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NET EMPLOYMENT BENEFITS OF DEEP DECARBONIZATION IN NEVADA

REGIONAL, SECTORAL, AND OCCUPATIONAL ANALYSIS AND RECOMMENDATIONS FOR QUALITY JOBS AND ECONOMIC INCLUSION

BY INCLUSIVE ECONOMICS

IN PARTNERSHIP WITH GRIDLAB, NRDC, SIERRA CLUB, EVOLVED ENERGY, PSE HEALTHY ENERGY, AND CLIMATE + CLEAN ENERGY EQUITY FUND

CONTENTS

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EXECUTIVE SUMMARY

This research paper is the third in a series looking at pathways to deep decarbonization in Nevada. The first paper analyzes the technologically and economically feasible pathways to deep decarbonization in Nevada, and the second assesses equity impacts and suggests recommendations for an equitable transition.[1,2] This paper models and examines the employment effects associated with three different decarbonization pathways and a reference case. In addition to statewide modeling, it parses these effects across three regions, across industrial sectors, and by occupation. The results are provided in terms of direct jobs, which are those that will be required to decarbonize, and total jobs, which include all jobs created from the ripple effects of the investments required to decarbonize, including both in-state supply chain jobs and the jobs created when workers spend their income on in-state goods and services. Job loss associated with reduced expenditures on fossil fuels is also factored into this analysis.

The employment modeling accounts for the increase in employment resulting from the investments required to decarbonize and the decrease in employment resulting from reduced use of fossil fuels in Nevada. These job gains and job losses are aggregated into the results shown in Figure ES-1, thus providing a measure of the net employment effects, which are generally positive. The fossil fuel segments of some industries and specific occupations see small net-negative effects, but they are dwarfed by the significant gains in the broader industry or occupational category. The analysis clearly shows that decarbonization will result in gains in economic activity and employment (see Figure ES-1). Renewable energy development, building retrofits, and distributed solar provide the greatest contributions to jobs in the state, but ensuring that these are good, stable, career-track jobs and that they are accessible to underrepresented workers will require intentional policies and efforts, which are suggested in the Recommendations section.

1 Dylan Sullivan, Arjun Krishnaswami, Priya Sreedharan, and Elspeth Dimarzio, "Pathways and Policies to Achieve Nevada's Climate Goals: An Emissions, Equity, and Economic Analysis" (Evolved Energy, GridLab, NRDC, and Sierra Club, October 2020), https://gridlab.org/wp-content/uploads/2020/10/GridLab_Nevada-Report.pdf.

2 Elena Krieger, PhD, Boris Lukanov, PhD, Ana McPhail, PhD, Audrey Smith, MPH, and Annelise Dillon, MS, "Equity-Focused Climate Strategies for Nevada: Socioeconomic and Environmental Health Dimensions of Decarbonization" (Physicians, Scientists, and Engineers for Healthy Energy [PSE], August 2021), https://www.psehealthyenergy.org/wp-content/uploads/2021/08/Equity-Focused-Climate-Strategies_NV_Report.pdf.

Each of the three decarbonization pathways results in a net increase in direct jobs, starting immediately. The central and slow electricity cases show higher job growth in the earlier years, while the 100-percent renewables case sees job growth between 2045 and 2050. Constraints in the decarbonization modeling push the renewable investment out to 2045, but the actual deployment could and should be smoother and steadier over time. From a workforce perspective, condensing renewables development into a few years could be hampered by labor shortages, lead to intermittent work, and trigger high job loss after the investment period, whereas long-term sustained investment can support new apprenticeship and other training programs and ensure stable and continuous employment.

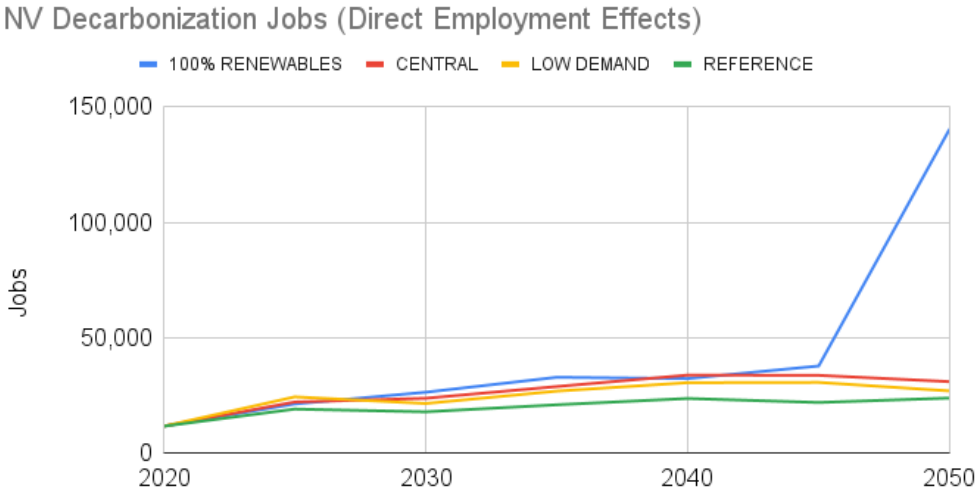


Figure ES-1. Nevada Jobs From Different Decarbonization Pathways

The 100-percent renewables scenario shows the largest increase in jobs by 2050. This large, late increase in jobs is a result of the model's optimized decision to delay large fossil fuel-replacing investments until the model's last time step. This late increase in jobs differentiates the fossil free scenario from the others that were modeled, and it should be considered somewhat separately rather than directly compared to the other scenarios.

Relative to the reference scenario, rural Nevada would see the greatest job growth. Figure ES-2 and Table ES-1 shows the percent increase in jobs by region in the year 2030 relative to total regional employment in 2019. These data show that relative to the reference scenario, each region will see an increase in jobs, and this effect is particularly pronounced in rural Nevada, where jobs grow more than 10 percent relative to 2019. In optimizing for lowest cost, the energy systems model delays investment in renewables, but investing in renewables sooner will spur significant job creation earlier than shown in Figure ES-1 and ES-2 and Table ES-1.

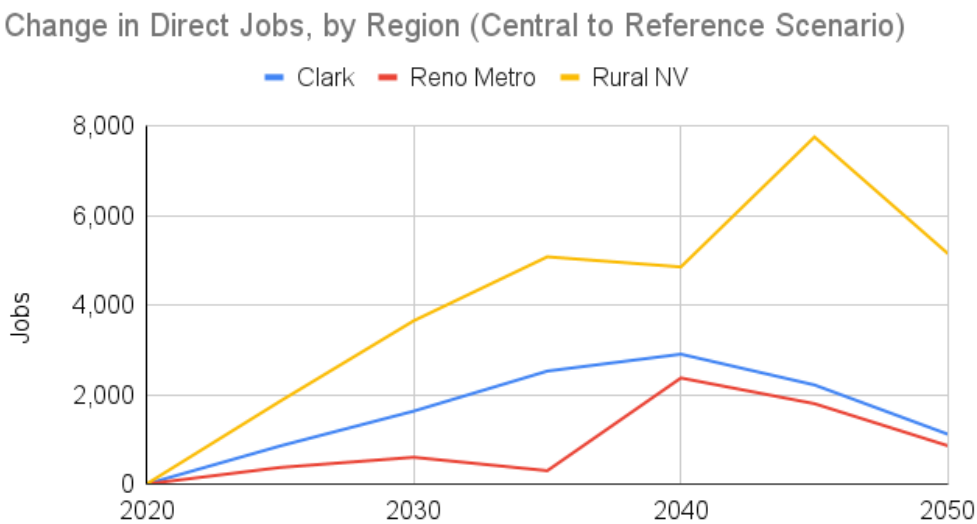


Figure ES-2. Direct Employment Effects due to Decarbonization Activities, by Region: Central Scenario

Table ES-1. Percent Increase in Regional Employment by Year 2030, Relative to 2019

REGION	100% RENEWABLES	CENTRAL	LOW DEMAND	REFERENCE
Clark	1.6%	1.5%	1.6%	1.5%
Reno Metro	2.1%	2.0%	2.0%	1.9%
Rural NV	15.6%	13.3%	10.9%	9.2%
TOTAL	2.4%	2.2%	2.1%	1.9%

Table ES-1 shows the percent increase in jobs by region by the year 2030 relative to regional employment in 2019. Each region will see an increase in total employment relative to a 2019 baseline. This effect is particularly pronounced in rural Nevada, where jobs grow more than 10 percent relative to 2019.

In terms of industrial sectors, the largest impacts, by far, are in the construction industry, which accounts for more than 90 percent of the new decarbonization jobs in each scenario. Construction activities include building new renewable energy facilities, transmission infrastructure expansion, building and home energy retrofits, electric vehicle charging infrastructure, building new manufacturing facilities to produce clean energy equipment, and the installation or replacement of equipment like HVAC systems, heat pump water heaters, or induction stoves in buildings. Most "clean energy" jobs in the State of Nevada will be in the construction sector.

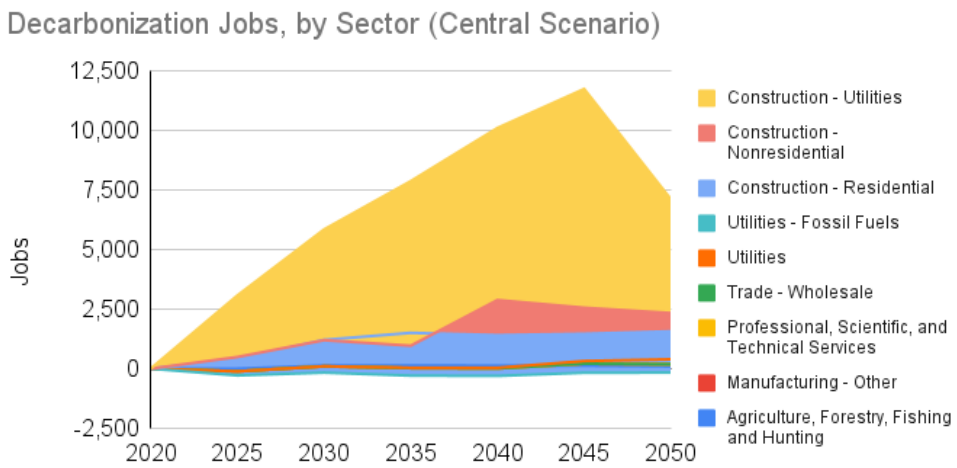


Figure ES-3. Direct Employment Effects, by Industrial Sector: Central Scenario, Relative to Reference Scenario

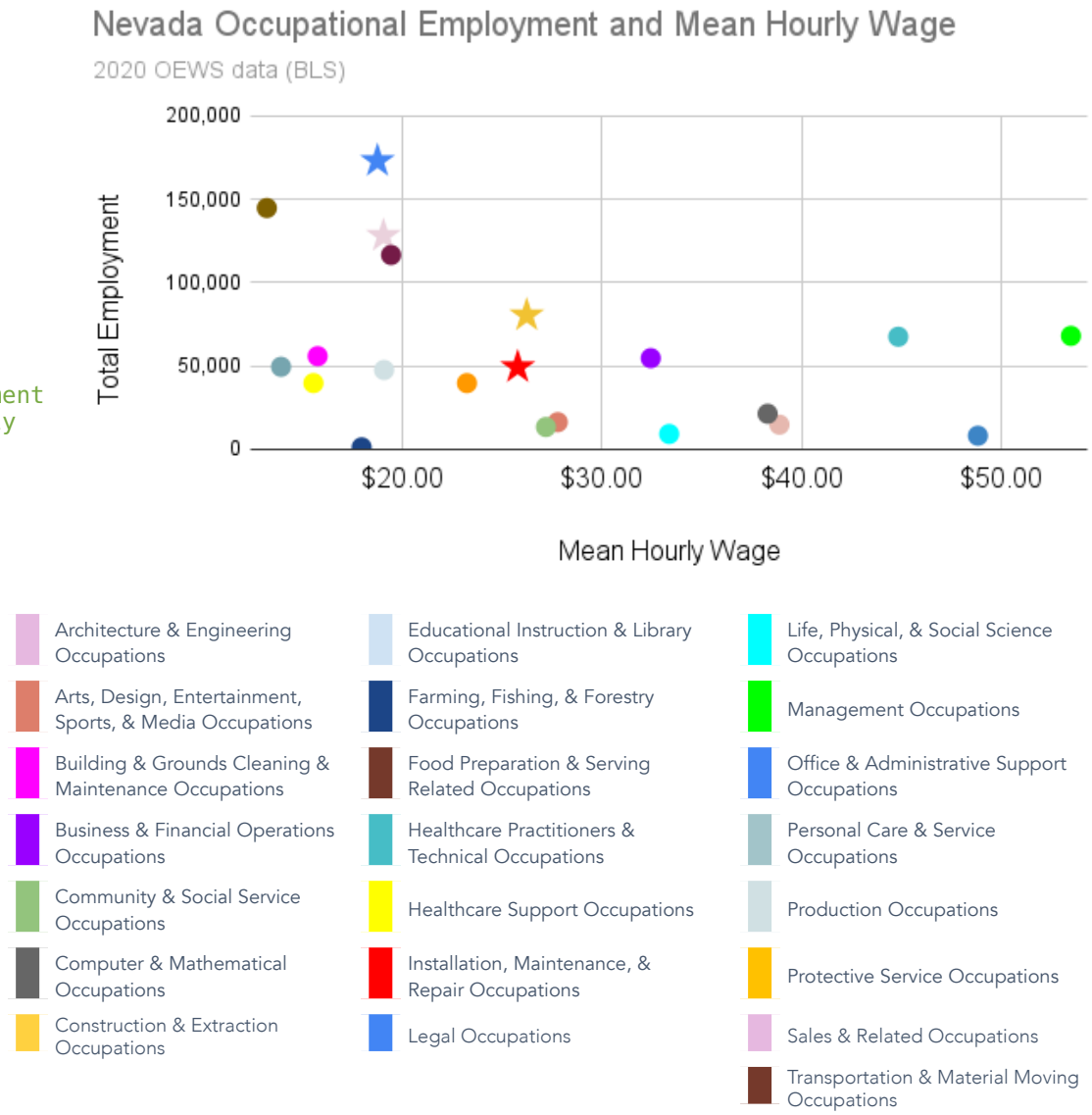
Figure ES-3 shows the change in direct decarbonization jobs for the central scenario. Because of the scale of job growth, the small categories of job loss are difficult to discern. While the model shows a loss of fossil fuel-related utility jobs of 559 by 2050 in the central scenario, there is an increase in other utility jobs of 209 by 2050, reducing the loss to 350 jobs. When accounting for the large increase in construction of new power plants, the reduction in utility operations jobs nearly vanishes.

As expected from the industrial impacts, construction- and maintenance-related occupations see the greatest growth. Other occupations, including administrative and office support, sales, and service jobs, also grow significantly. The high-growth occupations are represented by stars in Figure ES-4. These are middle-income occupations, many of which do not require a four-year or college degree.

With the construction occupations, the expansion of registered apprenticeship programs and use of registered apprentices on projects are good ways to ensure that skilled and trained workers are available to meet growing labor market demand and that new investments support career-track, family-sustaining jobs. The last section of this report provides detailed data on Nevada's apprenticeship programs for the in-demand occupations.

The data show higher participation by women and workers of color, as well as higher graduation rates, among the union apprenticeship programs, but there is still much room for improvement in this regard. Continuing to improve diversity, equity, and inclusion can be supported with targeted hire standards, contractor diversity programs, and pre-apprenticeship programs with wrap-around services. This paper provides detailed data and recommendations to support improved job quality and job access in the energy transition.

Figure ES-4. Nevada Employment and Mean Hourly Wage, by Occupational Category



Due to the regional, sectoral, and occupational aggregation used in this paper, it is possible that acute job losses in single counties, industries, and occupations have been missed. This is not to gloss over the challenge of job loss or the particular hardship faced by displaced workers. Even when job loss is small, it must be mitigated and managed. The geographic and occupational distribution of employment effects provided in this paper shed light on where more workers will be needed and which regions are poised to develop new clean industries. It details how to ensure that new investments support high-quality, family-sustaining jobs that are accessible to workers facing transition and populations traditionally excluded from career-track employment. Recommendations regarding job quality and job access are provided so policymakers and advocates can design and adopt policies to ensure that no one is left behind.

Decarbonization can be an engine of good job creation and equitable economic development. Developing domestic manufacturing—and clean energy supply chains, specifically—would result in considerably more jobs than shown here, since our modeling is constrained by current in-state activities and industry relationships. In addition to creating good career-track local jobs, decarbonization activities will save consumers money over the long haul, thus increasing household income for non-energy goods and services. The long-term cost savings of decarbonization, as well as cleaner air and reduced health expenditures, can also support broader economic development and diversification beyond clean energy, which are not captured in this paper. Economic diversification will continue to be important, particularly in regions currently dependent on fossil fuel activity.

INTRODUCTION

The effects of the climate crisis are already being felt in Nevada and threatening to change the state's landscape and livability. Temperatures have risen by 2.8°F on average across the state since 1970.[1] One of the most arid states in the United States, Nevada has traditionally had a dozen or so extreme heat days in summer, but this number totaled 20 in 2020 and is projected to reach 30 or more by mid-century. In recent years, Reno and Las Vegas, in turn, have both been ranked the fastest-warming city in the nation, and Las Vegas is the U.S. city with the most-intense summer heat island effect.[2,3,4] By 2100, the Las Vegas metropolitan area could have as many as 150 days per year with a heat index above 90 degrees (beyond which prolonged exposure poses a serious threat of heat disorder for humans).

Like neighboring states in the Southwest, Nevada has been gripped by drought since 2000, with little reprieve.[5] In January 2021, much of the State of Nevada was listed as "in extreme drought."[6] The Colorado River, which provides most of the state's water, is diminishing as a result of climate change, and the major reservoir it feeds, Lake Mead, has not approached full capacity since 1983 and 1999. In August 2021, the reservoir stood at just 35 percent of its capacity, the lowest level since it was formed in the 1930s.[7] As precipitation decreases and temperatures rise, demand for water is growing just as available supplies are shrinking. All of this adds up to serious threats to living conditions and livelihoods in Nevada if global greenhouse gas emissions are not dramatically reduced.

1 "How the Climate Crisis Is Impacting Nevada," Climate Reality Project, November 13, 2019, https://climaterealityproject.org/blog/how-climate-crisis-impacting-nevada.

2 "Nevada's Climate Threats," States at Risk, accessed February 21, 2021, http://statesatrisk.org/nevada/all.

3 "AMERICAN WARMING: The Fastest-Warming Cities and States in the U.S.," Climate Central (blog), April 17, 2019, https://www.climatecentral.org/news/report-american-warming-us-heats-up-earth-day.

4 Center for American Progress, "The Impacts of Climate Change and the Trump Administration's Anti-Environmental Agenda in Nevada," June 26, 2020, https://www.americanprogress.org/issues/green/reports/2020/06/26/486954/impacts-climate-change-trump-administrations-anti-environmental-agenda-nevada/.

5 Brian Kahn, "Southwest, Central Plains Face 'Unprecedented' Drought," Climate Central, February 12, 2015, https://www.climatecentral.org/news/southwest-central-plains-unprecedented-drought-18657.

6 Mike Wolterbeek, "Scientists Keep Watch on Climate and Weather as Drought Grips Nevada," Nevada Today - University of Nevada, Reno (blog), January 14, 2021, https://www.unr.edu/nevada-today/news/2021/drought-and-climate-in-nevada.

7 Michael Carlowicz and Kathryn Hansen, "Lake Mead Drops to a Record Low," (NASA Earth Observatory, August 27, 2021), https://earthobservatory.nasa.gov/images/148758/lake-mead-drops-to-a-record-low.

POLICY CONTEXT

Nevada's lawmakers have responded to this climate urgency. In April 2019, Senate Bill 358 was signed into law, raising the state's renewable portfolio standard to 50 percent by 2030. This law was followed by Nevada Senate Bill 254, setting statewide greenhouse gas emissions reduction goals of 28 percent below 2005 levels by 2025, 45 percent below 2005 levels by 2030, and zero or near-zero emissions by 2050. Also in 2019, Nevada Governor Steve Sisolak signed Executive Order 2019-22, committing the state to reduce pollution contributing to global warming. Having taken the crucial step of signing ambitious climate targets into law, Nevada now faces the challenge of achieving decarbonization on pace to meet these goals.

To help chart the course, a project was initiated by Sierra Club, GridLab, the Natural Resources Defense Council (NRDC), and the Climate and Clean Energy Equity Fund, using expert analysts, to examine feasible pathways to reach Nevada's climate goals. This paper is one of three resulting from this project; it specifically examines the job impacts of the decarbonization modeling presented in the partner paper by Evolved Energy, *Pathways and Policies to Achieve Nevada's Climate Goals: An Emissions, Equity, and Economic Analysis.* [8] Complementary analysis by partner PSE Healthy Energy has been published in *Equity-Focused Climate Strategies for Nevada* (August 2021).[9]

The research presented herein examines the employment and economic impacts of the decarbonization modeling by Evolved Energy. To enable data-driven impact assessments of Nevada climate policies, this report sheds light on the associated job impacts by providing granular analysis by industry and by region. It examines the distributional effects of these outcomes, including measures of job quality, such as occupational breakdowns, compensation, demographic trends, and training pathways. Lastly, it provides policy and program recommendations focused on job quality and job access to harness the momentum of large-scale change to create a more equitable low-carbon economy.

8 Dylan Sullivan et al., "Pathways and Policies to Achieve Nevada's Climate Goals: An Emissions, Equity, and Economic Analysis."
9 Elena Krieger, PhD, et al., "Equity-Focused Climate Strategies for Nevada: Socioeconomic and Environmental Health Dimensions of Decarbonization."

ECONOMIC CONTEXT

For Nevada's decarbonization efforts to avoid perpetuating the same practices that led to the current inequality and job precarity, the state needs policies and programs that protect not only jobs but job quality, across industries.

Tourism, spurred by the largest gaming market in the United States, is Nevada's leading industry, and one on which the state has been persistently reliant, despite pre-COVID-19 efforts to diversify. According to the 2021 Nevada Gaming Fact Book, "Historically, the leisure and hospitality industry accounts for more than one in four direct jobs in Nevada," and almost one in three if the ripple effect is considered.[10] With the industry essentially operating at half capacity as a result of the COVID-19 pandemic—slashing visitor spending, economic activity, and industry-specific taxes—Nevada's economy suffered a sharp downturn in 2020. While some believe the state will quickly bounce back as travel resumes, others see economic diversification as the way forward, away from the boom–bust cycle the state is known for, in favor of greater resilience.

While Nevada's economy was strong going into 2020, it was already marked by significant disparity in the distribution of economic gains and burdens. Nevada ranks as the fourth most-unequal state in the nation, when inequality is measured by comparing the ratio of top 1-percent incomes to bottom 99-percent incomes.[11] A 2019 study by the Guinn Center found a trend of growing income inequality in Nevada since 1945: in 2015, 55.7 percent of the state's income went to the top 10 percent of earners, with the other 90 percent sharing the remaining 44.3 percent of total income in the state. From 2009 to 2015, the top 1 percent in Nevada experienced significant income growth (22.4 percent), 16 times that of the other 99 percent. Economic disparity is reflected in the rate of uninsured Nevadans, which at 14 percent is above the national average of 10.5 percent.[12] Housing in Nevada represents a disproportionate cost burden among low-income renter households, and this burden increases the lower the income bracket: 80 percent of extreme low-income renter households are "severely cost burdened," meaning rent consumes more than half of their income.[13]

10 Nevada Resort Association and Applied Analysis, "2021 Nevada Gaming Fact Book," accessed March 23, 2021, https://www.nevadaresorts.org/about/factbook/.

11 "Income Inequality in Nevada," Economic Policy Institute, August 27, 2021, https://www.epi.org/multimedia/unequal-states-of-america/#/Nevada.

12 "Nevada's Uninsured Population" (The Guinn Center, 2019), https://guinncenter.org/wp-content/uploads/2019/04/Guinn-Brookings-NV-Family-Ec-Report-2019.pdf.

13 Nancy E. Brune, Meredith A. Levine, and Jaewon Kim, "A Step Up: Economic and Financial Security for Nevada's Families" (The Guinn Center and Brookings Mountain West, 2019), https://guinncenter.org/wp-content/uploads/2019/04/Guinn-Brookings-NV-Family-Ec-Report-2019.pdf.

Nevada's world-class clean energy resources have the potential to create a multi-decade economic boom for the state.

In 2019, Nevada's poverty rate was 12.9 percent, with significant racial disparity existing within this figure: 10.3 percent of white households, 17 percent of Latinx households, 21.5 percent of Black households, and 27.5 percent of Native American households experienced poverty in the state that year.[14] The COVID-19 pandemic has further exacerbated inequality in Nevada, not only through disparity in who has been most affected by job loss, but also through the state's reduction of social services. Facing a budget shortfall of $1.2 billion due to disruption from the pandemic, Nevada lawmakers made massive cuts in July 2020, whittling down or eliminating funding for healthcare and education programs that disproportionately serve low-income families and people of color, before reversing some cuts in the 2021 legislative session.[15,16]

In December 2019, just a few months before the COVID-19 shutdown, Nevada's unemployment rate was at an all-time low of 3.6 percent. By April 2020, it had spiked to 29.5 percent, a new record high for the state and the worst jobless mark in the nation at the time.[17] The accommodation and food service industry alone lost more than 40 percent of its jobs compared to April 2019.[18] While some jobs were regained over the course of 2020, in January 2021, Nevada nonfarm employment was still down 11.9 percent (150,100 jobs), compared to the previous January. With almost no industries spared, business services (-22,600 jobs) and construction (-8,800 jobs) were among those hit hardest; however, by far the largest job loss in Nevada was in its vast leisure and hospitality industry (-108,500). [19,20] In other words, unemployment due to the COVID-19 pandemic was concentrated among the lowest wage earners in Nevada, a state already ranked last in wage growth since 2007.[21]

Nevada's world-class clean energy resources have the potential to create a multi-decade economic boom for the state, but for Nevada's decarbonization efforts to avoid perpetuating the same practices that led to the current inequality and job precarity, the state needs policy and programs that protect not only jobs but job quality, across industries. Job growth in sectors like clean energy construction and manufacturing should be coupled with policies that ensure new jobs are stable, secure, safe, good-paying, and accessible to people traditionally excluded from career-track work opportunities.

This approach supports greater economic equity by increasing opportunity for groups under-represented in high-paying employment (people of color, women, veterans, etc.). In short, Nevada's future economic and climate resilience will depend on how the energy transition is carried out. The transition to a low-carbon economy is an opportunity to address historic inequalities. With policies to make sure traditionally underserved populations are well-represented in high-quality employment as the economy evolves, Nevada can forge a just and sustainable future.

14 Center for American Progress, "Nevada Report - 2019" (TalkPoverty, 2019), https://talkpoverty.org/state-year-report/nevada-2019-report/.

15 Bert Johnson, "How COVID-19 Has Impacted Income Inequality In Nevada," CapRadio, August 4, 2020, https://www.capradio.org/articles/2020/08/04/how-covid-19-has-impacted-income-inequality-in-nevada.

16 Associated Press, "Nevada to restore $301M in planned budget cuts to Medicaid," May 14, 2021, https://apnews.com/article/nv-state-wire-nevada-business-coronavirus-pandemic-medicaid-d6b4b4d943208822d9dcc83c906b4304.

17 "Current Unemployment Rates for States and Historical Highs/Lows," accessed March 22, 2021, https://www.bls.gov/web/laus/lauhsthl.htm.

18 "Nevada's 28% Joblessness Is Worst in US and in State History," AP NEWS, May 22, 2020, https://apnews.com/article/ca2c49328a5a6970fb80420f427600d6.

19 Nevada Department of Employment, Training and Rehabilitation, "Current Employment Statistics (CES)," NevadaWorkforce.com, accessed February 1, 2021, http://nevadaworkforce.com/CES.

20 Statewide, Leisure and Hospitality (January 2020 to January 2021)," Bureau of Labor Statistics Data, accessed November 24, 2021, https://data.bls.gov/pdq/SurveyOutputServlet.

21 "The 5 States Where Pay Has Gone up the Most since the Recession," Policygenius, accessed March 23, 2021, https://www.policygenius.com/blog/states-where-wages-have-grown-fastest-since-the-recession/.

SCOPE OF THIS ANALYSIS

Our economic modeling reflects the ways in which this transition will affect the Nevada economy and employment across sectors and across geographies, accounting for both increases and decreases in economic activity due to decarbonization. This is not to suggest that balancing the job equation is a simple tally of gains and losses. Job access and job quality need to be considered broadly, over the long term and in terms of who is benefitting.

The analysis presented here is constrained by the scenarios modeled, reflecting the technology and policy pathways identified to dramatically reduce emissions by 2050. Therefore, the job impacts revealed—and our related equity recommendations—are largely tied to energy and energy-related sectors. However, reshaping and diversifying Nevada's economy will increase employment in sectors and regions in ways that are beyond the scope of our analysis here.

Ensuring a just energy transition means making sure that workers and communities are not left behind. It means making sure that job growth outpaces job loss and also that the jobs created are stable, secure, safe, and good-paying. The transition to a low-carbon economy is an opportunity to address historic inequities by increasing opportunity for groups underrepresented in high-paying employment (Indigenous, people of color, women, veterans, etc.). With policies to support displaced workers and make sure traditionally underserved populations are well represented in high-quality employment as the economy evolves, Nevada can forge a just and sustainable future.

With policies to support displaced workers and make sure traditionally underserved populations are well represented in high-quality employment, Nevada can forge a just and sustainable future.

METHODOLOGY

This analysis uses the IMPLAN Input-Output model to ascertain the macroeconomic and employment effects of the deep-decarbonization scenarios.

Decarbonization Scenarios

The scenarios analyzed correspond to the following scenarios from Evolved Energy's February 2021 report.[22]

- **REFERENCE:** This "business as usual" scenario reflects existing policy at the end of the 2019 legislative session. While the renewable portfolio standard targets are met in the electricity sector, climate targets in SB-254 are non-binding.
- **CENTRAL:** "Rapid adoption curves for key demand-side technologies like electric vehicles and appliances [... and] optimizes energy supply decisions to meet 2030 and 2050 targets," leading to a rapidly decarbonized electricity sector by 2030 goal and near-complete electrification of on-road transportation and heating by 2050.
- **LOW DEMAND (ENERGY EFFICIENCY SENSITIVITY):** "Energy demand for the building and transportation sectors declines even further than in the central scenario due to increased retrofits of existing homes, increased buildout of public transit infrastructure, and reduced aviation use. Flexibility of building and transportation electricity load is double that in the central scenario."

Evolved Energy also considered a more ambitious scenario, the 100-percent renewables (fossil-free) model, which completely phases out oil and gas use and production across the country by 2050. This scenario is presented separately from the others because it emphasizes the build-out of renewable energy.

- **100-PERCENT RENEWABLES (NET ZERO BY 2050 SENSITIVITY):** "The United States stops producing and using fossil fuels by 2050, requiring the development of even more renewable fuels infrastructure."

IMPLAN Model and Limitations

The economic and employment impact analysis below is based on converting outputs from the Evolved Energy Research (EER) deep-decarbonization scenario modeling into inputs for IMPLAN. IMPLAN is an input-output (I-O) model that maps how changes in spending circulate throughout the economy, based on existing industry relationships and spending patterns in a local economy. The IMPLAN model has 544 industry sectors for which it maps the upstream and downstream relationships. I-O modeling is typically used to analyze how a change in economic activity in one sector of the economy affects that sector as well as activities, employment, and labor income in other sectors of the economy. When you model an impact (e.g., change in spending, change in output, change in employment, etc.) to a particular industry, it uses preset industry spending patterns to discern the indirect and induced impacts resulting from the initial impact. IMPLAN is not dynamic, which means that it does not account for any feedback, such as price adjustments or business, worker, and consumer activity adjustments in response to changing prices.

For this analysis, we used as inputs the non-levelized increases and decreases in economic activity across the industries directly affected by the decarbonization scenarios. If these changes result in higher costs for households and businesses, they are reflected as a reduction in household and business income, and when changes result in

22 Sullivan et al., "Pathways and Policies to Achieve Nevada's Climate Goals: An Emissions, Equity, and Economic Analysis."

The "direct" jobs are those directly affected from the activity modeled (e.g., investments in expansion of transmission infrastructure or construction of a wind farm). The "total" jobs include the direct jobs plus the "indirect" jobs that result from the intermediate (supply chain) expenditures and the "induced" jobs resulting from the spending of worker earnings.

reduced costs, they are reflected as an increase in household and business income. The impacts of these direct increases and decreases in spending ripple out across the economy, affecting other industries and jobs, and ultimately, they result in additional changes in spending on local goods and services.

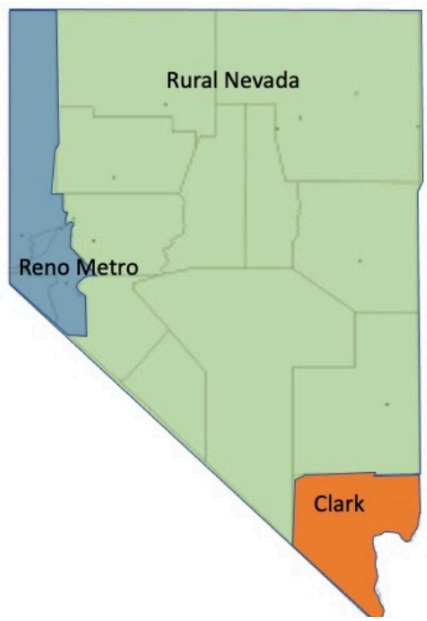
The analysis provides the "direct" and "total" macroeconomic and employment effects. The direct effects are those created directly from the activity modeled (e.g., investments in expansion of transmission infrastructure or the construction of a wind farm), while the total impacts include the indirect effects that result from intermediate (supply chain) expenditures and the induced effects created by the spending of worker and business earnings.

In an effort to reach Nevada's economy-wide decarbonization goals, Evolved's models shift energy systems over time from using fossil fuels to using clean energy sources. The models have a more detailed representation of infrastructure costs in the power and clean energy sectors than they do of infrastructure costs in non-power fossil fuel systems. Therefore, the IMPLAN modeling of Evolved's results reported here characterizes the economic impacts of the clean energy expansion required to meet climate goals, rather than the impacts of reduced use of fossil fuel distribution infrastructure, like refineries or gas pipelines. More detail on the specific methodology can be found in Appendix A, with the mapping on Evolved's modeling outputs to IMPLAN inputs in Appendix B.

Regions

To provide distributional impacts across the state, we allocated 17 county-level impacts to the three regions shown in Figure 1. Appendix C provides the county names by region.

Figure 1. Nevada's Regions



Sectors and Occupations

For ease of conveying distributional impacts across IMPLAN's 544 industrial sectors and 823 occupations, we allocated impacts to the higher-level groupings of sectoral and occupational categories. The sectoral and occupational aggregations are shown in Appendix D, Tables A1 and A2.

EMPLOYMENT RESULTS

STATEWIDE IMPACTS

It is clear that in each decarbonization pathway modeled, the State of Nevada would see an increase in direct employment relative to the business-as-usual reference case. The direct employment impacts are shown in Figure 2. These figures represent jobs in the industries directly affected by the decarbonization scenarios, mostly increased clean energy jobs (e.g., construction of renewable energy, manufacturing clean fuels and products, performing energy retrofits, etc.), as well as reduced jobs in fossil fuel industries. The reference scenario is graphed as the green line.

Each decarbonization scenario shows increases in employment relative to the reference case. The 100-percent renewables/fossil-free scenario shows a very large increase in jobs from 2045 to 2050. This large, late increase in jobs is a result of the model's optimized decision to delay large fossil-fuel-replacing investments until the model's last time step, given the constraint of meeting decarbonization objectives while ending fossil fuel use. Additionally, this late increase in jobs differentiates the fossil-free scenario from others that were modeled, and it should be considered somewhat separately rather than directly compared to the other scenarios.

Figure 3 shows the total economy-wide job effects of the decarbonization scenarios. Mainly these totals differ from the direct job growth trends only in the number of jobs, with the total number of jobs being about double the direct jobs. The greater the intermediate spending in an industry and the stronger the in-state supply chains, the greater the indirect and induced employment ripple effects, measured as a multiplier. The indirect and induced job multipliers are shown in Table 1. For every 100 direct jobs created due to decarbonization activities, another 70 to 87 jobs will be created in the state economy. This multiplier will increase as in-state supply chains for clean energy equipment develop.

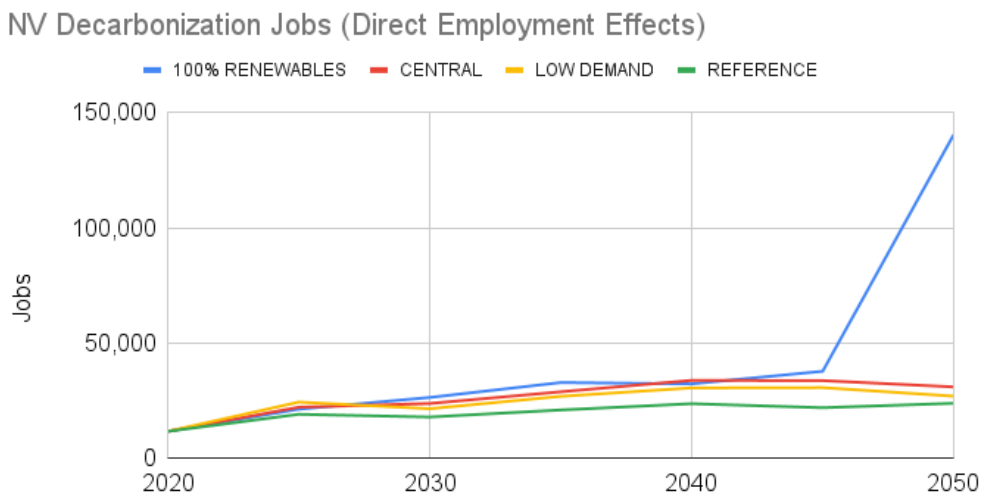


Figure 2. Statewide Direct Employment Effects of Decarbonization Scenarios

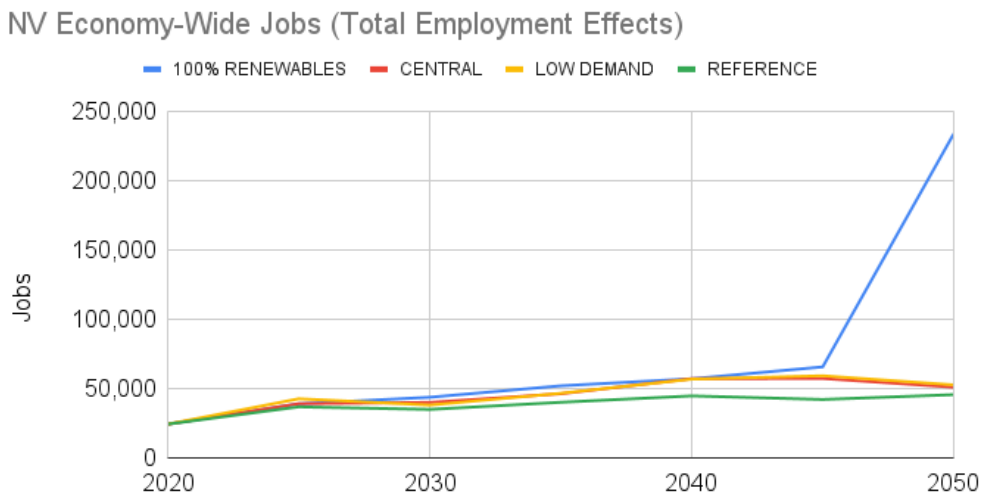


Figure 3. Statewide Total Employment Effects of Decarbonization Scenarios

Table 1. Employment Multipliers (Indirect + Induced Jobs/Direct Jobs), by Scenario

	100% RENEWABLES	CENTRAL	LOW DEMAND	REFERENCE
Indirect and Induced Employment Multiplier	0.71	0.71	0.87	0.94

The indirect and induced job multipliers are shown in Table 1. Relative to the reference case, the indirect and induced multipliers for the decarbonization scenarios are lower, likely because in-state supply chains for decarbonization activities have not yet been well developed in Nevada. As more in-state businesses develop to meet changing energy needs and if Nevada workers and households shift more spending of income and energy cost savings to in-state businesses, these multipliers will increase.

A summary of the total macroeconomic impacts by scenario is presented in Table 2. All three decarbonization pathways support greater job growth and economic activity relative to the reference scenario. The 100-percent renewables scenario creates the highest economic benefits in 2030 and 2050, while in 2040, the macroeconomic effects of all the decarbonization scenarios are similar and about 27 percent higher than the reference scenario.

Table 2. Total (Direct, Indirect, and Induced) Macroeconomic Effects, by Scenario (Dollars Reported in $ Billion)

Scenario/ Year	Employment	Output	GDP	Labor Income	State & Local Taxes	Federal Taxes
100% RENEWABLES						
2030	43,767	$9.86	$5.21	$2.81	$0.37	$0.63
2040	57,127	$12.31	$6.68	$3.61	$0.48	$0.81
2050	234,089	$47.79	$26.70	$14.93	$1.71	$3.30
CENTRAL						
2030	40,033	$9.12	$4.77	$2.57	$0.34	$0.58
2040	57,174	$12.29	$6.72	$3.63	$0.47	$0.81
2050	51,051	$11.07	$6.01	$3.26	$0.42	$0.73
LOW DEMAND						
2030	38,136	$8.68	$4.51	$2.42	$0.34	$0.55
2040	56,870	$12.08	$6.56	$3.53	$0.49	$0.79
2050	52,707	$11.04	$5.95	$3.22	$0.46	$0.73
REFERENCE						
2030	34,977	$8.36	$4.22	$2.21	$0.33	$0.50
2040	44,753	$10.33	$5.41	$2.83	$0.40	$0.64
2050	45,654	$10.62	$5.49	$2.88	$0.42	$0.65

REGIONAL IMPACTS

The direct job effects across regions are largely driven by two factors: population and renewable resource potential. Regions with large populations will see more building retrofit and distributed solar jobs, while rural areas with more solar potential will see more large-scale renewable energy development. Figure 4 shows the direct clean-energy-related jobs by region for the three decarbonization scenarios relative to the reference scenario. The "direct employment effects" capture the jobs required to decarbonize the state economy and support a clean energy transition. These include jobs required to build renewable energy facilities, retrofit buildings, and manufacture equipment (e.g., vehicles, clean fuels, appliances, etc.) to meet Nevada consumer demand (to the extent such manufacturing capacity is located in Nevada).

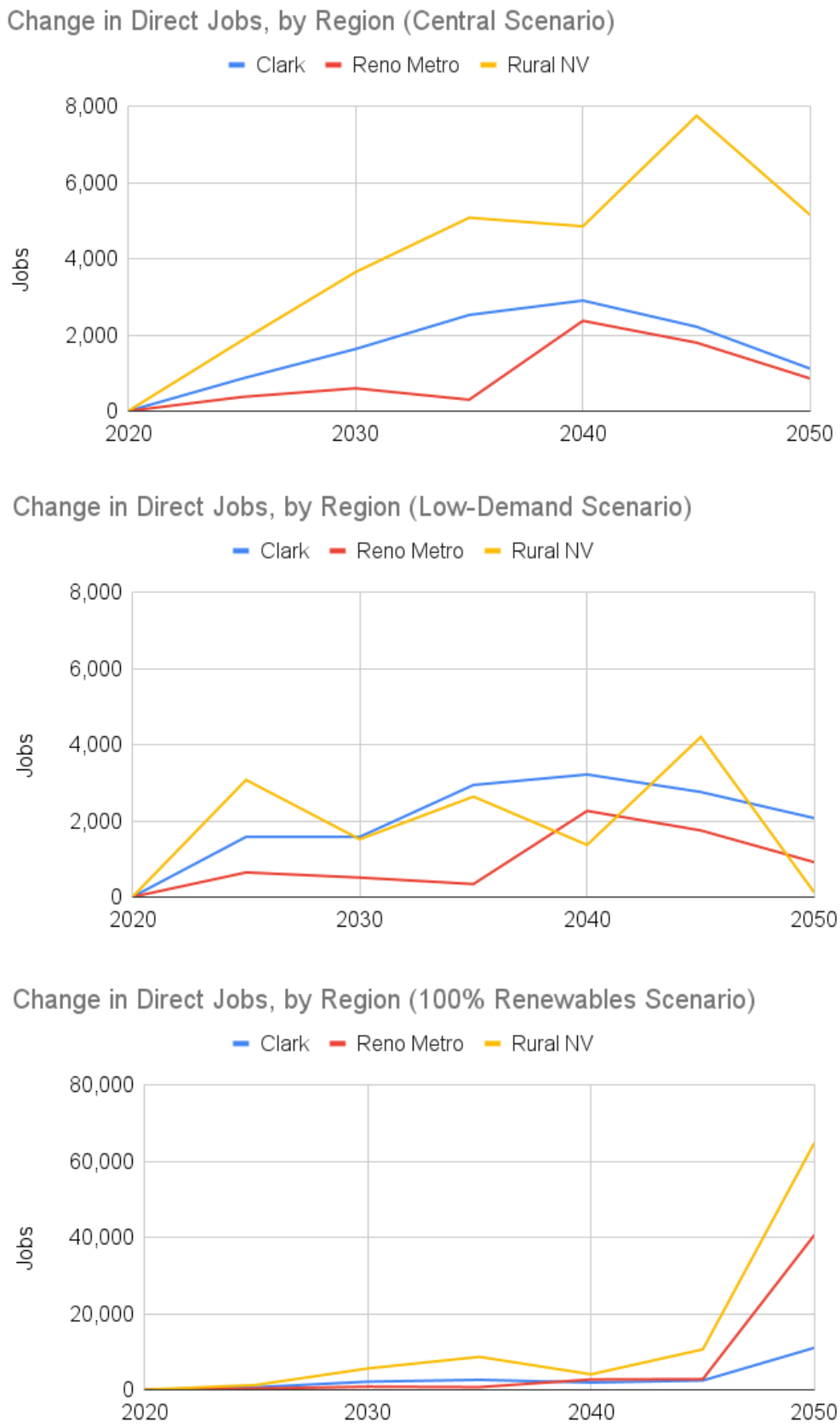


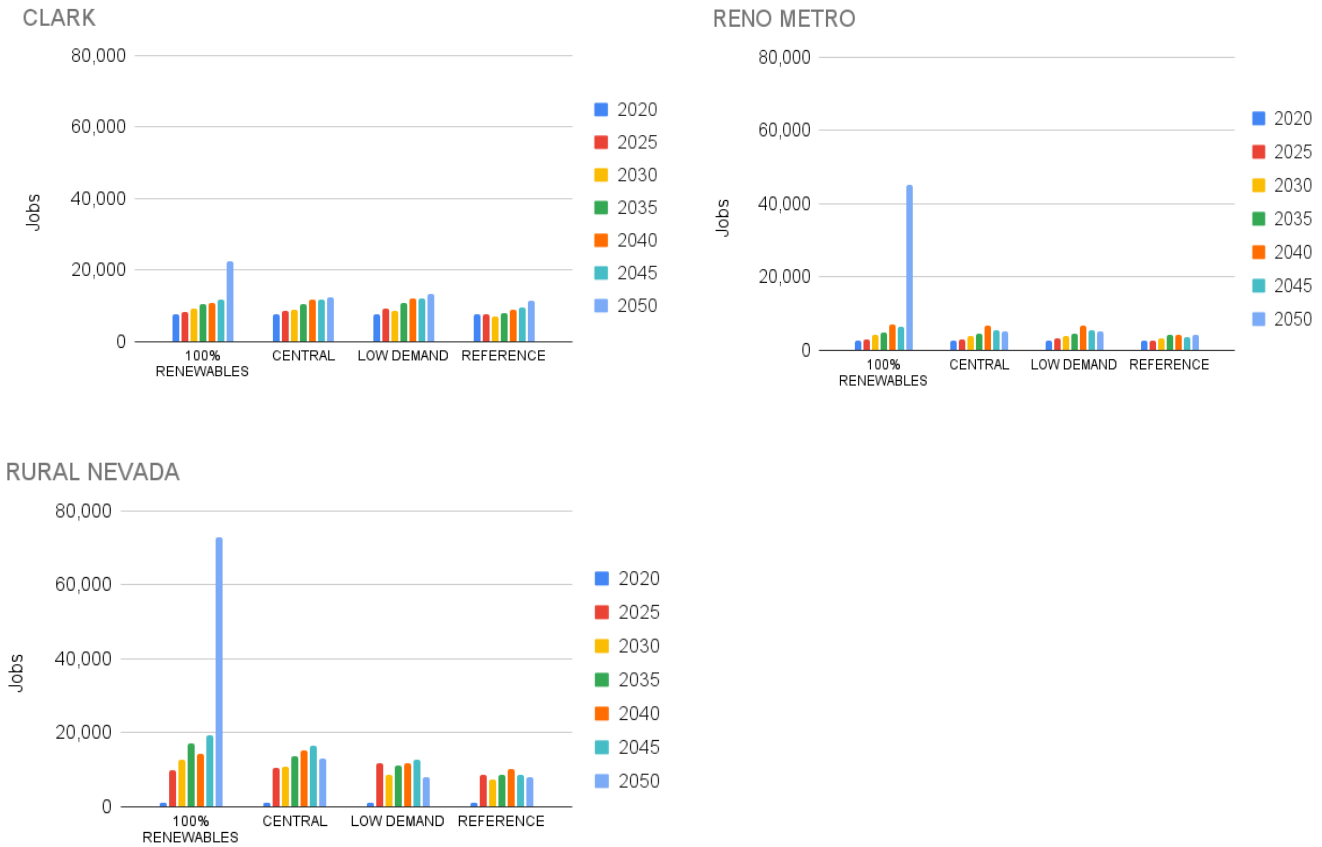
Figure 4. Decarbonization Jobs (Direct Effects), by Region (Relative to Reference Scenario)

The scale of the direct employment impact across scenarios (and the scale depicted on the vertical axes) vary significantly. The scale of the employment impact from the 100-percent renewables scenario is 10 times higher than for the other two scenarios, indicating that Nevada, with its strong solar resource, would benefit significantly from a nation-wide commitment to get off of fossil fuels by 2050. In both the 100-percent renewables scenario and the central scenario, rural Nevada sees larger employment effects than the Reno metropolitan (Reno Metro) and Clark County regions, due to investments in large-scale renewables relative to rooftop solar and energy efficiency investments (accentuated in the low-demand scenario), which create more jobs in areas of higher population.

The employment impacts are based on the pace of investments outputted by Evolved's decarbonization modeling, which operates under constrained optimization. In the real world, outside of the model, investment may happen more smoothly. A steady path of decarbonization through 2050 can support consistent career-track employment for Nevada's workers. If decarbonization follows a path of fits and starts, job stability will suffer, and it will be difficult to secure trained and qualified workers to implement climate solutions. A strong policy signal and commitment to decarbonize by 2050, with a regulatory framework to support strong and steady private sector and ratepayer investments as well as a committed source of public revenue to build the infrastructure necessary to support those investment can ensure a stable source of jobs for tens of thousands of Nevadans over the next 30 years.

The regional results shown in these line graphs are reproduced in Figure 5, which shows regional snapshots of the total annual jobs (including those in the reference scenario). These charts capture the direct employment effects for each region, graphed on the same vertical scale. Across all three regions, the spike in investments from 2045 to 2050 in the 100-percent renewables scenario causes a spike in jobs. This is a function of the decarbonization modeling, which optimizes for lowest cost within the provided parameters. Since the models project declining costs, the decarbonization models will push out investments in energy infrastructure to the point in time when the cost is the lowest while still meeting the goal of full decarbonization by 2050. In reality, a more steady investment in renewable energy starting now would distribute those jobs more evenly over time.

Figure 5. Regional Direct Employment Effects (i.e., jobs related to decarbonization and clean energy transition)



The different-sized impacts across regions are partially explained by the resource endowments and investment opportunities in different regions. For example, rural regions with high solar potential will see greater job gains than urban regions without such resources. Urban regions will see higher impacts than rural regions in building retrofits, rooftop solar, etc. To help make sense of these differences, we compare 2019 employment to the total job growth by decarbonization scenario by 2030. Table 3 shows this comparison, and Table 4 represents regional job growth as a percent of 2019 employment.

As with the charts in Figure 5, these data show that total employment effects for the urban regions are slightly more than double the direct employment effects. For every 100 jobs created in Clark County from the investment required to decarbonize, another 130 jobs are created in the local supply chain and from local spending of labor income. In the Reno Metro area, every 100 decarbonization jobs will spur the creation of another 110 indirect and induced jobs. In rural Nevada, however, every 100 decarbonization jobs will only support another 10 jobs in the local economy. These effects take into account the higher costs or higher savings to businesses and households related to decarbonization (e.g., higher or lower energy costs, fuel purchases, investments in cars or appliances, etc.).

This significant differential in the employment multipliers between rural and urban Nevada indicates that rural counties in the state are support few shops and services, and that spending on equipment, materials, and services used in energy development in rural Nevada happens in the state's urban regions or out of state. Likewise, compensation from such development is spent in urban or out-of-state regions. Renewable energy development in rural Nevada, however, could support rural economic development and diversification, resulting in higher indirect and induced jobs than shown here. Rural economic development and a statewide economic diversification and resiliency strategy will be important elements of a comprehensive statewide climate strategy.

This finding is important since rural Nevada (outside of the Reno and Las Vegas metropolitan regions) sees the greatest impacts across all scenarios, both in terms of both numbers of jobs and percent growth, because renewable investments were distributed according to solar resource potential and land area. By 2030, decarbonization investments could grow jobs in rural Nevada by 11 to 16 percent.

Table 3. Change in Total Employment in Year 2030 Compared to 2019 Employment

REGION	2019 EMPLOYMENT	100% RENEWABLES	CENTRAL	LOW DEMAND	REFERENCE
Clark	1,314,594	21,644	20,369	20,625	19,446
Reno Metro	395,411	8,478	8,005	7,979	7,508
Rural NV	87,547	13,645	11,659	9,532	8,023
Statewide Total	1,797,552	43,767	40,033	38,136	34,977

Table 4. Percent Increase in Regional Employment by Year 2030, Relative to 2019

REGION	100% RENEWABLES	CENTRAL	LOW DEMAND	REFERENCE
Clark	1.6%	1.5%	1.6%	1.5%
Reno Metro	2.1%	2.0%	2.0%	1.9%
Rural NV	15.6%	13.3%	10.9%	9.2%
Statewide Total	2.4%	2.2%	2.1%	1.9%

INDUSTRY IMPACTS

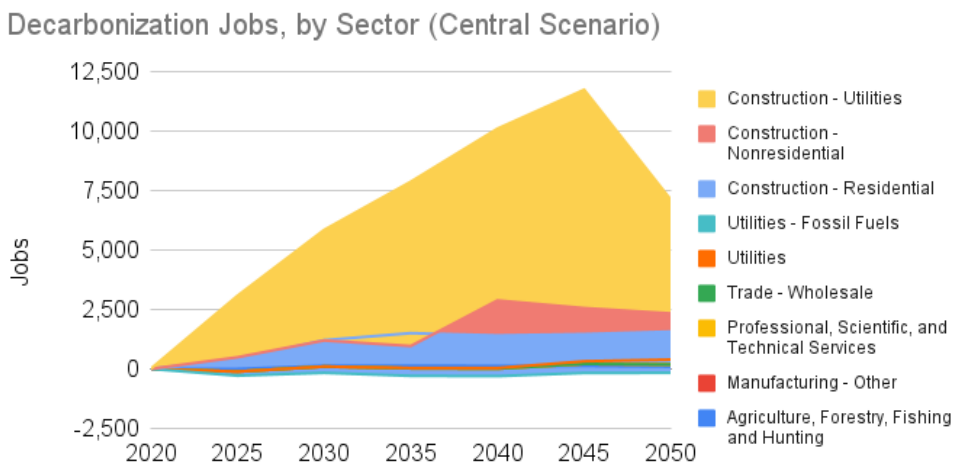
Across all decarbonization scenarios, the largest impact by far is in the construction industry, which accounts for roughly 93 percent of the new jobs required to decarbonize. Construction activities include building new renewable energy facilities, transmission infrastructure expansion, building and home energy retrofits, electric vehicle (EV) charging infrastructure, building new manufacturing facilities to produce clean energy equipment, and the installation or replacement of equipment like HVAC systems, heat pump water heaters, or induction stoves in buildings. Most clean energy work in the State of Nevada will be in the construction sector. If Nevada grows its clean-energy-related manufacturing industry, the state will see higher job numbers there. The modeling for this project was constrained by the extent to which in-state demand for particular products (e.g., vehicles, HVAC systems, household appliances, etc.) is currently met by in-state manufacturers. The distribution of decarbonization jobs across industries is shown in Figure 6.

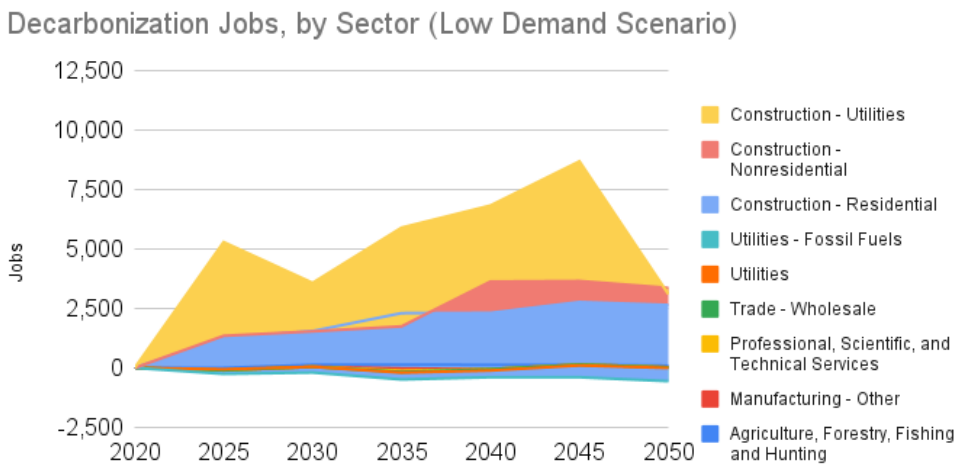
In this analysis, the construction-related employment is distributed by sector, the sectors being residential, non-residential, and energy. Residential construction includes energy efficiency retrofits, electrification activities, and rooftop solar. Non-residential construction will include commercial building retrofits, commercial solar, electrification activities, and the construction of new manufacturing facilities. Energy construction includes utility-scale renewable energy facilities, transmission and distribution infrastructure, and EV charging infrastructure.

The intermediate expenditures within these directly affected industries impact some other industries, and the change in labor income associated with decarbonization activities affect yet another set of industries. Thus, most industrial sectors across the Nevada economy experience ripple effects of decarbonization investments. Figure 7 shows that by 2045, there will be an additional 4,000 to 8,000 indirect and induced jobs in the decarbonization scenarios relative to the reference scenario, even after accounting for some job loss in the fossil fuel sector.

The storage battery manufacturing industry employed more than 3,000 workers in the Reno Metro region in 2019, and these jobs could grow significantly to meet increasing demand for batteries not only in Nevada, but also in other states. While the model captures the supply chain jobs, in this project the model was constrained by the extent to which in-state demand for particular products is met by in-state suppliers. It does not capture the employment effects of providing storage batteries to consumers in other states or related supply chain impacts. In addition to the employment not considered here, there are cultural, environmental, and health concerns around growing supply chain industries such as lithium extraction in Nevada.

Occupations and industries are different. For example, not all of the jobs in the construction industry are construction occupations. There are finance professionals, business managers, and accountants employed in the construction industry, just as there are electricians, pipefitters, or construction laborers employed in the utility, extraction, and other industries. When people train for occupations, they can move between industries that require those occupational skills. When people are trained for a very specific industry or a very specialized occupation, whether it be coal mining or solar installation, they are more vulnerable to ebbs and flows in industrial investment due to policy changes. The distribution of the jobs across occupations associated with decarbonization in Nevada is shown in the next section.





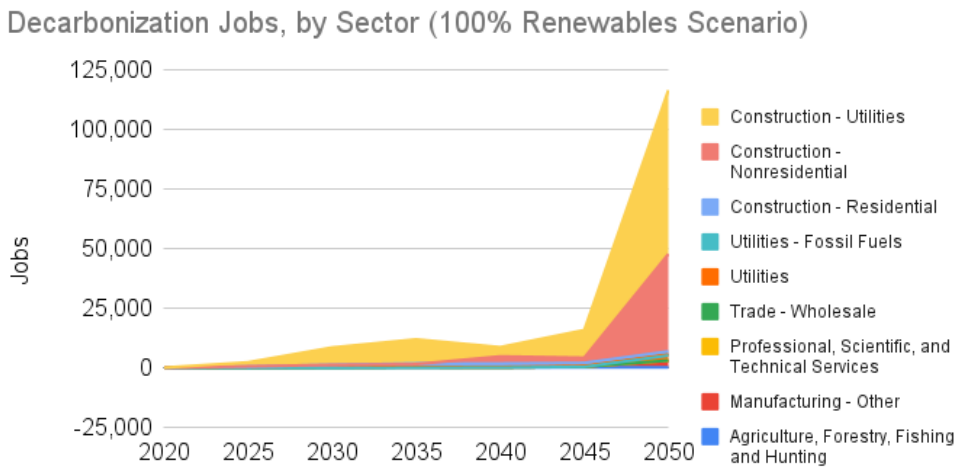


Figure 6. Decarbonization Jobs (Direct Effects), by Industrial Sector, Relative to Reference Scenario


Photo Credit: Catherine Werner, City of St. Louis IBEW Training Center

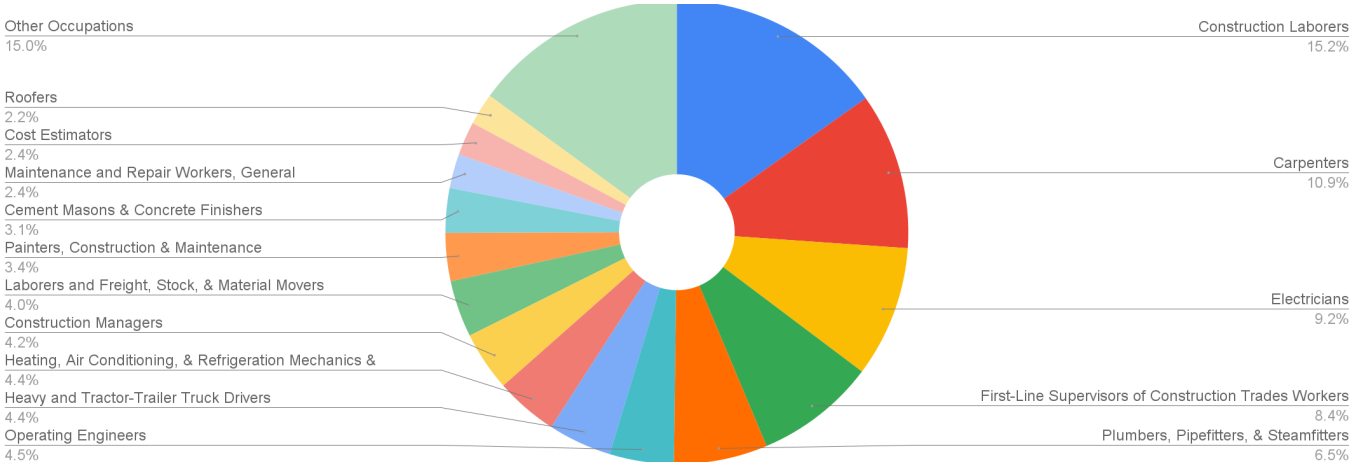
OCCUPATIONAL IMPACTS

The main difference between the decarbonization scenarios and the reference scenario is the higher percentage of construction occupations. The largest categories of job growth are in construction and extraction occupations (in Nevada, which has almost no fossil fuel extraction, this category makes up only construction occupations); office and administrative support occupations; installation, maintenance and repair occupations; sales and related occupations; transportation occupations; and management occupations. While the number of jobs in each occupational category differs by scenario, the distribution of jobs across occupations is consistent across the three decarbonization scenarios. This information is important for guiding workforce development activities so that the number of new workers trained is calibrated to the creation of jobs. This principle is important for ensuring that workers and employers who invest in training see a return on that investment.

The specific needs for workers trained in different occupations will vary and will differ from the IMPLAN modeled distribution of decarbonization work among construction occupations shown in Figure 7. IMPLAN's assignment of occupations to industries is based on federal employment surveys, and the categorization does not perfectly represent nuanced differences between general energy-related construction and renewable energy construction. The occupations required to install wind turbines and solar photovoltaic (PV) farms differ from those required to install new transmission lines. In addition, the jurisdictional boundaries of different work tasks can vary by trade. That said, most of the jobs in wind and solar construction and installation will fall within traditional construction occupations (i.e. laborers, carpenters, electricians, etc.).

The key take-away for workforce development is to focus on broad occupational training leading to industry-recognized credentials, rather than investing in technology-specific training. This will allow greater transferability of skills across clean energy industries, provide workers more stable employment and job security, and ensure the State of Nevada has the qualified workers needed to implement the full range of decarbonization activities.

Figure 7. Distribution of Jobs, by Clean Energy Construction, Operations, and Building Retrofit Occupations: Decarbonization Scenarios



The top nine clean energy construction and building retrofit-related occupations are provided in the charts in Figure 8. These charts show the top construction jobs for the central scenario for all three Nevada regions. The results for each scenario are shown in Appendix E. For the clean energy transition in Nevada to create good, stable employment, the state will need to adopt a strategy ensuring steady investment in energy efficiency, renewable energy, EV charging infrastructure, and other associated infrastructure rather than wait to make such investments. The data should inform workforce development staff and apprenticeship coordinators to expand education and training programs across regions, calibrated to growing demand for particular occupations. Toward that end, these bars represent single-year snapshots of labor market demand due to decarbonization.

Figure 8. Top Eight Clean Energy Construction and Building Retrofit Occupations, by Region: Central Scenario in Three Most-Affected Regions

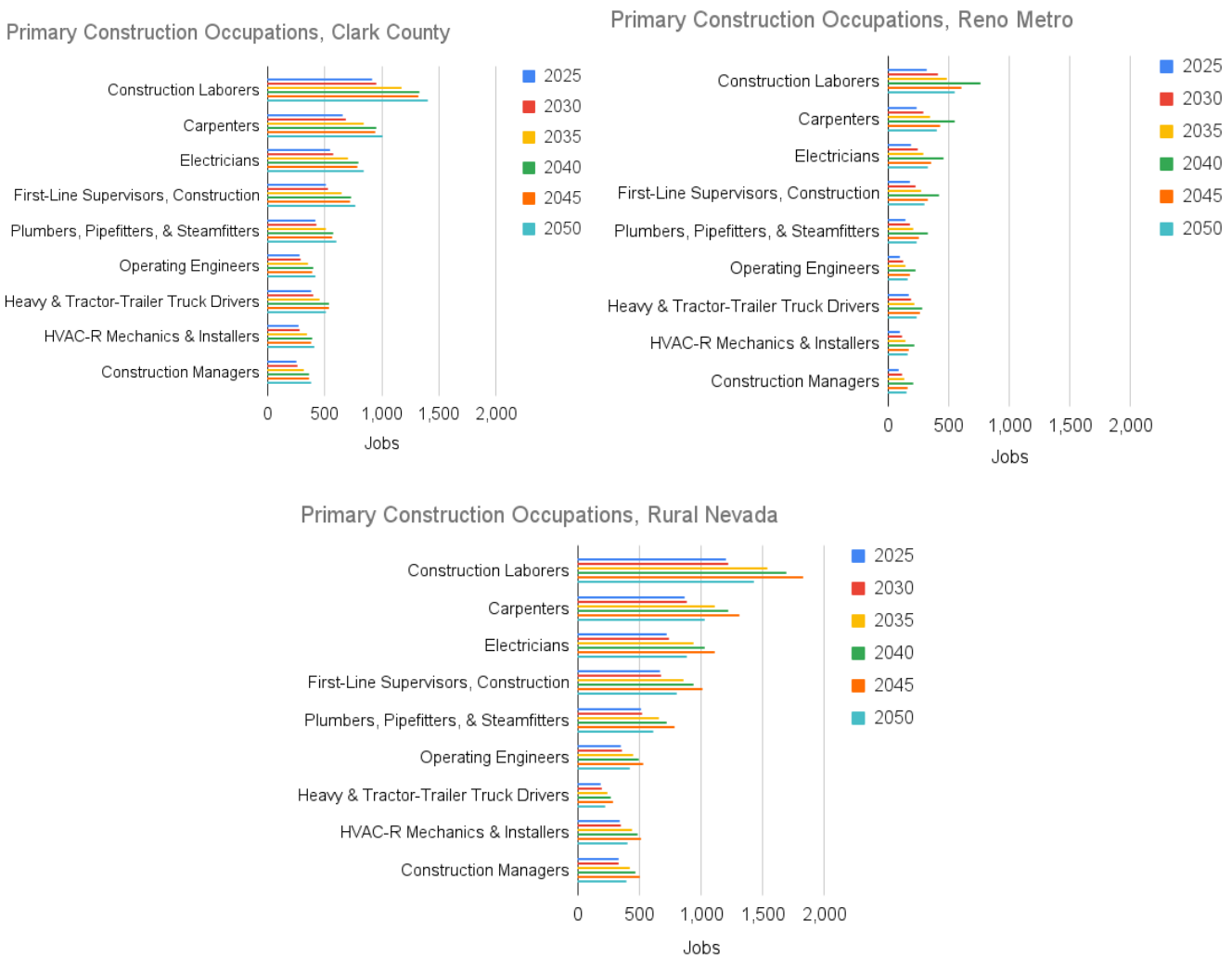


Table 5 provides the most recent wage data and educational and licensing requirements for the top clean energy occupations in Nevada. All of these occupations are apprenticeable, and registered apprenticeship programs exist for these occupations throughout Nevada. Appendix F provides information on the registered apprenticeship programs in Nevada. Some apprenticeships are offered by single employers, while others are offered through joint labor–management apprenticeship training councils. Even among registered apprenticeships, quality can vary. More information on quality apprenticeships, including journey-level wages for the occupations in Table 5, is provided in the next section.

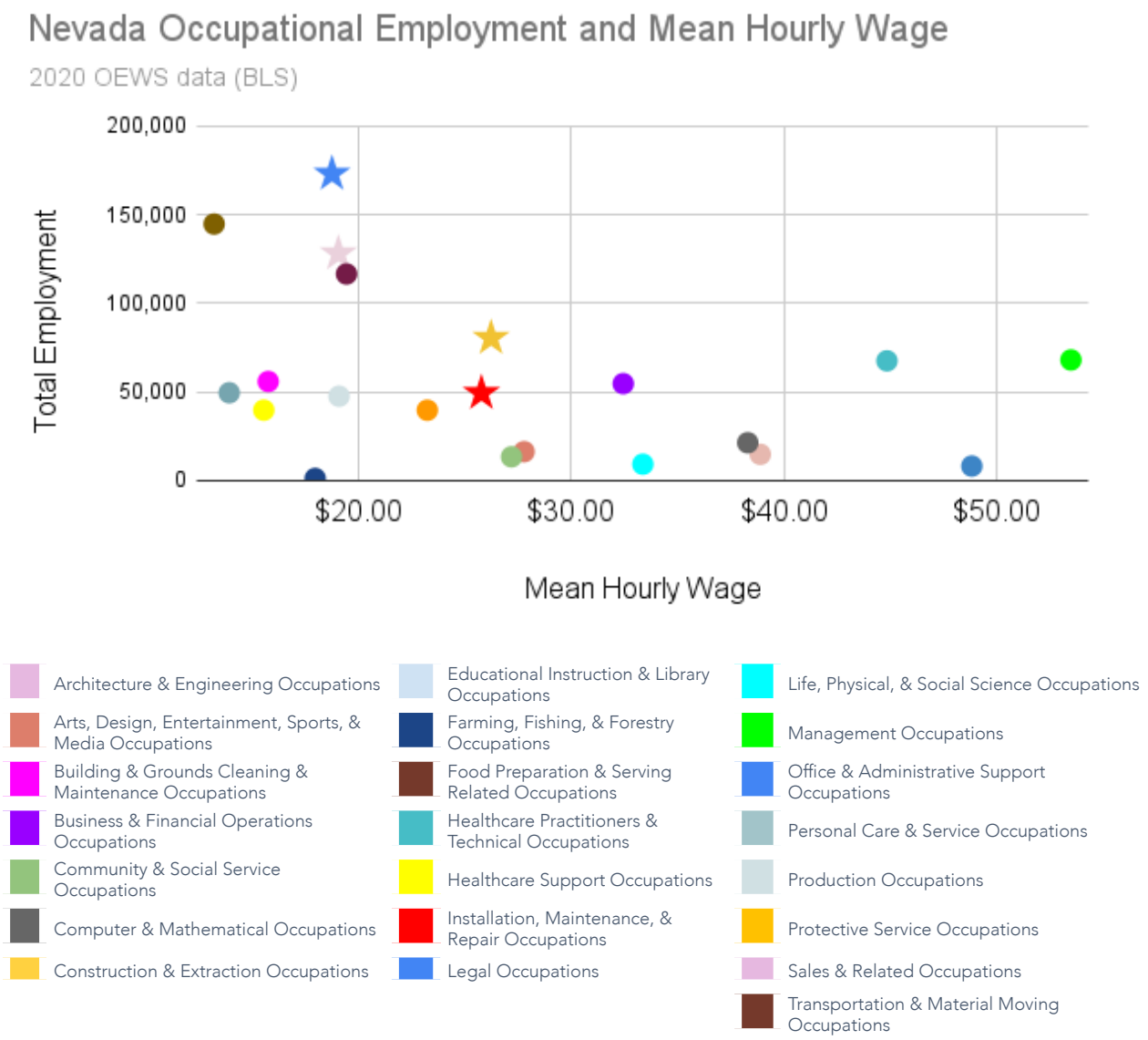
Table 5. Wages, Educational and Licensing Requirements for Top Clean Energy Occupations[23]

Occupation	Total employment	Average wage per hour	10th percentile wage per hour	90th percentile wage per hour	Educational requirements	License or Certification[24]
Construction Laborer	10,850	$18.60	$11.65	$28.13	Usually less than high school	No
Carpenter	12,670	$28.06	$14.09	$47.04	Usually at least high school diploma or equivalent	C-3 Carpentry Contractor
Electrician	7,240	$32.44	$17.87	$48.61	Trade school or apprenticeship program	Master Electrician
First-line Supervisor of Construction Trades Workers	6,460	$34.90	$21.48	$51.00	Usually at least high school diploma or equivalent	Contractor's license
Plumbers, Pipefitters, & Steamfitters	4,540	$30.26	$17.58	$49.95	Trade school or apprenticeship program	Master Plumber
Operating Engineers & Other Construction Equipment Operators	4,980	$26.35	$16.61	$38.77	Usually at least high school diploma or equivalent	Not specified
Tractor & Trailer Truck Drivers	12,100	$24.59	$16.98	$33.62	Usually less than high school	Commercial driver's license
Heating, Air Conditioning, & Refrigeration Mechanics & Installers	3,000	$26.84	$16.64	$38.48	Usually trade school or apprenticeship program	C-1 Plumbing or Heating Contractor

23 Bureau of Labor Statistics, Department of Labor, "May 2020 OEWS Estimates," accessed August 13, 2021, www.bls.gov/oes.
24 "NAC Chapter 624 - Contractors," Nevada State Legislature, accessed August 13, 2021, https://www.leg.state.nv.us/NAC/NAC-624.html#NAC624Sec200.

Figure 9 provides the most recent statewide employment numbers and hourly wages by occupational category. The occupations depicted by stars represent those with the highest job growth due to decarbonization. While these are not the highest-paid occupations in the state, the data indicate that decarbonization activities have the potential to create living wage jobs for workers without a four-year or professional degree. There is always room to improve worker compensation and doing so may be necessary to ensure an adequate supply of workers.

Figure 9. Nevada Employment and Mean Hourly Wage, by Occupational Category



JOB QUALITY AND INCLUSION

Good jobs can broadly be defined as those offering family-sustaining compensation, job security, and career mobility. Improving economic inclusion requires not only that good jobs exist (job quality), but that the diverse population of workers has equitable access to them (job access).

A pathway to a secure career in clean energy involves equipping workers with the skills they need to succeed in the in-demand occupations and calibrating training programs to market demands with a view to long-term job security. In the construction sector, quality pre-apprenticeship and apprenticeship programs strike this balance, providing established pathways to secure, family-sustaining jobs during and beyond the energy transition.

JOB QUALITY

Many clean energy training programs focus on a narrow set of skills that prepare workers for a narrow set of work tasks. This exposes them to excessive market volatility compared with workers who receive broad occupational training.

The significant growth in demand for construction workers in both the basic and specialty trades is apt to raise concerns about labor shortages and a need for investments in workforce training. Indeed, Indeed, meeting aggressive climate goals will require massive infrastructure investments and significant growth in construction occupations. However, labor shortages cannot be adequately addressed with training or other "supply-side" strategies alone. Jobs must offer enough in the way of security, compensation, and other benefits to attract and retain skilled workers.

Since the 1970s, construction has shifted dramatically toward a "gig economy" model of self-employment, cutting costs for employers by stripping workers of benefits and protections. As a result, poor conditions for workers play a large part in the perceived "labor shortage." With only 20 percent of construction projects in the United States today completed by unionized firms—compared to 80 percent in the 1970s—workers have increasingly lost leverage to combat low wages, job insecurity, lack of benefits and mobility, and abuses such as wage theft, which are all widespread today.[25] Moreover, as union-coordinated apprenticeship programs declined in response to this trend, the non-union sector failed to organize an alternative system for training workers. The "skills gap" decried for decades by homebuilders, homeowners, and construction firms has made plain the importance of organized training in maintaining a robust pool of skilled labor. Training requires time and money. Unless the acquisition of credentials is tied to increased wages and better benefits, neither workers nor employers will make this investment.

Moreover, workforce development programs that focus on the *supply side* of the labor market can flood the market with new trainees ready to work when jobs for them do not exist. Excessive supply of trained workers relative to demand can drive down wages, which hurts incumbent workers as well as trainees, destabilizing and de-skilling the industry as retention of skilled and experienced workers becomes more challenging under these conditions. Furthermore, many supply-side training programs in the clean energy sector focus on a narrow set of skills that prepare workers for a narrow set of work tasks. Solar installation and wind technician programs are two examples of training that focus on narrowly defined skills, education, and competencies of workers, which exposes them to excessive market volatility.

25 For historical analysis of the "labor shortage" phenomenon in construction, driven by anti-union agendas since the 1960s and 19070s, see Andrew Yamakawa Elrod, "Built Trades," Phenomenal World, August 11, 2021, https://phenomenalworld.org/analysis/construction-labor-shortage.

Registered Apprenticeship

Broad occupational training, such as registered apprenticeships, can insulate against such volatility by strengthening workers' attachment to their occupations. Apprenticeship is an earn-as-you-learn training model with articulated wage progressions as trainees acquire skills and experience. Apprentices engage in both on-the-job training and classroom-based education, learning the theoretical and practical knowledge and skills to successfully complete a broad range of occupational tasks, including those required for a clean energy transition.

Construction union apprenticeships are overseen by joint labor–management–apprenticeship training committees (JATCs), ensuring that the training meets the needs of workers as well as employers. Union apprenticeships are carefully calibrated to labor market demand. JATCs estimate how much work is coming up and how many new apprentices need to be recruited to fill the positions. This demand-driven model helps ensure that individuals who invest time in their skills development and training and employers who support them will see a return on their investment, while also ensuring that employers will have access to sufficiently skilled and trained labor to complete contracted jobs.

While apprenticeship training is expanding across many industries, the quality of apprenticeship programs varies significantly. Registered apprenticeships are vetted by either the U.S. Department of Labor, in the case of federally-registered apprenticeships, or the Nevada State Apprenticeship Council, in the case of state-registered apprenticeships. In both cases, key elements of registered apprenticeships is that they provide pathways to certification by completing a specified number of on-the-job training hours and related technical instruction, and involve a demonstration of competency in defined subject areas. Even for registered apprenticeships, graduation rates are indicative the quality of the program. An effective program should be able to graduate about 50 percent of its apprentices. JATC programs are responsible for the majority of apprentices, and perhaps even more importantly, apprenticeship graduates.

Rather than investing solely in workforce education and training, decarbonization investments should also be tied to workforce standards that can "pull" trained workers into jobs. Project labor agreements, project stabilization requirements, community workforce agreements, responsible contractor pre-qualification, best-value contracting, prevailing wage requirements, and skill standards are all demand-side levers that create the market conditions to address labor shortages and expand opportunities for career-track training. Labor standards on public, ratepayer, and private investments will create more openings in quality apprenticeship programs.

Apprentices engage in both on-the-job training and classroom-based education, learning the theoretical and practical knowledge and skills to successfully complete a broad range of occupational tasks, including those required for a clean energy transition.

As more apprenticeship openings and programs are created, investments also need to be made in creating more inclusive access to these opportunities. Barriers can be addressed through quality pre-apprenticeship or apprenticeship-readiness programs that provide a range of individualized support services during and after program completion to foster skills that workers need to enter and succeed in construction careers. Training programs can provide soft skills, professional development, and math tutoring to help applicants meet common criteria, as well as transportation and childcare support to reduce and remove barriers to success, disproportionately affecting women and workers of color.[26] Diversity and cultural competency training and practices among program staff and peers can likewise foster more inclusive and welcoming environments.

26 North America's Building Trades Unions, "Requirements Matrix," North America's Building Trades Unions, March 2017, https://nabtu.org/wp-content/uploads/2017/03/Requirements-Matrix.pdf, quoted in Frank Manzo, Betony Jones, and Katherine Luke, "How to Achieve Economic Justice in Illinois' Clean Energy Transition" Sierra Club and Inclusive Economics, January 2021, https://drive.google.com/file/d/1gEE1zRgg17YAsEvR-ngAgMTQuSRlYl4l/view

Installation labor represents just 11 percent of total solar project costs, so even large increases in worker compensation, have small effects on solar project costs.

Photo Credit: Catherine Werner, City of St. Louis, IBEW Training Center

Prevailing Wage

Prevailing wage laws work to recruit and retain skilled workers in the construction industry. While concerns that prevailing wage rules increase project costs abound, the vast majority of peer-reviewed studies have concluded that prevailing wage laws have no impact on public construction costs.[27] Labor costs represent a low percentage of total costs on construction projects, generally, and an even lower percentage of total costs on clean energy projects. Nationwide, in 2012, labor costs accounted for approximately 23 percent of total costs in construction, while the most recent federal data indicate that labor costs were just 11 percent of total solar project costs.[28, 29] This means that even wage increases of 20 percent would have minimal impact on construction costs, even before accounting for improved productivity, which tends to offset the potential impact.[30] When wages increase in construction, higher-skilled workers substitute in for less-productive workers.[31] Studies show that worksite productivity improves 14 to 33 percent as a result.[32, 33] Prevailing wage laws, therefore, increase worker efficiency, stabilize costs, and help to retain a skilled workforce.[34]

27 Frank Manzo and Kevin Duncan, "An Examination of Minnesota's Prevailing Wage Law: Effects on Costs, Training, and Economic Development" (Midwest Economic Policy Institute, 2018). An analysis of 335 school construction projects built before and after the 2015 repeal of prevailing wage in Indiana reveals that repeal had no statistical impact on the average cost per public school project. See: Frank Manzo and Kevin Duncan, "The Effects of Repealing Common Construction Wage in Indiana: Impacts on Ten Construction Market Outcomes" (Midwest Economic Policy Institute, 2018), https://midwestepi.files.wordpress.com/2018/01/mepi-csu-effects-of-repealing-common-construction-wage-in-indiana-final.pdf.

28 U.S. Census Bureau, "2012 Construction (NAICS Sector 23)," 2016, https://www.census.gov/data/tables/2012/econ/census/construction.html.

29 David Feldman, Vignesh Ramasamy, Ran Fu, Ashwin Ramdas, Jal Desai, and Robert Margolis. "U.S. Solar Photovoltaic System and Energy Storage Cost Benchmark: Q1 2020" (National Renewable Energy Laboratory [NREL], January 2021), https://www.nrel.gov/docs/fy21osti/77324.pdf, 45.

30 Furthermore, by promoting the use of higher-skilled workers, prevailing wage laws reduce expenditures on materials, fuels, and rental equipment. See: Kevin Duncan and Alex Lantsberg, "How Weakening Wisconsin's Prevailing Wage Policy Would Affect Public Construction Costs and Economic Activity" (National Alliance for Fair Contracting, 2015).

31 William Blankenau and Steven Cassou, "Industry Estimates of the Elasticity of Substitution and the Rate of Biased Technological Change between Skilled and Unskilled Labor," Applied Economics 43, no. 23 (2011): 3129–42.

32 Peter Philips, "Environmental and Economic Benefits of Building Solar in California: Quality Careers, Cleaner Lives" (Donald Vial Center on Employment in the Green Economy, Institute for Research on Labor and Employment University of California, Berkeley, 2014), http://laborcenter.berkeley.edu/pdf/2014/building-solar-ca14.pdf.

33 Other important factors to consider include apprenticeship enrollment, which is 6 to 8 percent higher, and apprentice completion of on-the-job and classroom training, which occurs at faster rates in states with prevailing wage laws. See: Cihan Bilginsoy, "Wage Regulation and Training: The Impact of State Prevailing Wage Laws on Apprenticeship" (Working Paper Series, Department of Economics, University of Utah, 2003), https://ideas.repec.org/p/uta/papers/2003_08.html; Cihan Bilginsoy, "The Performance of ABC-Sponsored Registered Apprenticeship Programs in Michigan: 2000-2016" (Illinois Economic Policy Institute, 2017).

34 Frank Manzo, Betony Jones, and Katherine Luke, "How to Achieve Economic Justice in Illinois' Clean Energy Transition" (Sierra Club and Inclusive Economics, January 2021), https://drive.google.com/file/d/1gEE1zRgg17YAsEvR-ngAgMTQuSRlYl4l/view.

Nevada Apprenticeship Data

Tables 6 and 7 present the U.S. Department of Labor's record of Nevada apprentices and programs for Q3 2020.

An apprenticeship is a multi-year earn-as-you-learn occupational training. A journeyman, or journeyperson, is a worker who has completed an apprenticeship qualifying them to be employed in a specific trade.

Table 6. Nevada Apprentices and Apprenticeship Graduates, by Industry

Industry	Active Apprentices	Journey Employees	Female Employees	Employees of Color
Construction	6,036	41,186	2,672 (5.6%)	12,393 (26.2%)
Non-Construction	31	894	8 (0.9%)	6 (0.6%)
Utilities	165	995	18 (1.6%)	336 (29.0%)
Grand Total	6,232	43,075	2,698	12,735

Many of Nevada's registered apprenticeship programs provide on-the-job training for jobs critical for decarbonization. Surveying the most recent apprenticeship data for the state in Registered Apprenticeship Partners Information Database System (RAPIDS) for 2020 Q3, there were 6,232 active apprentices, 6,036 of whom were in construction and industry-related occupations most relevant to decarbonization needs.[35]

Table 7. Nevada Construction Apprentices and Apprenticeship Graduates, by Program Type

Union/ Non-Union	Active Apprentices	Journey Employees	Female Employees	Employees of Color
Non-Union	1,090	3,498	34 (0.7%)	793 (17.3%)
Public	271	4,057	511 (11.8%)	1,385 (32%)
Union	4,675	33,631	2,127 (5.6%)	10,215 (26.7%)
Grand Total	6,036	41,186	2,672	12,393

In Nevada, 4,675 apprentices were in joint labor–management apprenticeship (JATC) programs. These programs have higher completion rates than non-union programs in Nevada. Of registered construction apprentices in Nevada, 39 percent of apprentices in joint labor–management programs have graduated versus 32 percent in the non-union programs. In addition to higher graduation rates, the union programs are about five times larger than the non-union programs in terms of enrollment. The federally registered apprenticeship programs for the most in-demand occupations are shown in Table 8.

35 "Employment and Training Administration | Registered Apprenticeship Partners Information Database System (RAPIDS)," Data and Statistics | U.S. Department of Labor, accessed July 23, 2021, https://www.dol.gov/agencies/eta/apprenticeship/about/statistics/2020.

Table 8. Nevada Federally Registered Apprenticeship Program, Highest-Growth Occupations

Program Name	Region	Occupation	Journeyperson Wage
Carpenters JATC Northern Nevada	Reno Metro	CARPENTER	$28.94
Carpenters JATC Southern Nevada	Clark	CARPENTER	$37.00
		CARPENTER, PILEDRIVER	$35.00
		CARPENTER, ROUGH	$35.00
Electrical Workers Local 357 JATC	Clark	ELECTRICIAN (Alternate Title: Interior Electrician)	$44.00
Titanium Metal JATC	Clark	ELECTRICIAN, MAINTENANCE	$26.15
Operating Engineers Local # 3 JATC	Reno Metro	OPERATING ENGINEER (Alternate Title: Heavy Construction Equipment Mechanic)	$30.00
		TRUCK CRANE OPERATOR (Alternate Title: Crane Operator)	$32.00
Plumbers Local 350 JATC	Reno Metro	PLUMBER	$35.78
		REFRIGERATION UNIT REPAIRER	$25.64
Plumbers Local 525 JATC	Clark	PLUMBER	$41.41
Southern Nevada Operating and Maintenance Engineers JATC Local 501	Clark	STATIONARY ENGINEER	$31.00
Stationary Engineers Local 39 JATC	Reno Metro	STATIONARY ENGINEER	$19.00

Table 9 lists the total number of employees who are journey level, female, workers of color, and active apprentices for these apprenticeships. While participation by women and workers of color may seem low, there is value in programs that track actual data in this regard. As the adage goes, what gets measured improves.

Program Name	Journey Employee Count	Female Employee Count	Workers of Color	Journeyperson Wage
Carpenters JATC Northern Nevada	1266	3	49	267
Carpenters JATC Southern Nevada	3192	37	1485	644
Carpenter JATC Piledrivers	2	0	0	0
Carpenters JATC Scaffold	11	0	7	72
Electrical Workers Local 357 JATC	869	194	638	388
Titanium Metal JATC	20	0	0	0
Operating Engineers Local # 3 JATC	212	5	65	58
Plumbers Local 350 JATC	560	5	10	64
Plumbers Local 525 JATC	600	22	147	19
Southern Nevada Operating and Maintenance Engineers JATC Local 501	2000	100	100	68
Stationary Engineers Local 39 JATC	12	0	1	0
Operating Engineers Local # 3 JATC	59	1	12	2

Of the Nevada apprenticeship data reported in the RAPIDS system, about one-third of active apprentices were in the electrical trades, and another 10 percent were plumbers and pipefitters. The carpenter and basic trades account for the rest.

EQUITY AND INCLUSION

Photo Credit: Rising Sun Center for Opportunity

Non-discrimination policies are meant to support equity and inclusion, but their real-world effectiveness is limited if they are unenforced or out of date. United States Federal Executive Order 11246 stipulates that federal contractors and contractors who receive federal assistance for construction projects must adhere to specified non-discrimination policies. These measures include participation goals of 6.9 percent for female workers nationwide and geographically specific goals for workers who are Black, Indigenous, and People of Color (BIPOC), which includes workers of Hispanic or Latinx ethnicity whether or not they identify as white.

While these federal standards are available and calculated to represent the demographic and geographic diversity of Nevada, the BIPOC inclusion goals are based on the 1970 Census and are out of date with the current racial and ethnic composition of some regions.[36] For example, the targets for BIPOC inclusion in Nevada range from 8.2 percent in Reno (Washoe County) to 13.9 percent in Las Vegas (Clark County), [37]whereas the U.S. Census Bureau's 2019 American Community Survey estimates that, collectively, the BIPOC population and people of Hispanic/Latinx ethnicity who identify as white make up 35.9 percent of the population in Washoe County and 60.6 percent in Clark County.[38, 39]

36 "Technical Assistance Guide for Federal Construction Contractors: Participation Goals for Minorities and Females" (U.S. Department of Labor, n.d.), http://federalconstruction.phslegal.com/wp-content/uploads/sites/116/2006/11/Construction_Contractor_Guide.pdf.

37 Office of Federal Contract Compliance Programs - U.S. Department of Labor, "FAQs on Nondiscrimination in the Construction Trades," accessed January 20, 2019, https://www.dol.gov/ofccp/regs/compliance/faqs/NondiscriminationConstructionTrades_FAQs.htm#Q14.

38 For each county, calculated as the difference between "Total Population" and "White alone, not Hispanic or Latino." 2019 American Community Survey 5-Year Estimates, "U.S. Census Bureau - Geography Profile: Washoe County, Nevada | People and Population | Race and Ethnicity" (2019), https://data.census.gov/cedsci/profile?g=0500000US32031.

39 2019 American Community Survey 5-Year Estimates, "U.S. Census Bureau - Geography Profile: Clark County, Nevada | People and Population | Race and Ethnicity" (2019), https://data.census.gov/cedsci/profile?g=0500000US32003.

Photo Credit: Rising Sun Center for Opportunity

Furthermore, federal standards require that contractors "engage in outreach and other good faith efforts to broaden the pool of qualified candidates to include minorities and women," meaning that if contractors fail to meet the participation goals, they are not in violation of the Executive Order.[40] State and local funding agencies could adopt more-stringent requirements that trigger penalties when contractors fail to meet the established criteria for participation.[41,42]

In Nevada, in 2019, according to the Solar Foundation's Solar Jobs Census, 19.4 percent of solar jobs were held by women. This figure falls below the national average of 26 percent. Hispanic or Latinx workers held 17.6 percent of solar jobs, up from 14.6 percent in 2015.[43,44] As the clean energy economy matures, inclusion and equitable participation of women and people of color at all levels of employment across all industries (not only solar) must be a guiding principle.

40 "Nondiscrimination in the Construction Trades - FAQ," U.S. Department of Labor.

41 Julian Gross and PolicyLink, "Local and Targeted Hiring" (Policy Brief, Local Progress: The National Municipal Policy Network), accessed February 1, 2021, https://www.policylink.org/find-resources/library/local-and-targeted-hiring.

42 For example, the City and County of San Francisco passed a Local Hire Ordinance in 2011 applying to "contracts for public work or improvement projects with an engineer's estimate in excess of $400,000," with an applicable penalty for failure to comply in the "amount equal to the journeyman or apprentice prevailing wage rate for the primary trade used by the contractor for each hour the contractor fell short." San Francisco - Office of Economic and Workforce Development, "San Francisco Local Hiring Policy for Construction Fact Sheet," San Francisco Public Works, accessed September 23, 2021, https://www.sfpublicworks.org/sites/default/files/2081-5%20Local%20Hire%20Fact%20Sheet.pdf.

43 The Solar Foundation, "Nevada Solar Jobs Census 2019" (2019), https://www.solarstates.org/#state/nevada/counties/solar-jobs/2019.

44 The Solar Foundation, "Nevada Solar Jobs Census 2015" (2015), https://www.solarstates.org/#state/nevada/counties/solar-jobs/2015.

A related national study, *U.S. Solar Industry Diversity Study 2019: New Resources on Diversity and Inclusion in the Solar Workforce*, surveyed 377 solar industry firms and 398 employees (72.5-percent men and 27.2-percent women). The responses indicate that people of color were less likely to be in manager, director, or president (MDP) positions: 37 percent of white solar workers held MDP positions, compared to 35 percent of Black solar workers and 25 percent workers of other races. While white workers made up 73.3 percent of the solar workforce overall, they held 88 percent of top executive positions. Although around 6 percent of both men and women respondents fell in the highest wage bracket of $75 or more per hour, the overall gender wage gap in solar stood at 26 percent, i.e., women earning 74 cents on the dollar compared to men. Only 26 percent of women reported being "very satisfied" with their wage and position, compared to 40 percent of men.

In terms of career advancement, the study finds the gender gap endures and is significantly greater for women of color: only 60 Black women for every 100 men receive promotions to a manager position, compared to a ratio of 84 to 100 for white women.[45] Moreover, the previous edition of the study in 2017 reported that women of color were "grossly excluded from the highest wage category, with only 4 percent of women of color earning wages above $75 per hour."[46]

45 "U.S. Solar Industry Diversity Study 2019: New Resources on Diversity and Inclusion in the Solar Workforce" (The Solar Foundation, Solar Energy Industries Association [SEIA], 2019), https://www.thesolarfoundation.org/diversity/.

46 "U.S. Solar Industry Diversity Study 2017: Current Trends, Best Practices, and Recommendations" (The Solar Foundation, 2017), https://irecusa.org/resources/2017-solar-industry-diversity-study/.

RECOMMENDATIONS

Both climate change and the energy transition will affect workers—workers in the fossil fuel and energy-intensive industries, workers subject to the vagaries of harsh weather, workers dependent on natural resources threatened by climate change, and workers who have never had access to secure employment. The energy transition will create new jobs but may also see the decline of long-established jobs. While the data in this report do not model significant job loss, shifting to a carbon-neutral economy will change the composition of the state's occupations and industries.

To maximize benefits and minimize costs on its path to decarbonization, Nevada should continue investing in just transition tools and resources, support the growth of high-quality jobs, and improve access to jobs and contracting opportunities for women, people of color, and other marginalized people.

1. Just Transition

If industries shutter, individual workers—and in some cases, entire communities—will require support to avoid excessive hardship. Workers may need retraining, wage guarantees, or bridges to retirement. Communities may require economic diversification and development investments. These are the elements of a just transition, but the need for transition support is best averted by minimizing industry destabilization that leads to abrupt layoffs.

Minimizing transition risks requires long-term planning. There are uncertainties as to the future of fossil fuel extraction and use, but when uncertainty leads to inaction, there is real risk for workers. Setting targets and engaging in long-term planning are essential to avoid industry death spirals and disorderly worker displacement. Avoiding layoffs requires managing fossil fuel decline to avoid—or at least plan for—the disruption to existing industries. By looking ahead, the state can negotiate retention bonuses to retain skilled workers even as an industry contracts, align industry contraction with retirements, and minimize or avoid layoffs. Long-term planning is also required for comprehensive statewide industrial strategy that is compatible with and supportive of a decarbonized economy as well as forward-looking economic diversification across all of Nevada's unique regions.

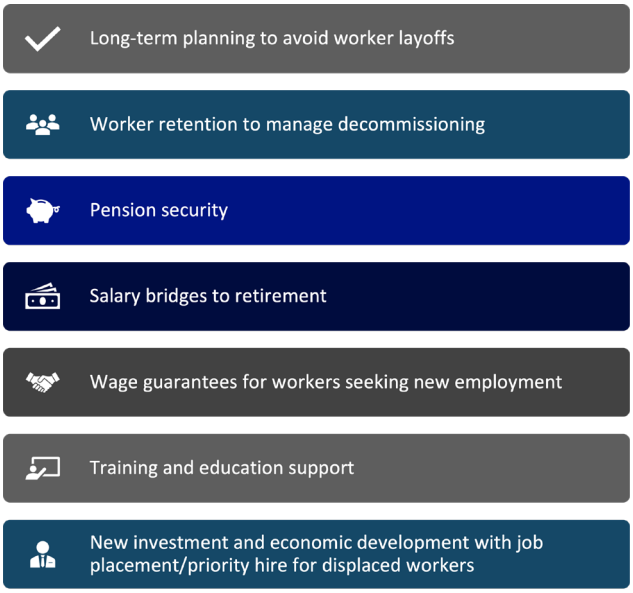


Figure 10. Components of a Just Transition for Fossil Fuel Workers

2. Support High-Road Jobs

Creating secure family-sustaining jobs means both supporting responsible "high-road" employers and closing off the "low road" whereby firms gain a competitive advantage by skirting laws and regulations. High-road employers are those who invest in: reduction of pollution, emissions, and other environmental impacts; workplace health and safety; and employee benefits, compensation, and training. High-road firms cannot compete in an economy (or energy plan) in which low-road firms are allowed to cut corners with impunity. Growing responsible businesses requires adopting and enforcing robust rules so that all participants in an industry meet threshold responsible employer criteria. In a global economy, Nevada must align different facets of labor, economic, and industrial policy to explicitly support the high-road path to decarbonization. Tools include:

PUBLIC PROCUREMENT: JOB-QUALITY STANDARDS

In order to firmly counter a "race to the bottom," labor standards, inclusive hiring practices, and environmental standards need to be embedded in RFPs and contracts whenever the state is spending money on goods or services. In general, public procurement is an under-utilized lever for meeting climate, equity, and workforce goals. It is through the procurement of both goods and services that the state government signals its policy priorities. Prevailing wage laws establish criteria for the utilization of registered apprentices as well as a threshold for worker pay and benefits. These laws ensure that firms employing skilled workers are not underbid, that public works construction can attract and retain a skilled workforce, that industry accounts for the full costs of doing business (i.e., not passing costs on to taxpayers by paying sub-standard wages that require welfare subsidies), and that public dollars will support the training of the next generation of skilled workers through apprenticeship.

Beyond construction, public contracting for other services is also a lever for job quality and job access. When a public contracting process prioritizes lowest cost over best value, it actually undermines the goals of developing a skilled, stable, and diverse workforce. Nevada procures a wide range of products and services, many of which are related to its energy goals. Energy service contracts, transit vehicle purchases, and other public contracts are opportunities to ensure that the jobs the state is supporting are high-quality jobs accessible to workers of color and other marginalized individuals.

The U.S. Employment Plan (USEP) developed by the Jobs to Move America Coalition is a customizable tool to encourage companies competing for public procurement contracts to disclose information on job creation, job quality, and plans to recruit and train historically marginalized workers. It provides public agencies with guidance on building good jobs and equity into their bidding processes. LA Metro, Amtrak, and Chicago have already used USEP, and new legislation proposed in New York State would mandate the public bus system's conversion to electric using USEP.[47]

47 Jobs to Move America, "U.S. Employment Plan," April 10, 2020, https://www.ladbs.org/services/green-building-sustainability/existing-buildings-energy-water-efficiency-program/2016-ebewe-annual-report.

In addition to supplier diversity goals, it is equally important to establish standards protecting workers on public contracts. In the slow economic recovery following the Great Recession, more than 300,000 workers on federal contracts were victims of wage-related labor violations,[48] and repeated analyses of federal contracting data show that this trend is ongoing. Lowest-bid contracting especially harms women and workers of color, who are disproportionately employed in low-pay and high-risk industries.[49] High-road contracting can help end economic segregation that consigns women and workers of color to low pay and multigenerational wealth disparities. Nevada can immediately put to use its annual outsourcing budget to ensure private sector adherence to the state's climate, equity, and workforce goals.

PRIVATE INFRASTRUCTURE REGULATION AND INCENTIVES

While prevailing wage laws only apply to projects where state or federal money is used, the state can leverage its other powers to improve the quality of jobs in the private sector. A tax credit can be offered for projects that meet certain labor standards, along with a tax exemption for projects that pay prevailing wage and for projects developed under a Project Labor Agreement (PLA) or Community Workforce Agreement (CWA).

Beyond tax credits and exemptions, permit review and licensing and skill standards are other ways the state government can influence job quality in the private sector. California just adopted legislation to require EV Infrastructure Training Program (EVITP) certification for crews that install EV charging infrastructure.[50] Illinois requires that distributed solar installers meet certification criteria equivalent to at least an associate degree.[51] Stringent licensing and skill standards can improve job quality while also ensuring public safety.

These measures should not be considered costs to state government because there are significant public benefits of higher worker wages. When jobs do not pay enough, workers turn to public assistance in order to meet their basic needs. Welfare expenditures can be reduced by higher wages and increases in employer-provided health insurance.

CUT OFF THE LOW ROAD

Improving job quality will be more difficult and less effective if firms that skirt laws and regulations continue to undercut responsible employers. In the gig economy, misclassifying employees as independent contractors allows companies to avoid supporting the social safety net or reimbursing workers for the costs incurred in doing their job, such as mileage reimbursement. Employee classification protects workers through workers compensation insurance, family and medical leave, unemployment insurance, and workplace health and safety laws. One study on the misclassification of truck drivers in California shows that compliance with the state's environmental regulation was lower for misclassified drivers because they could not afford the costs of compliance.[52] Cutting off the low road through increased enforcement and fines is essential for meeting the state's energy, equity, and workforce goals.

48 Office of Senator Elizabeth Warren, "Breach of Contract: How Federal Contractor Fail American Workers on the Taxpayer's Dime" (United States Senate), accessed August 13, 2021, https://www.warren.senate.gov/files/documents/2017-3-6_Warren_Contractor_Report.pdf.

49 In the Public Interest, "How Privatization Increases Inequality" (In the Public Interest, September 28, 2016), accessed August 13, 2021, https://www.inthepublicinterest.org/wp-content/uploads/InthePublicInterest_InequalityReport_Sept2016.pdf.

50 "Energy: Transportation Electrification: Energy Efficiency Programs: School Energy Efficiency Stimulus Program," Pub. L. No. AB-841 (2020), https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201920200AB841.

51 "Illinois Solar Energy Association - Distributed Generation Installer Certification," Distribution Generation Installer Certification, accessed August 13, 2021, https://illinoissolar.org/dgcertification.

52 Sam Appel and Carol Zabin, "Truck Driver Misclassification: Climate, Labor, and Environmental Justice Impacts" (UC Berkeley Labor Center, August 2019), https://laborcenter.berkeley.edu/pdf/2019/Truck-Driver-Misclassification.pdf.

3. Improve Access to Economic Opportunity for People of Color, Women, and Other Marginalized Groups[53]

While we cannot achieve equity without ensuring job quality, improving job quality does not automatically improve equity. In fact, often, as job quality improves, jobs tend to become more exclusionary. This is the result of a broken system, and deliberate investments are required to counter this trend and build a system of equity and inclusion. These investments involve building and strengthening partnerships between employers, training providers, and community-based organizations; securing commitments from employers to hiring participants of training programs; conditioning financial assistance for clean energy or workforce development on targeted hire standards; expanding public sector employment; and improving access to broad occupational training.

BUILD PLACE-BASED TRAINING PARTNERSHIPS

When investing in workforce education and training, respond to employer needs, but also secure employer commitments to interviewing and hiring graduates of the training programs. In addition to employer partnerships, partnering with community-based organizations can support improved recruitment of under-represented populations and provide support services needed for participant success, such as childcare, transportation, mentoring, counseling, or other supports. No single entity in a community can, alone, correct for historic and systemic racism and sexism in tan industry. To ensure diversity, equity, and inclusion, invest in establishing and strengthening formal partnerships.

CONDITION PUBLIC FUNDING ON TARGETED HIRE STANDARDS

By emphasizing both job quality and job access together, Nevada can enable inclusive access not only to jobs, but to good, career-track, family-sustaining jobs. Job training and education may improve outcomes for individual workers, but demand-side levers in the procurement process—like targeted and local hire criteria—are essential "pull" mechanisms that ensure upward mobility. To promote equity, tools to improve job quality and job access must go hand-in-hand; when they do not, better-quality jobs are likely to become more exclusionary, keeping people of color, women, and other marginalized people relegated to more precarious and low-paying employment. The clean energy industry has a lot of work to do to overcome race and gender disparities; the gender pay gap is greater in solar than in the broader U.S. workforce, and senior executives in the solar industry are disproportionately white.[54]

EXPAND THE PUBLIC SECTOR

A strong public sector is essential for long-term climate adaptation and resiliency. Communities benefit from a robust public sector. Public employees across all occupations enhance community well-being, help people navigate ordinary hardships, and respond effectively to emergencies. Public health workers, social workers, 911 operators, and librarians join with maintenance workers, stormwater managers, and others to maintain safe and operational systems and step up in times of crisis. There is also an opportunity for expanded public employment in energy efficiency, tree planting, and other climate activities.

Public-sector employment enhances racial equity in the workplace. Even as the private sector has remained segregated, the public sector has been a critical source of well-compensated, stable jobs for Black Americans since the mid-20th century. The median wage earned by Black employees is significantly higher in the public sector than in other industries. Some 44 percent of Black public-sector workers are able to gain economic security through homeownership,

53 Supplier diversity initiatives and worker-owned cooperatives have been held up as promising tools for supporting economic equity; however, these are business/employer strategies, rather than workforce strategies and are not covered here. In both cases, efforts to support and build the capacity of these firms to meet job-quality and inclusion standards will be necessary. The structure and/or ownership of the firm alone does not fully protect workers from exploitation and low-road practices.

54 "U.S. Solar Industry Diversity Study 2019."

as opposed to 28 percent of Black private-sector workers.[55] From 2008-2010, 21.2% of all Black workers were public employees, compared with 16.3 percent of the workforce as a whole.[56] Public-sector contraction and outsourcing, therefore, disproportionately affects Black workers.[57] Expanding state and municipal employment can also support equity by providing jobs for individuals facing barriers to employment such as poverty, lack of a high school diploma or GED, a criminal record, homelessness, etc.

IMPROVE ACCESS TO BROAD OCCUPATIONAL TRAINING

Education and training will be essential to meet the demands of a low-carbon economy, but education and training do not create jobs, nor do they improve the quality of jobs created. Workforce education and training must be calibrated to labor market demand. Otherwise, the supply of workers can outstrip the demand for workers, increasing competition between workers and driving down wages.

Rather than training people for new "green jobs," an emphasis should be placed on training people for traditional occupations that will increasingly engage with clean energy technologies. Broad occupational training remains important. A worker will have more options, a more-stable career, and better pay as a fully licensed electrician than as a solar installer. Many of the jobs we think of as "green" are jobs that fall within traditional occupational jurisdiction. As the demand for workers proficient with new technologies grows, there is an opportunity to train more people with the foundational broad knowledge and skills to be able to grow and adapt with the technology.

Apprenticeship provides a college-alternative pathway to a family-sustaining career, but apprenticeships are competitive and selective. Pre-apprenticeship or apprenticeship-readiness programs are a good way to introduce new workers to trades work, provide them with some on-the-job experience, math skills, and work-readiness skills to successfully gain entry to and succeed in an apprenticeship program. The Multi-Craft Core Curriculum (MC3) is a comprehensive pre-apprenticeship training curriculum that has received support from industry, government, and labor partners.[58] Across the country, community-based organizations, high schools, and community colleges utilize the MC3.[59, 60] Many MC3 pre-apprenticeship programs are targeted to specific populations, such as women, opportunity youth, or formerly incarcerated individuals and provide specific wrap-around support services to help workers overcome barriers to quality training employment.

55 Deja Thomas, Lola Smallwood-Cuevas, and Saba Waheed, "Reimagined Recovery: Black Workers, the Public Sector, and COVID-19" (UCLA Labor Center, June 2020), https://www.labor.ucla.edu/publication/reimagined-recovery-black-workers-the-public-sector-and-covid-19/.

56 Steven C. Pitts, "Black Workers and the Public Sector" (UC Berkeley Labor Center, April 3, 2011), https://laborcenter.berkeley.edu/black-workers-and-the-public-sector/.

57 "How Privatization Increases Inequality" (In the Public Interest), accessed August 13, 2021, https://www.inthepublicinterest.org/report-how-privatization-increases-inequality-2/.

58 North American Building Trades Unions, "The Building Trades' Multi-Craft Core Curriculum: A Guide for Students and Parents," 2017, https://nabtu.org/wp-content/uploads/2017/08/MC3-in-Our-Schools-A-Guide-for-Students-and-Parents.pdf.

59 Tommy Burress, Tom Gannon, and Ragini Kapadia, "Community-Based Organizations and Union Apprenticeship Programs: Creating Pathways to Careers in the Unionized Construction Trades for Minorities and Lower-Skilled Workers" (Green Ways: A Jobs for the Future initiative, April 2011), https://jfforg-prod-prime.s3.amazonaws.com/media/documents/CommBasedOrg-UnionApprentProg_040212.pdf.

60 North American Building Trades Unions, "Why Should We Teach MC3 in Our Schools?," 2017, https://nabtu.org/wp-content/uploads/2017/03/Why-We-Should-Adopt-the-MC3-in-Our-School-2-22-17.pdf; North American Building Trades Unions, "What Is a Building Trades Apprenticeship Readiness Program?," (2018), https://nabtu.org/wp-content/uploads/2018/02/ARP-MC3-Program-Overview.pdf.

CONCLUSION

The analysis herein examines the impacts of a reference case and three defined scenarios for decarbonizing Nevada's economy, each of which focuses on energy. The production and consumption of energy are indeed at the core of decarbonization, but the state's transition to a green economy can and must also involve changes in many other economic areas—the development of new sectors and the waning of others—which are not fully captured here. This diversification of the state's economy will create jobs, but without modeling what a new economy will look like, it is difficult to project the future composition of industries and occupations in Nevada. The same planning and policy principles outlined here for energy-related sectors can be used elsewhere to ensure that workers are not left behind and that the jobs created are good jobs, helping to forge a resilient, just, and sustainable future for the State of Nevada.

APPENDICES