214 miles and includes the
addition of 345 kV Phase Shifters on the Falcon – Robinson Summit 345 kV and Gonder – Robinson 345 kV lines.

This project would provide a new line from the NV Energy system at Robinson Summit substation to the planned Clover substation in central Utah. Because both terminations of this project are existing, it does not access new electric providers. Currently neither location is a major transactional hub for energy trading although it is likely that Robinson Summit will become one. This project enhances ON Line capacity in both directions and together with Greenlink North provides the ability to deliver diverse renewable resource into NV Energy’s northern system.

**SWIP-North (Midpoint – Robinson Summit 525 kV)**

The proposed SWIP-North project is a 525 kV line between Midpoint Substation in Idaho, and Robinson Summit substation in Nevada. It is proposed to be approximately 275 miles and includes the addition of 345 kV Phase shifters on the Falcon – Robinson Summit 345 kV and Gonder – Robinson 345 kV lines.

The proposed Ft Churchill – Robinson Summit 525 kV line (NV Energy’s Greenlink North) in conjunction with Midpoint – Robinson 525 kV (SWIP-North) strengthens ON Line and creates an additional intertie with Idaho Power. It has shown a preliminary increase in system import from 1275 MW to 2000 MW, or an increase of 725 MW. SWIP-North is a complimentary project to NV Energy’s proposed Ft Churchill – Robinson Summit 525 kV line and would increase the benefits associated with NV Energy’s proposed project. Under the Transmission Use Agreement, if SWIP-North was constructed, NV Energy would hold approximately 1000 MW of the line’s total capacity.

Both projects have similar benefits to northern Nevada import capacity as well as create regional access to more diverse resources. PacifiCorp is currently developing phased projects referred to as Gateway that enhance the capacity into both Clover and Midpoint, as discussed below.

**PacifiCorp Gateway Projects**

Gateway South is a proposed 525 kV line planned to connect Aelous substation in southeast Wyoming to Clover substation in central Utah. PacifiCorp owns Aelous substation and is developing up to 3,000 MW of wind generation to interconnect there. PacifiCorp plans to utilize this connection to bring approximately 1,700 MW of wind produced energy into their major load pockets via Clover substation.

Gateway Central reinforces existing connections between Populus substation in southeast Idaho and Clover substation in Utah. This project increases the total capacity of wind energy delivered to Clover from 1,700 MW to 3,000 MW by diversifying the path into Clover. Gateway West connects Aelous to Populus to Midpoint to Hemingway. This connection ties Gateway South and
Gateway Central together along with creating access to hydro energy via the Boardman to Hemingway project ("B2H"). B2H is being developed by PacifiCorp, Idaho Power and Bonneville Power Administration to connect Boardman substation in southern Washington to Hemingway substation in eastern Idaho.

The Gateway projects create diverse resource capacity to both Clover and Midpoint substations and respectively compliment both the Cross-tie and SWIP-North projects.

**TransWest Express**

The TransWest Express project is similar to PacifiCorp’s Gateway projects in that the developers intend to access Wind resources originating in Wyoming and connect to central Utah. The TransWest Express project currently proposes a direct current ("DC") line from Wyoming to LADWP’s IPP station in central Utah, then a new 525 kV from IPP to Crystal 525 kV in southern Nevada to Eldorado 525 kV. This project attempts to access 3,000 MW of wind energy and deliver it to southern Nevada and California. The project is fluid in that other connections can be made based on which parties are interested in benefiting from the line.

The TransWest Express project can create access to wind resources in southern Nevada through Crystal substation. There is also potential for an arrangement to be made for the project to connect through Clover substation and connect to Nevada via the Cross-Tie project.

Figure VI-1 on the following page shows the planned regional projects in correlation with NV Energy’s current and planned 525 kV transmission.
FIGURE VI-1
OVERVIEW OF MAJOR REGIONAL TRANSMISSION PROJECTS INCLUDING THE PROPOSED GREENLINK PROJECTS
Table VI-1 shows a summary of import limits with the proposed NV Energy projects and those projects in conjunction with certain regional projects.

<table>
<thead>
<tr>
<th>Greenlink Project(s)</th>
<th>Cross-Tie or SWIP-N</th>
<th>Import Limit (MW)</th>
<th>Increase (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greenlink West</td>
<td></td>
<td>1,275</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td></td>
<td>X</td>
<td>2,000</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>2,800</td>
<td>1,525</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>2,000</td>
<td>725</td>
</tr>
</tbody>
</table>

Both Crosstie and SWIP-North result in the same increase in import. Both projects create a second strong source to Robinson Summit substation allowing for higher overall imports into northern Nevada. The Gateway projects discussed do not connect directly to NV Energy’s system but compliment the Crosstie and SWIP-North projects by creating capacity and access to new resources both at Clover substation in central Utah and Midpoint substation in southern Idaho.

While NV Energy is not currently participating in the development of any of the third party transmission projects discussed, they all do affect Nevada’s access to diverse renewable resources and how the state would ultimately fit in to the overall regional network or possibly a Regional Transmission Organization.

**NV Energy’s 10 to 30-Year Planning Horizon**

The following projects were identified as alternatives to the Greenlink projects and remain future transmission upgrades that are planned to provide additional transmission infrastructure as required.

*Robinson to Valmy 345 kV line*

This 210-mile, 345 kV project would provide a second parallel line from the NV Energy system into Robinson Summit substation. Because both terminations of this project are internal to NV Energy, it will not access new electric providers. Both Valmy and Robinson Summit substations have the electrical strength to support this additional interconnection. Currently neither location is major transactional hub for energy trading.
With the planned reinforcements of the TransCanyon Cross-Tie and/or SWIP-North facilities, Robinson Summit could become a major trading hub.

**Robinson to Harry Allen #2 (ON Line #2)**
This 231-mile, 525 kV project would provide a new line in parallel with the existing ON Line project between Robinson Summit and Harry Allen substations. Because both terminations of this project are existing, it will not access new electric providers. Harry Allen substation has the electrical strength to support this additional interconnection. Currently Robinson Summit substation does not. If both Cross-tie and SWIP-North are constructed NV Energy would likely capture significant Point to Point revenues by constructing this line.

**Falcon to Midpoint 345 kV line**
This 230-mile, 345 kV project would provide a second parallel line from the NV Energy system into Idaho Power. Midpoint has the electrical strength to support this additional interconnection. Currently Midpoint is not a major transactional hub for energy trading. This project would be within Department of Energy defined 368 corridors.

**Alturas 345 kV Reinforcement**
This project would reinforce the existing Alturas 345 kV intertie by constructing a 70-mile Captain Jack to Hilltop 345 kV line and 45-mile East Tracy to Fort Sage 345 kV line. Captain Jack is considered part of the California Oregon Border trading hub, thus, an interconnection there would access multiple new electric providers. Captain Jack has the electrical strength to support this additional interconnection but would require significant substation upgrades to support the addition of a 525 to 345 kV XFMR and 345 kV terminals.

**Ft. Churchill to Captain Jack 525 kV line**
This 300-mile, 525 kV project would provide a new line from the NV Energy system into Captain Jack. Captain Jack is considered part of the California Oregon Border trading hub, thus, an interconnection there would access multiple new electric providers. Captain Jack has the electrical strength to support this additional interconnection, but Fort Churchill would need to be upgraded to 525 kV and 345 kV and interconnected to the Reno area 345 kV facilities.
Figure VI-2 presents the major transmission projects NV Energy may pursue in the next 30 years depending on load and renewable resource development.

FIGURE VI-2
GREENLINK PROJECTS AND 10-30 YEAR HORIZON TRANSMISSION PROJECTS

Regionalization

Currently, NV Energy participates in the CAISO EIM. The market serves many purposes, but it will primarily serve the net-zero carbon emissions goal by providing a mechanism for efficient renewable resource operations by providing a larger more diverse load and resource footprint to balance intermittent resources. Participation in the market does not directly increase import of renewable generation, but it does allow for greater penetration of renewable generation inside NV Energy by optimizing the balancing of the real-time system. This market is continuously evolving and reflects California’s similar de-carbonization goals. In addition, the CAISO has been working towards the development of an Extended Day-Ahead Market (“EDAM”) to expand this functionality and improve day-ahead resource balancing.
Other than EIM, NV Energy is not currently part of Regional Transmission Operator ("RTO") or Independent System Operator ("ISO"). However, the growing challenge of cost effectively operating and balancing a portfolio of mostly variable renewable sources will likely make participating in a larger organized market very beneficial for customers and facilitate carbon emission reduction. In 2016, a meta-analysis conducted by the Brattle Group found that “Numerous existing studies show that ISO-operated regional markets facilitate renewable generation investment and, thus, a more rapid development and growth of renewable generating resources.”26 That same report found that most regional market integration studies show production cost savings ranging from 1 percent to 3 percent, that market integration can improve access to low-cost renewable resources, regional markets can reduce the investment cost of meeting RPS goals, and regional markets reduce the cost of balancing variable renewable generation output.27 That same year, the Natural Resources Defense Council concluded that “A western RTO or Regional System Operator (RSO) would greatly facilitate efforts to transform the electricity sector in the region to a low-carbon energy delivery system.”28

However, there are risks associated with regionalization. The nonpartisan, nonprofit Next10 research organization identified “Governance Risk” as a top risk of regionalization.29 Currently, NV Energy’s electric utility investments are regulated almost entirely by Nevadans, with the sole exception being investments under the Federal Energy Regulatory Commission’s jurisdiction. Regionalization would require transmission investment to be optimized according to the regions needs rather than optimized for the needs of Nevadans. A potential outcome of regionalization could be increased use of carbon generating plants outside of Nevada being used to serve NV Energy load. This could occur if the other states in the region do not adopt similar zero carbon emissions goals and carbon generating plants offer wholesale energy at a lower price than the renewable plants on the grid. The effort could also effectively outsource Nevada jobs to other states if resources (renewable or otherwise) can be developed cheaper elsewhere in the region. Therefore, it will be important for Nevada to ensure that the governance structure of an organized market in which it participates recognizes state authority over important policies and decision. These could include policies such as energy supply resource mix and adequacy standards or allocation of capacity and cost of new transmission projects.

Despite the risks, regionalization is likely to be pursued in the next 10 years as a means of gaining better access to a diverse portfolio of renewable resources. Whether it occurs through the

27 Id.
development of full RTO similar to PJM and MISO or more piecemeal like the current CAISO EDAM efforts, the benefits of regionalization are well-established and significant.

Over the next 30 years, a nationwide regionalization effort may be pursued for similar reasons. The nationwide regionalization concept, while ambitious, is in its infancy. It would be premature to develop any concrete plans in anticipation of a nationwide energy market, and instead the current strategy is to focus only on western region solutions.
SECTION VII - ELECTRIFICATION

As Nevada embarks on a low-carbon future, the Companies are well positioned to assist the State in reducing its GHG emissions by transitioning fuel and/or energy usage across all sectors from carbon-intensive fossil fuels to electricity served by renewable energy.

**Nevada Greenhouse Gas Emissions by Sector**

Figure VII-1 shows Nevada’s GHG emissions by sector over time.

**FIGURE VII-1**
RELATIVE CONTRIBUTIONS OF NEVADA’S GROSS GHG EMISSIONS BY SECTOR, 2005, 2016, 2025, AND 2030

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Nevada Electrification by Sector

Transportation
NV Energy has long supported cleaner transportation starting with the electric time of use rates, the Electric Vehicle Charging Station Shared Investment Program doubled EV charging in the State in 2013 in partnership with commercial and government customers, the Nevada Electric Highway Partnership with the Governor’s Office of Energy started in 2015 to connect Nevada’s urban and rural areas for electric vehicle drivers, and the Electric Vehicle Infrastructure Demonstration Program created by Senate Bill 145 ("SB145") in the 2017 legislative session that was expanded to support electric school buses in the 2019 session with Senate Bill 299 ("SB299").

The Electric Vehicle Infrastructure Demonstration Program provides education, incentives, and technical support and is capped at $15 million with $10.38 million remaining as of October 2020. This demonstration program is mainly beneficial to the light-duty EV market. The program provides incentives for installing public chargers for workplaces, fleet electrification, multifamily dwellings, government buildings, electric school buses, and even custom grants. NV Energy provides an electric vehicle comparison tool, and technical advisory services to better help customers understand all options to go electric.

In recent years, a significant focus has been shifted to decarbonizing the transportation sector. Since 2015, this sector has surpassed electricity generation as the largest source of GHG emissions in Nevada.

Given this fact, electrification of the transportation sector is the most mature electrification conversation in Nevada with the Governor’s Office of Energy having a long-term roadmap, Electrifying Nevada’s 21st Century Transportation System: Actions, Opportunities, and Aspirations.

Going forward, electric utilities will need to accommodate electrification in the transportation sector, which will bring both grid and societal benefits, including environmental benefits.

Major segments include:

- Transport Network Companies ("TNC")/Taxis,
- School Buses,
- Government Fleets,
- Transit Agencies & Nevada Department of Transportation,
- Rail,
- Aviation and Ground Service Equipment,
- Mining.
The expanded role of the utility can be accomplished, like in other States, through the filing of a Transportation Electrification Plan.

Residential & Commercial

NV Energy has long supported improving energy efficiency in customers’ homes and businesses by educating customers on opportunities to save energy through conservation, installing more energy-efficient appliances and no-cost/low cost ways to save money on their utility bills. The process to approve these programs is through the Demand Side Management Plan filing as part of the Integrated Resource Plan.

The Companies do not currently offer any electrification or “fuel-switching” programs as part of the Demand Side Management Program.

Potential Policy Impact to Energy Demand from Electrification

While the majority of policies that are contemplated in the Nevada Statewide Greenhouse Gas Inventory and Projections\(^{32}\) aim to reduce energy consumption, below is a collection of contemplated electrification policies that may increase electricity consumption in order to reduce carbon emissions through reduction of fossil fuel consumption.

Transportation

Reduction of Vehicle Miles Travelled

- Provide incentives for the procurement of Low Emission Vehicles (“LEV”) and Zero Emission Vehicles (“ZEV”) for rideshare and other for-hire transportation services.

Incentivize the Statewide Transition to Low and Zero Emission Vehicles

- Adopt a program similar to the federal Car Allowance Rebate System, colloquially known as “cash for clunkers,” that provides financial incentives to vehicle owners to trade in older, less fuel-efficient vehicles and replace them with LEVs and ZEVs.
- Provide incentives for the replacement of public transit and school buses to ZEVs.

Procurement

- Adopt a coordinated, interagency economy of scale procurement program for state, county, municipal fleets, and school districts that supports LEV and ZEV acquisitions and realizes a reduction in individual unit costs.

Electricity Generation
Electric Utility Electric Vehicle Infrastructure Planning
- Provide incentives to promote electric vehicle infrastructure/rate structure for more ZEV deployment.

Industry
Fuel Switching
- Provide incentives for stationary combustion sources that fuel switch to less carbon intense fuels.

Residential and Commercial
Energy Efficiency
- Provide incentives to increase renewable energy sourced electrification of the built environment. Incentives would be provided for new construction as well as for existing buildings, both residential and commercial, to switch from fossil fuels to all electric.
Reduce or Eliminate Fossil Fuel Use
- Provide incentives for the conversion of fossil fuel dependent appliances to renewable energy sourced electric alternatives (examples include stoves, water heaters, and furnaces).
- Evaluate a freeze or limitation on the installation of gas lines to newly constructed homes and businesses.

Infrastructure Improvements in Homes and Businesses to Facilitate Transition to Zero Emission Vehicles
- Provide incentives for installation of charging infrastructures in existing facilities.
- Provide incentives for inclusion of electric vehicle charging infrastructure in new residential, commercial, and industrial settings.
- Establish a planning process to develop robust ZEV infrastructure for all vehicle types across a broad set of stakeholders, including:
  - A ZEV infrastructure planning process developed and implemented by an electric utility or rural electric cooperative;
  - Opportunities to incentivize and increase the development of workplace charging infrastructure for electric vehicles at existing commercial and industrial facilities;
  - Opportunities to incentivize and increase the development of charging infrastructure for electric vehicles for all types of existing residences, including those in underserved and rural areas;
  - Opportunities to incentivize and increase electric vehicle readiness for the new built environment by facilitating the addition of charging infrastructure for electric vehicles in new residential, commercial, and industrial settings;
- Opportunities to support the increased development of electric vehicle charging infrastructure at state, county, and local government buildings; and
- Incentivize and encourage the purchase of ZEV’s that will utilize this infrastructure.

Due to uncertainty, these electrification policies are not contemplated in the current load forecast. To ensure that future electrification efforts do not hinder carbon reduction goals, NV Energy’s goal is to maximize the ability for load shaping, ensuring, where possible, that electrification load is designed to be:

- Flexible to follow excess renewable energy through tariff or controlled technology,
- Demand response capable to respond immediately to reliability and/or market issues.
SECTION VIII - DEMAND SIDE PLANNING

NV Energy is committed to transforming how energy is generated, accessed, consumed, and managed, while maintaining flat or declining rates for customers. In order to achieve these goals, NV Energy is working to align its resources with Nevada’s Executive Order 2019-22, NRS 445B.380; and State legislative initiatives with SB65, SB146, SB145, SB150, SB204, AB223, SB254, SB358, and AB405. The goal of achieving by 2050 an amount of energy production from zero-carbon dioxide emission resources that is equal to the total amount of electricity sold by providers of electric service in this State; is a collaborative effort by all stakeholders. Together NV Energy and the State can mitigate climate affects, reduce GHG emissions, and achieve a net-zero carbon energy-vision through programs such as integration of resources, adoption of renewables, DSM, DR, energy market management tools, increasing penetration of DERs and grid modernization. A component of this vision is managing the appropriate energy assets and distributed energy resources. Additionally, it requires innovative grid operations in an environment of increasing demand- and supply-side renewable energy production. NV Energy is pursuing options to expand, advance, and DR, energy efficiency, and clean energy programs, such as energy-efficient measures, demand limiting devices, non-wires alternatives, electric transportation, solar, and charging stations. By NV Energy integrating programs and initiatives allows the Companies to effectively respond to customer needs and State goals. The Company is focused on identifying load-shaping opportunities in the relative absence of flexible resources, which can assist in reducing GHG emissions. Energy efficiency and DR programs are resources managed by NV Energy that are integral to a balanced portfolio; they give customers the tools to reduce energy consumption, either during times of peak demand or throughout the day and year. As customers become more aware of their energy usage and change their consumption patterns, whether through special time-of-use rates or other programs, energy savings and carbon reductions will be realized.

Demand Response Programs

DR programs are another component to manage and shape loads throughout the day and year. These programs assist in placing aggregated demand-side energy resources on par with traditional supply-side resources. The DR programs assist the Companies to balance its portfolio and provide additional resources that assist in reducing peak demands, energy costs, and potentially delay higher cost transmission and distribution infrastructure upgrades and investments. DR programs are tools for NV Energy and its customers to reduce energy consumption, change usage patterns, and gain a greater understanding of how energy is used, which provides benefits for all customer across segments. Additionally, these programs provide economic value in managing energy markets’ high peak energy prices, while increasing the value proposition for both NV Energy and its customers. DR programs include direct load control components, automated energy efficiency services, and energy storage benefits. Other technologies, like, thermostats, bring-your-own devices, non-wire alternatives, distributed generation, energy storage, and grid software and
controls, which facilitate energy savings and reduce overall demand requirements. These technologies also allow commercial and industrial customers to interact not only with air conditioning, but also with lighting and motor controls end-use loads.

**Demand-Side Management Programs**

NV Energy views energy efficiency as a readily deployable and clean energy resource that provides many benefits. It reduces energy consumption by incorporating energy efficiency improvements in customers’ homes and businesses and is delivered through PowerShift, an effective educational marketing tool. Focus on energy efficiency may require up-front investment by upgrading or switching to new technology. NV Energy’s strategy includes continued work with stakeholders to align energy efficiency for equitable financial compensation. NV Energy’s overall energy efficiency goal is to provide programs that help engage and educate customers to help save energy, reduce overall energy usage and support system reliability.

The DSM (energy efficiency and demand response) programs continue to assist the Companies to achieve energy savings while maintaining a relatively similar budget as in past years. NV Energy’s program delivery plan is to make best use of energy efficiency opportunities and maximize the dollars per kilowatt-hour savings for customers. This allows NV Energy to maintain flat or declining rates for customers, while delivering programs that will support energy savings goals outlined in SB150 of 1.1 percent. NV Energy is cognizant of the overall economic climate currently affecting Nevada and the impact it is having on both residential and commercial customers and participation in DSM programs assists customers to lower their energy bills.

NV Energy includes in its portfolio a low-income program that is designed to provide energy-savings measures to low-income residential customers that experience the most hardships and greater energy burden. This program provides customers with the installation of new ENERGYSTAR® rated qualified appliances and other energy saving products appliances, such as refrigerators, plug load controllers, clothes dryers, light-emitting diode lamps, and occupancy/proximity sensors for lighting controls, to assist them in reducing their overall energy consumption. These opportunities not only assist low-income customers by reducing their energy bills and energy burden, but also provide environmental benefits to the State.

The Companies also offers a suite of residential programs, such as, online and in-home energy assessments and a direct install program that complements the demand-response thermostat program. The programs allow customers to receive direct feedback on what measures to install, identification of behaviors that impact their energy bills, and direct installed energy-efficient measures in their homes. The direct installation of measures in combination with other DSM programs further enhances the value proposition for the customer and the Companies, which maximizes utility benefits and energy savings.
Additional residential programs include residential pool pumps and air conditioning rebates and incentives to install high-efficiency equipment to reduce energy use, reduce peak load, reduce impacts on the environment, and save money.

Currently, for commercial and industrial customers, NV Energy offers a business energy services program, which includes a component for new construction and provides an integrated approach to develop building designs that reduce electricity use and peak demand relative to the current baseline building energy code. This program incorporates an analysis of “whole building” packages with typical measures that provide more efficient ways to light and heat industrial facilities or run equipment, such as lighting, heating ventilation and air conditioning motors, shell design, window treatments, and shading. Additionally, the program facilitates the implementation of energy efficiency measures in commercial, industrial, and institutional facilities by offering financial incentives and technical services. The prescriptive incentives offered include lighting, cooling, motors, refrigeration, commercial kitchen equipment, vending machine controls, and other energy-efficient retrofits. The program also offers custom incentives for most measures not covered under the prescriptive component that result in verifiable energy savings. Another program offering provides building optimization and small commercial direct install incentives and services.

Other opportunities for non-residential customers include an energy smart schools program that is directed to Nevada’s public schools and institutions of higher education. The program’s goal is to reduce energy consumption and save money by implementing energy efficiency improvements in both new and existing schools. Energy smart schools benefit by installing high efficiency lighting, cooling, controls, and other energy-saving measures that reduce the overall carbon footprint of public schools and institutions.

**Demand Side Management Innovation**

NV Energy continuously looks for opportunities to incorporate into its suite of programs to offer customers, generate energy savings, and reduce the overall load requirements.

As the electric and renewable technology industries continue to evolve, demand response control techniques are expanding to new distributed energy resources asset types such as energy storage, PV systems, conservation voltage reduction and EV. These new technologies create even more flexible and faster acting resources for a wider variety of grid services, which provides risk avoidance, arbitrage, economic and operational efficiencies, and system reliability.

With the onset of the new technologies and techniques to managing loads, NV Energy is investigating a more robust distributed energy resources management system ("DERMS"). A new resource management system would provide support for grid management and DR activities, as
well as provide the opportunity to facilitate new DR program types and enable enhanced control of both stationary storage devices and EV charging infrastructure. These new technologies would also support utility-scale renewable energy adoption by creating the infrastructure that drives NV Energy’s capability to shape load responsiveness to both system and distribution level conditions.

The Companies are investigating the use of an online marketplace to provide additional avenues to market programs and engage customers. This component would support authorized DSM programs through an online portal that is designed specifically for residential and small business customers. The purpose of an online marketplace is to enhance the online energy assessments by providing customized energy tips and information for customers to take action on recommended energy savings opportunities.

Additional options being investigated are for residential retrofitting and residential new construction, which offer potential for residential energy savings. A residential home construction program will increase energy efficiency in new home construction with the goal to move the efficiency of new homes well beyond the requirements for ENERGYSTAR New Homes. This will include a component to build above codes and standards. Residential retrofits will encourage both single-family and multi-family residential customers to upgrade equipment in their homes to more efficient ones. Measures such as appliances, weatherization, and heating and cooling will complement the current residential measures the Companies currently offer.

**Clean Energy Programs**

The suite of clean energy programs provides education, outreach, and customer service to NV Energy customers to promote onsite renewable energy generation (PV solar), energy storage, and EV adoption. The goals are to reduce dependence on carbon-based fuels, to promote energy independence, and encourage solar installations. Under SB254 and EO 2019-22, Nevada has set forth an aggressive, but necessary, benchmark for reducing GHG emissions and mitigating climate impacts throughout Nevada. NV Energy provides education, outreach, and customer service to customers who wish to participate in programs that reduce GHG and energy consumption by installing private generation systems, EV infrastructure, or energy storage systems. With the implementation of more renewable energy supply, NV Energy’s generation portfolio will diversify and continue to help reduce GHG emissions from the electric generation sector.

The passage of AB405 resulted in a large increase of installed systems for the solar energy systems incentive program, which became fully subscribed in June 2019. However, through NV Energy’s program outreach, non-incentive solar interconnection applications continue at a steady pace. Solar PV systems provide clean energy support to customers. The solar program was modified to encapsulate businesses that serve the highest at-risk populations, with the creation of the low income solar energy program, which provides up to two MW of solar energy systems to businesses,
including, without limitation, homeless shelters, low-income housing developments, and public entities, other than municipalities, which support a significant population of low-income NV Energy customers. The program provides up to $1 million per year in support through 2023, with an installation target in each service territory of 500 KW in Sierra and Nevada Power, each year, for a total goal of 1,000 KW annually. These targets provide additional value to this subset of customers by reducing energy bills and energy burdens and allowing those business to serve a greater number of at-risk customers and to reduce GHG emissions.

The energy storage program promotes market adoption by providing incentives to customers that install a battery storage system. These systems provide energy benefits to both customers and NV Energy by reducing peak demand requirements, improving reliability of transmission and distribution grid operations, and help to defer investments in new generation, transmission, and distribution assets.

The Companies’ EV incentive program is designed to expand the EV charging infrastructure and promote adoption of EVs across the State by providing incentives to offset the cost of engineering, procurement, and installation of the EV charging stations. The Nevada electric highway program is an important component that supports the adoption of EVs. Through this component NV Energy has partnered with the Nevada Governor’s Office of Energy to focus on EV charging station sites along Nevada’s state highways, with 12 of the 38 designated charging infrastructure sites installed along five major highway corridors.

In addition, the Companies are also working with low-income, multi-family residential housing owners to install EV charging stations. Another program component provides incentives to school districts for purchase of new electric school buses and changing infrastructure to replace diesel engine buses.

Other EV adoption activities the Companies engage in to foster electric vehicle adoption is ride and drive events, training, and an online EV comparison tool that allows customers to make more informed decision about purchasing EVs.

**Clean Energy Innovation**

The energy efficiency and renewable energy Department of Energy grant project will help advance DR operations through coordination and integration of behind-the-meter PV systems and energy storage through learning software applications embedded in a distributed control architecture. The project is investigating the employment of distributed energy resource types to provide more flexible and faster acting grid services.
Rates

Rates can be an important component that can support DSM and clean energy program initiatives. There are numerous rate options and structures that can be developed and employed to send the correct pricing signal to customers to conserve energy. For example, the net energy-metering rate allocated customers into one of four tiers. Each tier outlines the rate at which a customer is compensated for any excess generation that is produced on a monthly basis. This rate helps expand and accelerate the development and use of energy storage systems.

NV Energy’s time-of-use rates incorporate a time and day element in rates to customers. Customers can benefit individually on any of the schedules by using less energy, or shifting their usage, from high cost hours to low cost hours. Unlike customers on the standard flat-rate, who can only reduce their bill by using less energy, time-of-use customers can save money by shifting when they use energy. Time-of-use rates are a tool that sends a load shaping signal to customers.

To support the development of a fast-charging station infrastructure, the Companies developed an optional EV commercial charging rider - time-of-use rate. Electric vehicle commercial charging rider provides a discount to the standard commercial schedule time-of-use demand charges.

Additionally, net metering customers can opt into the optional time-of-use schedules: daily demand pricing, critical peak pricing, or hybrid (critical peak pricing + daily demand pricing) rates. These offerings are provided to expand the development and use of energy storage systems. The daily demand pricing rate is a lower flat rate for consumption charge. It has daily demand charge for summer and winter on-peak.

The critical peak pricing rate offers lower consumption rates for time-of-use. The critical peak pricing plus daily demand pricing rate combines the two and offers lower consumption rates for time-of-use and critical peak pricing. It has a higher daily demand charge for summer and on-peak.

NV Energy’s goal is to continue to run a well-managed portfolio that assists customers and installation contractors. NV Energy believes that this portfolio will focus resources where they are most impactful and provide customers with choices; support private renewables development, assist Nevada’s legislative goals, and engage customer to participate in energy storage and EV programs. NV Energy is committed to supporting the benefits that these programs provide for customers while achieving aggressive energy and demand savings goals in the context of an evolving electricity grid with significantly increasing volumes of renewable energy supply and distributed energy resources. This potentially has impacts on NV Energy’s net load shape, driving new peak hours. Load flexibility measures will become increasingly important to assist with the management of renewable supply. This includes enabling and implementing methods to consume and store excess renewable energy in order to avoid curtailment and loss of a portion of the huge
environmental benefits these new resources bring. NV Energy is working on aligning energy and capacity saving targets. The goal is to educate stakeholders on the effects of saving energy versus demand savings and how each target impacts customers.
SECTION IX – SUPPLY SIDE PLANNING

The pathway to net-zero carbon electricity production requires continued changes to the electrical energy supply. Traditional fossil units are retiring and being replaced with renewable resources which, in the state of Nevada, are mostly solar PV. And while it is true that cost of solar generation technology has significantly decreased over the years, significant planning will be required to ensure these generation resource changes are cost-effective and that system reliability can be maintained going forward. This section will address the challenges to achieving a cost-effective, reliable energy supply that nets zero carbon emissions.

The current fleet of NV Energy resources consists mainly of natural gas fueled generation as can be seen in Figure IX-1, which includes combustion turbines (“CT”) and combined cycle (“CC”) units. Gas-fueled generation has been a low-cost reliable source of energy for Nevada for decades, but since burning natural gas also produces GHGs, reliance on this source of energy will need to be significantly reduced to achieve the state’s net-zero carbon emissions goal.

![Figure IX-1: Existing Resources](image)

The only other existing fuel type contributing to greenhouse gases, coal fired generation, has been mostly retired from the Companies’ resource mix. Coal combustion has been a major contributor globally to greenhouse gases and air pollution. NV Energy has committed to transition away from coal-fired generation.

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33 Energy production data sourced from Preferred Plan in the Amendment to the Fourth Amendment of the 2018 IRP.
Extensive use of renewable energy sources like solar with energy storage devices such as pumped storage and batteries will be a major change to the resource portfolio mix of the future as shown in Figure IX-2. These clean energy technologies work well together, as energy storage mitigates some of the variability and uncertainties of renewable energy. While BESS does not produce any energy and is normally only approximately 85 percent efficient, it helps manage the demand/supply balance of renewable resources. While energy storage devices such as batteries are still relatively expensive, downward trends show promise.

In the future, there could also be more dependence on market purchases in supplying NV Energy’s demand for energy. While future market conditions are widely unknown at this time, receiving generation from outside the state could help diversify the resource mix. Also, discussed elsewhere in this report, markets could provide benefits if the right price signals are used to place value on the type of resources needed to maintain reliability.

As stated in Section V, Nevada has an abundance of solar and geothermal potential, however, the potential for in-state development of complementary sources of renewable energy including hydropower, wind, and biofuel remains minimal with current technologies. Power purchase agreements with renewable resources outside the state could contribute to advancement toward a

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34 Energy production data corresponds to Preferred Plan in the Amendment to the Fourth Amendment of the 2018 IRP.
net-zero carbon emissions future while also diversifying the resource mix and contributing to resource adequacy.

Developments that allow renewable resources to be dispatched, admittedly on a limited basis, could also mitigate some of these resources’ variability. Solar PV has been shown to be capable of responding quickly to dispatch, which can increase its flexibility and provide cost savings in scenarios of increased penetration.35

Expanding existing units’ flexibility has been and will continue to be a goal in NV Energy’s plans. As the demand profile changes and more variable resources integrate onto the system, the need for a core footing of firm, dispatchable resources will become even more important for reliability. Firm generation resources are those units which can provide a consistent and dependable supply of energy. These remaining gas-fueled units will need to have quicker ramping and faster starting. And since there are and will be even fewer non-renewable units on the system in the future, the remaining ones will need a larger range of operations to balance and follow demand, such as reduced minimum output levels. These improved operating characteristics will be highly valued and needed when balancing the system with significant amounts of variable resources. Indeed, the ability of these firm resources to ramp and cycle will be a key determinant of the level of operational challenges of a highly decarbonized system.

**Reliability**

As explained in E3’s Effective Load Carrying Capability Report36 in the 4th Amendment to the Companies’ 2018 IRP, resource adequacy is the ability of an electric power system to serve load across a broad range of weather and system operating conditions, subject to a long-run reliability standard. No electricity system is perfectly reliable; there is always some chance that generator failures and/or extreme weather conditions impacting supply and demand could compound on one another to result in loss of load. The resource adequacy of a system thus depends on the characteristics of its load – seasonal patterns, weather sensitivity, hourly patterns – as well as its resources – size, dispatchability, outage rates, and other limitations on availability such as the variable and intermittent production of renewable resources. As Figure IX-3, which looks at a blend of geographically diverse solar resources in Nevada, illustrates, solar PV output does not peak at the same time load does. Ensuring an appropriate level of resource adequacy is an important goal for utilities seeking to provide both reliable and affordable service to their customers.

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36 Docket No. 20-07023, Technical Appendix ECON-5.
Variable non-firm renewable resources like solar and wind contribute significantly less to resource adequacy as compared to firm dispatchable resources, such as combustion turbines. Resource adequacy is paramount for ensuring that NV Energy can continue to provide reliable and affordable power to its customers. To maintain the reliability customers have become accustomed to and meet standard loss-of-load metrics, greater capacity of non-firm non-dispatchable resources will be needed relative to the amount of firm resources they are replacing.

The capacity contribution of a resource is commonly measured as the ELCC, which is often expressed in terms of percentage of nameplate installed capacity value. Incremental ELCC refers to the ELCC of the next incremental resource after a certain penetration has been reached. Firm capacity resources like gas-fueled resources typically have ELCC values in the 90 percent range or higher. But renewable resources and batteries can have significantly lower ELCC values, especially as more and more of this type of resource is added to the system. This is due to two major factors. First, renewable resources are variable in nature and their energy source is tied to natural resources like wind and solar radiance that fluctuate and do not always provide energy. The second factor is shown illustratively in Figure IX-4 – the diminishing contribution of increasing levels of solar PV production on the “net peak” demand (load less dispatch-limited resources). While the first increments of solar PV provide significant capacity value at the time of peak demand, at high penetrations, the net peak shifts into the early evening when the sun is setting or has already set such that further additions provide little to no incremental capacity value to the system.

37 Id.
FIGURE IX-4
ILLUSTRATIVE EXAMPLE OF SOLAR PV ABILITY TO REDUCE PEAK

Geo-diversity (locating renewable resources in different regions) can help improve ELCC to some extent, but cloud cover and nighttime will always affect solar resource output. The following figures, also from E3’s Effective Load Carrying Capability Report, demonstrate the low and declining characteristics of renewable and battery resources with increasing penetration. Please note, these figures provide an example of the trend of the saturation of ELCC as penetration increases, exact ELCC values could be different under a different portfolio resource mix or under different system definitions.

FIGURE IX-5
SOLAR PV INCREMENTAL ELCC FOR 3 DIFFERENT SITES AND COMBINED

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38 Id.
39 Id.
While the ELCC of energy storage declines with penetration similar to other dispatch-limited resources, as illustrated in Figure IX-6, storage can be paired with solar to increase the ELCC of a solar PV facility as shown in Figure IX-7 on the following page. A key aspect of storage resources in a deep penetration portfolio is the total energy capacity (in MWh) of storage available.

In addition, longer duration energy storage and storage not dependent on solar output, such as pumped storage hydro, are needed for events that last for many hours or even days. These events could include extended cloud or smoke cover significantly reducing solar generation output or long periods of drought that could impact hydro or other renewable generation. Having long duration storage solutions increases the reliability of the system because they help mitigate the risks of difficult-to-predict reductions in renewable output and affords more time for system operators to replace with other net-zero carbon resources.

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40 Id.
As shown in Figure IX-8, a Nevada wind resource would be timed to contribute more at the annual peak hour than wind from Wyoming or New Mexico, despite being a more marginal resource overall.

41 Id.
42 Docket No. 20-07023, Technical Appendix ECON-5.
These examples demonstrate how non-firm resources do not provide the same capacity contribution that firm resources provide, why so many more renewable resources are needed to maintain reliability, and that these resources are plagued by declining capacity contribution as more are added. This is why having a foundation of firm resources and diversifying the renewable resource mix is so important in optimizing costs. One exception to this rule is geothermal, which has very little saturation effect as penetration levels increase, as shown in the figure below. Planning the right mix of resources will be necessary to the grid resiliency of the future.

**FIGURE IX-9**

**GEOTHERMAL INCREMENTAL ELCC**

New Technologies

Hydrogen fueled combustion turbine generators provide a carbon free, firm energy supply replacement option to natural gas fueled resources. Hydrogen fuel can be created from water through electrolysis, but at a huge energy cost, thus, one option is to create hydrogen fuel when the supply of renewable energy exceeds the total demand of load. This is an alternative to curtailing the renewable resources and could be a valuable energy storage medium, allowing renewable energy that would otherwise be curtailed to contribute to the state’s net-zero carbon emissions goal. Designs and technologies are being developed for hydrogen-fueled generators, with some currently under construction and many existing gas-fueled turbines capable of operating on a partial hydrogen fuel mix. The future looks promising, though infrastructure like hydrogen pipelines and hydrogen storage will need to be industrialized. Long term hydrogen storage could be a good solution to seasonal variability of renewable energy, filling the gap that short term batteries cannot adequately support.

---

43 *Id.*
Continuing development of new technologies will surely help to improve cost-effectiveness and reliability in the drive to meet the net-zero carbon emissions goal. Other types of energy storage devices and carbon capture devices could be game changers in reducing carbon and better managing variable energy sources. Innovative technology will contribute greatly to achieving an economically viable net-zero carbon emissions future.

Throughout industry nuclear energy is by far the largest non-carbon producing resource, if removed creates a huge gap of energy supply that will need to be replaced at an expensive cost. As a result, there is forming an engineering consensus that nuclear energy should be maintained as possible at current levels and potentially adding new nuclear units like is happening in some European countries. The removal of nuclear energy is more of an overall electric grid issue and not so directly impactful to Nevada.

**Markets and External Sales**

As the future generation mix changes with increasingly different resource attributes, different market products can be utilized to help manage and place value on the features most required to maintain the integrity of the electric system. A market paradigm shift is expected as the resource mix changes. Currently energy markets dominate the liquidity of economic trade happening on the bulk electric system. But in the future, there will need to be more significance and value placed on generation capacity and unit flexibility to ensure reliability in light of the increasing amount of variable resources on the system. Having the right market signals and products will ensure the right type and amount of resources are planned and built, with the required operating characteristics.

As previously discussed, having a core footing of firm resources and a diverse renewable generation fleet is a desired and cost-effective plan. Thinking beyond Nevada and participating in a regional energy market, could help NV Energy access different resources as well as sell surplus renewable energy.

Sharing and selling Nevada’s abundant solar energy out of state is a good idea both economically and to help keep firm natural gas resources on the system for reliability in the net-zero carbon emissions future, but, as discussed in Section VI of this report, future transmission systems will need to be planned and designed to better allow for this intra-state trading of energy, acknowledging that the desert southwest is becoming saturated with this particular resource.

**Conclusion**

The objective of the electric system is to reliably and cost effectively maintain the supply-demand energy balance. The tradeoffs of cost and reliability are the main struggle towards achieving net zero carbon production. It is more easily achieved at either high cost or low reliability, but the goal
is to strike a balance where the correct level of reliability is achieved at an acceptable cost. This outcome is aided by maintaining a cadre of firm, dispatchable resources and energy storage in the mix. There is significant value in obtaining a diverse renewable resource mix, and doing so may involve generation sources outside of Nevada.
SECTION X - CLEAN ENERGY FUTURE

Net-Zero Carbon View

The Preferred Plan from the IRP 4th Amendment, filed October 7, 2020, serves as the basis of the following evaluation of achievement of the net-zero carbon emissions goal. In this plan, Greenlink Nevada increases Sierra’s transmission import capacity by 1,525 MW and Nevada Power’s import capacity by 1,000 MW and creates access to untapped renewable zones in isolated regions of Nevada. The plan dramatically increases renewable resources, taking the Companies from a renewable portfolio of just over 2,000 MW in 2021 to nearly 9,000 MW in 2050 and moving from just over 6,000 Gigawatt-hours (“GWh”) of renewable energy in 2021 to nearly 27,000 GWh in 2050. The plan includes 8,850 MW of solar PV capacity and 6,100 MW of BESS in 2050.

Despite the addition of extraordinary quantities of renewable resources, the Preferred Plan shows a system in transition and does not meet the net-zero carbon emissions goal. The Companies made great strides in this plan to move away from a fossil-based generation system to a significantly “greener” one and recognize there is more work to be done, especially to maintain a reliable and low-cost system for all customers throughout and after the transition.

Distributed Renewable Generation

Besides NV Energy-owned and contracted renewable resources, distributed renewable generation, such as rooftop solar, is a zero-carbon resource interconnected to NV Energy’s system. As such, the analysis presented here incorporates excess energy placed by the interconnected renewable generation on the grid. This report assumes 92 GWh of such excess energy would be placed on the grid by 2050. The forecasted excess energy was estimated by assuming that a certain level of rebated net-metered customers will generate excess energy. Specifically, this assumption was applied to the forecasted net-metered generation to obtain an estimate of total excess generation from net-metered customers.

Progress to Date

As mentioned earlier in this Section, NV Energy has progressed towards a greener portfolio, moving in the direction of the state’s net-zero carbon emissions goal for the past two IRP filings as shown in Table X-1 on the following page.
TABLE X-1
NV ENERGY’S PROGRESS TOWARD A NET-ZERO CARBON EMISSIONS GOAL

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NV Energy Retail Sales (GWH)</td>
<td>28,877</td>
<td>33,927</td>
<td>34,237</td>
</tr>
<tr>
<td>NV Energy Owned and Contracted Zero-Carbon Generation</td>
<td>Native Load Service (GWH)</td>
<td>6,213</td>
<td>12,892</td>
</tr>
<tr>
<td></td>
<td>Sales of Excess (GWH)</td>
<td>0</td>
<td>820</td>
</tr>
<tr>
<td>Excess Output from Rooftop Solar (GWH)</td>
<td>26</td>
<td>92</td>
<td>92</td>
</tr>
<tr>
<td>Goal Progress</td>
<td>22%</td>
<td>41%</td>
<td>65%</td>
</tr>
</tbody>
</table>

Additional Zero-Carbon Resources Selection

As the majority of the zero-carbon resource mix from the IRP 4th Amendment Preferred Plan is Solar PV and BESS, to increase the benefits of a diverse mix of resources and to reliably employ resources with adequate ELCC, the ensuing evaluation will build cases with added geothermal and/or wind generation coupled with storage to move NV Energy towards becoming a net zero-carbon load serving entity.

Geothermal Potential

Greenlink Nevada provides access to isolated geothermal energy resources that could be developed in Nevada, diversifying renewable resources for the state. The Nevada Renewable Energy Transmission Access Advisory Committee ("RETAAC") identified 1,355 MW of geothermal resource potential in renewable zones accessible along the Greenlink Nevada route. Another 441 MW was identified in other zones. The RETAAC Phase II report did not evaluate the amount of this potential that is commercially developable, but provided ratings for each zone. The zones along Greenlink Nevada route received a higher rating. For the purpose of this evaluation, it is assumed that not all identified geothermal potential in Nevada would be commercially developable nor owned or contracted by NV Energy.

The energy cost applied to additional geothermal generation is based on the cost used in the IRP 4th Amendment geothermal placeholder.

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44 NV Energy Owned and Contracted Zero-Carbon Generation includes only in-state resources serving NV Energy’s load in this evaluation.
46 Id.
47 Id., at 39.
Wind Potential

While wind energy potential is marginal in Nevada, NV Energy could purchase wind energy from states with abundant wind resources with higher capacity factors. Adding wind energy into the resource mix would further diversify the zero-carbon portfolio and increase system reliability. For the purpose of this evaluation, however, wind resources are assumed to be developed only in southern Nevada.

Spring Valley Wind, operating since 2012, is NV Energy’s only existing wind resource which operates with a capacity factor of 24 percent. A higher capacity factor would reduce the cost of a project. According to International Renewable Energy Agency (“IRENA”) forecasts, for onshore wind plants, global weighted average capacity factors would increase from 34 percent in 2018 to a range of 30 percent to 55 percent in 2030 and 32 percent to 58 percent in 2050.48 Additional wind generation placeholders in 2040 will use a capacity factor of 40 percent, assuming advancement in wind technology consistent with IRENA forecasts while still acknowledging the marginal wind resource in Nevada.

The energy cost applied to additional wind generation is based on 2020 NREL Annual Technology Baseline wind data.

Economic Analysis

The Companies conducted an analysis to illustrate the potential cost impacts for NV Energy’s contribution to the State’s net-zero carbon dioxide emissions goal in 2050. The analysis uses the Preferred Plan filed with the IRP 4th Amendment as the base case. This plan includes 8,850 MW of solar PV and 6,100 MW of BESS in 2050 with minimal diversity of resources. Consistent with the assumption in the IRP 4th Amendment, renewable resources were assumed to be non-dispatchable. That is, the analysis will show time periods when the supply of renewable energy exceeds the system requirements. This excess energy could be curtailed or sold to the market.

With more and more renewable development and a glut of PV in the desert southwest, it is possible that participants may experience difficulty selling excess energy during the valley hours of the day unless selling into states outside of the region. For this reason, the net-zero carbon dioxide emissions evaluation that follows was performed using the assumption that NV Energy will be able to sell only one-third of its excess renewable energy into the market while the remaining excess renewable energy will be curtailed. The more excess energy that can be sold on the market, the better the net-zero carbon performance for a given portfolio.

Using similar assumptions, two additional cases were developed which added additional in-state zero-carbon dioxide emitting resources to the last decade of the Preferred Plan, prior to the State’s

48 IRENA, Future of Wind, a Global Energy Transformation Paper (October 2019).
goal deadline. The additional resources were chosen to add more diversity to the Companies’ portfolio. The mix of renewable resources in any given year could be adjusted, but this analysis used the unaltered Preferred Plan as the base upon which to build the Illustrative Cases, only adding resources and not moving or adjusting the resources already in the plan’s portfolio. The type, timing and size of the resources were not optimized for the analysis.

While electrification and evolving DR policies will play a significant role in shaping load to more cost-effectively achieve the state’s net-zero carbon emissions goal, they are not specifically incorporated in the Illustrative Cases presented here beyond the level described in Section IV of this report.

**Illustrative Case A - Geothermal Case:** This case is built upon the Preferred Plan with 8,850 MW of solar PV, which is pushing the bounds of the diminishing returns expected from incremental solar due to its declining ELCC even when coupled with BESS, as discussed in Section IX. The case adds 1,300 MW of geothermal generation starting in 2040 in the joint system. This may be at the limit of known developable resources in the state as described earlier in this Section. The case also adds 500 MW of 4-hour grid-tied battery in this same time frame, incremental to the 6,100 MW of BESS in the Preferred Plan. More BESS was not added due to the declining incremental ELCC at this level of penetration, as explained in Section IX of this report.

**Illustrative Case B - Geothermal and Wind Case:** This case builds on Illustrative Case A, replacing a small portion (150 MW) of the geothermal resources added in Case A with an incremental 300 MW of wind resources in Nevada. The wind addition was limited to 300 MW as it represents the extent of developable wind resources in Nevada, which, admittedly, are of a poorer quality than in a number of other states. Illustrative Case B includes the same incremental 500 MW of 4-hour grid-tied battery starting in 2040 in the joint system. Again, these resources are in addition to the 8,850 MW of solar PV and 6,100 MW of BESS in the Preferred Plan.

To be clear, the Illustrative Cases do not transform NV Energy into a net-zero carbon dioxide load-serving entity. The cases demonstrate the level of progress towards the net-zero carbon dioxide emissions goal that can be reasonably achieved with developable in-state resources upon approval of Greenlink Nevada and with the present-day state of renewable technologies. All other assumptions used in the analysis are consistent with those used in the IRP 4th Amendment.
Table X-2 presents the resources that were added to the IRPA 4th Amendment portfolio in order to develop Illustrative Cases A and B.

<table>
<thead>
<tr>
<th>Year</th>
<th>Illustrative Case A</th>
<th>Illustrative Case B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nevada Power</td>
<td>Sierra</td>
</tr>
<tr>
<td>2040</td>
<td>500 MW BESS</td>
<td></td>
</tr>
<tr>
<td>2041</td>
<td>300 MW geothermal</td>
<td></td>
</tr>
<tr>
<td>2042</td>
<td>300 MW geothermal</td>
<td></td>
</tr>
<tr>
<td>2043</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2044</td>
<td></td>
<td>300 MW geothermal</td>
</tr>
<tr>
<td>2045</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2046</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2047</td>
<td>400 MW geothermal</td>
<td></td>
</tr>
<tr>
<td>2048</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2049</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2050</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure X-1 illustrates the changes in NV Energy’s resource buildouts over time. The first column shows NV Energy’s planned mix in the year 2021 from the IRP 4th Amendment Preferred Plan. It highlights the Companies’ relatively heavy reliance on fossil fuel to meet its load requirements. The second column shows the continued reliance on fossil fuel assumed for the year 2048 in the IRP 3rd Amendment to the IRP. Nevertheless, this column demonstrates the strides that NV Energy has made to a “greener” portfolio. The third column shows the resources for 2050 from the IRP 4th Amendment Preferred Plan, which achieves significantly more decarbonization. The fourth and fifth columns illustratively show additional in-state developable zero-carbon resources filling the open positions from the IRP 4th Amendment Preferred Plan to bring NV Energy’s renewable energy output closer to achieving the net-zero carbon dioxide emissions status.
Each of the cases modeled uses assumptions that are consistent with those used in the latest IRP amendment. The assumptions are based, in part, on the Companies’ operating experiences and established utility practices. Electric utilities generally have little to no operating experience with such high levels of variable renewable penetration in their operating fleets, and NV Energy is no exception. The assumptions used in the analysis will evolve over time and have been discussed in other sections of this report. As a review, key categories of assumptions that impact the economic analysis are:

- Load forecast and load shape,
- Operational requirements (reserves) needed for reliable operation,
- Price and availability of market purchases,
- Price and availability to sell in the market,
- Price and availability of new renewable resources,
- Price and availability of new technologies,
- Adequate transmission systems to support renewable diversity.
The economic analysis is the Companies’ estimate of potential costs for NV Energy’s move to a “greener” system, given the broad assumptions used. The overall costs calculated for each case are significant. As technologies evolve during the move towards a net-zero carbon dioxide emissions outcome over the next thirty years, the key assumptions noted above will also evolve influencing the operating requirements and potential costs. The Companies’ long-term planning process will continue to refine and optimize the resource mix to provide a cost-effective reliable system.

Table X-3 presents the Present Worth of Revenue Requirement (“PWRR”) for the two Illustrative Cases as well as the Preferred Case from the IRP 4th Amendment.

<table>
<thead>
<tr>
<th>Table X-3</th>
<th>INTEGRATED PLAN RESULTS</th>
<th>(2021 DOLLARS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 Year PWRR 2021-2050 (million $)</td>
<td>IRP 4th Amendment Preferred Plan</td>
<td>$ 26,712</td>
</tr>
<tr>
<td>Illustrative Case A</td>
<td>$ 26,898</td>
<td></td>
</tr>
<tr>
<td>Illustrative Case B</td>
<td>$ 26,880</td>
<td></td>
</tr>
</tbody>
</table>

Both Illustrative Cases contribute further to the state’s net-zero carbon dioxide emissions goal. Both cases create diversity value and mitigate the reliance on solar and BESS, compared to the IRP 4th Amendment Preferred Plan. All three cases utilize the increased access created by Greenlink Nevada to renewable resources in previously untapped renewable energy zones within the state.

This analysis adds diverse renewable resources for improved outcomes relative to the state’s net-zero carbon dioxide emissions goal. It also demonstrates that the advancement to the goal has an additional cost. The relatively small increases to the PWRR are encouraging; however, a more concrete conclusion would be ill-advised without optimizing the resource mix in each case.

Figure X-2 shows the Companies’ energy mix in GWH for the Illustrative Cases in comparison to the IRP 3rd and 4th Amendment Preferred Plans. As before, the IRP 3rd Amendment Preferred Plan is provided for reference to demonstrate the changing resource mix – the amount of renewables that have already been added in the IRP 4th Amendment.
Each of the cases analyzed has generation periods when more renewable energy is produced than is required. The amount and cost of the excess renewable generation can be calculated by a production cost model, but excess generation cannot be part of a reliable system. In creating Figure X-2, it was assumed that renewable generation must either be curtailed, or the excess must be sold. In Figure X-2, the energy mix in each case includes the assumed sale of a portion of the excess renewable energy production. To illustrate the curtailment of excess energy, the “Solar & Battery” block has been reduced for excess that is not sold. The assumption of market sales was only applied in evaluation of progress toward the State’s goal and was not included in the production cost model.

For the purpose of this calculation, NV Energy conservatively reduced the zero-carbon generation involved in charging BESS to account for the losses that occur in the batteries, resulting in battery storage being a net sink for zero-carbon energy. This may be unnecessarily conservative, resulting
in understatement of zero-carbon generation, as energy storage is not a form of energy generation. BESS performance is arguably irrelevant to the State’s goal except insofar as it facilitates renewable generation at times when demand does not require it, shifting the output to later hours when it is required.

**NV Energy’s Path to Net Zero-Carbon Emissions**

Table X-4 presents NV Energy’s path to achieving net-zero carbon emissions. Table X-4 is an evolution of Table X-1, showing progress towards a net-zero carbon emissions goal through the two Illustrative Cases. The table shows that, under Illustrative Case A, 83 percent of NV Energy’s retail load could be served by zero-carbon emitting resources (NV Energy owned and contracted and distributed generation) in 2050. The net zero-carbon ratio increases to 84 percent under Illustrative Case B.

**TABLE X-4**
**NV ENERGY’S CONTRIBUTION TO NEVADA’S NET-ZERO CARBON EMISSIONS GOAL**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NV Energy Retail Sales (GWH)</td>
<td>28,877</td>
<td>33,927</td>
<td>34,237</td>
<td>34,237</td>
<td>34,237</td>
</tr>
<tr>
<td>NV Energy Owned and Contracted Zero-Carbon Generation</td>
<td>Native Load Service (GWH)</td>
<td>6,213</td>
<td>12,892</td>
<td>19,874</td>
<td>25,127</td>
</tr>
<tr>
<td></td>
<td>Sales of Excess (GWH)</td>
<td>0</td>
<td>820</td>
<td>2,259</td>
<td>3,354</td>
</tr>
<tr>
<td>Excess Output from Rooftop Solar (GWH)</td>
<td>26</td>
<td>92</td>
<td>92</td>
<td>92</td>
<td>92</td>
</tr>
<tr>
<td>Goal Progress</td>
<td>22%</td>
<td>41%</td>
<td>65%</td>
<td>83%</td>
<td>84%</td>
</tr>
<tr>
<td>Incremental Amount Required to Achieve Net-Zero (GWH)</td>
<td></td>
<td>12,000</td>
<td>5,700</td>
<td>5,500</td>
<td></td>
</tr>
</tbody>
</table>
For both the Illustrative Cases and the 4th Amendment Preferred Plan, additional resources are required to close the gap on a full net-zero achievement. Each Illustrative Case includes nearly 9,000 MW of solar PV and 6,600 MW of BESS, which push the bounds of the diminishing returns expected from incremental resources due to a declining ELCC at this level of penetration, as discussed in Section IX. Both cases also include incremental geothermal and wind resources in Nevada, which may be at the limit of developable resources in the state. In addition, the increasing levels of renewables in the Illustrative Cases are not flexible resources, thus, the dependence on the few remaining fossil resources does not differ significantly from the Preferred Case. It seems likely that a regional perspective is required to achieve further decarbonization. Solutions to fill this gap will evolve over time, and may include:

- Ability to export NV Energy’s excess solar and geothermal energy through new transmission connections to states that have fewer of these resources;
- Access to more diverse out-of-state renewables through new transmission connections;
- Developments in storage technology, such as pumped storage hydro, that would provide longer duration storage solutions;
- Developments that reduce the carbon dioxide emissions of traditional fossil resources, such as use of hydrogen fuel.


<table>
<thead>
<tr>
<th>Option</th>
<th>Energy Cost ($/MWh)</th>
<th>Wheeling Cost ($/kW-year)</th>
<th>NV Energy Transmission Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind Energy (Out of State)</td>
<td>46-65</td>
<td>79-138</td>
<td>Greenlink Nevada</td>
</tr>
<tr>
<td>Hydropower (Out of State)</td>
<td>60-81</td>
<td>38-109</td>
<td>Greenlink Nevada</td>
</tr>
<tr>
<td>Pumped Storage Hydro (NV)</td>
<td>64-67</td>
<td>N/A</td>
<td>varies by location</td>
</tr>
</tbody>
</table>

The ability to import diverse resources and export excess solar PV is dependent on the transmission system and the strength of the connections to neighboring systems. As discussed in section VI, the Greenlink Nevada initiative is the first step in strengthening Nevada’s internal transmission system. The value of Greenlink also opens up capacity on the existing connections to northern California, Idaho and Utah. Each of these interties is still limited to its individual line capacity limit. To leverage these existing connections, the Companies would need to invest in both the cost
of energy associated with the off-system resource as well as the third-party transmission rate to move the energy. Section VI discusses several regional transmission projects which are all intended to deliver diverse resources into Nevada. All options, using existing infrastructure and participating in discussion with regional developers, should occur to identify the most reliable and economical plan for Nevada’s renewable future.
SECTION XI - CONCLUSION

Nevada’s net-zero carbon emissions goal is a lofty one and will require great coordination and planning for a balance of diverse resources, both in-state and out-of-state, both zero-carbon and low-carbon, a solid transmission infrastructure, managed electrification of various sectors of the economy, and a load-shaping demand side management plan. For its part in meeting the state goal, the Companies will need to maintain a core footing of firm, dispatchable resources to balance the variable renewable resources, while aggressively adding renewables and energy storage options. Investment in transmission infrastructure will similarly be key to provide access to a diverse set of zero-carbon resources and ensure reliability, as well as enable zero-carbon import and export. Careful attention to electrification in other sectors and demand-side planning will help to shape the load to absorb excess renewable output.

There are many combinations of resources and infrastructure that could lead to net-zero carbon dioxide emissions in 2050. Thirty years from now, the resource mix may look different than could ever have been imagined in the year 2020. While the future is uncertain, one thing is known — now is the time to put the building blocks in place to enable a net-zero carbon future. Without long term planning, the State’s goal will not be achieved. The details of the Companies’ plan will evolve over time as they adapt to changing technologies, but the planning must start now.

Throughout the decarbonizing transition, NV Energy will continue to provide safe, reliable, reasonably priced electric service through prudent and practical long-term planning and investments.
CERTIFICATE OF SERVICE

I hereby certify that I have served the foregoing filing of NEVADA POWER COMPANY d/b/a NV ENERGY and SIERRA PACIFIC POWER COMPANY d/b/a NV ENERGY in Docket No. 19-06010 upon the persons listed below by electronic mail: 

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DATED this 13\textsuperscript{th} day of November, 2020.

\textit{/s/ Lynn D'Innocenti}  
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Nevada Power Company  
Sierra Pacific Power Company