A Guide to Nevada Energy Policy

By James Taylor

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Introduction

Energy policy is arguably the most important factor affecting the strength of Nevada's economy. Abundant and affordable energy directly lowers consumer energy bills. Lower energy costs also reduce production and operating costs that factor into virtually all goods and services traded in our economy. This stimulates greater consumer purchasing power and rising living standards. Conversely, scarce and expensive energy raises consumers' direct energy bills, raises the costs of goods and services throughout the economy, and reduces consumer purchasing power and living standards. Rising energy costs bring the economic pain of a tax hike, except that consumers get nothing in return for their rising energy costs. Falling energy costs stimulate the economy like a tax cut, except that falling energy costs do not squeeze government budgets or services.

This Nevada Energy Policy Guide is designed to give policymakers important information necessary to cultivate sustainable economic growth through wise energy policy. This Guide also recognizes important environmental concerns tied to Nevada energy policy. Rather than accepting at face value the environmental claims of industry groups competing for energy-market share, this Guide offers a full-spectrum assessment of environmental impacts associated with competing power sources. These real-world environmental impacts — rather than the self-serving claims of various energy industry sectors — should guide policymakers in accounting for environmental impacts of competing power sources.

I. Monopoly Utilities

A. Monopoly Structure

Under Nevada state law, consumers have limited choices regarding electricity supply. Nevada law divides electricity consumers by geographic location and then grants monopoly rights to a single electricity supplier within each geographic region. NV Energy is the dominant electric company and the sole investor-owned utility in the state, with monopoly supply rights to 85 percent of Nevada residents.[1]

One of the central justifications for the government-created and government-enforced monopoly system is a fear that an unscrupulous electricity supplier might be able to win monopoly or near-monopoly status under free-market conditions. Supporters of the government-created monopoly claim it is better for government to designate, protect, and regulate a monopoly electricity company than take a chance that an unscrupulous company might gain monopoly status under free-market conditions.

Another central justification for the government-enforced monopoly system is the assertion that electric service would be unreliable and inefficient if government did not set up monopoly providers and guarantee them generous profits.

B. Incentives to Drive up Costs

Under the government-enforced monopoly regime, government bureaucrats set the terms and conditions of the electricity market. The Nevada Public Utilities Commission (PUC) guarantees NV Energy a profit of 10.5 percent on its equity investments. In return for this guaranteed profit margin, NV Energy must submit important business decisions — such as rate changes and capital investments — to the PUC. The PUC, whose three members are appointed by the governor, is supposed to serve as a watchdog for consumers who would otherwise be vulnerable to monopoly business practices.

It is vitally important for the PUC to vigorously execute its watchdog responsibilities. With no market competitor threatening to provide ratepayers with lower-cost electricity, NV Energy has no vested self-interest in working to keep rates low. Moreover, NV Energy's guaranteed rate of profit on its investments gives it a vested financial self-interest to spend as much money as possible on its investments and therefore reap as much profit as possible.

NV Energy's financially self-interested stake in higher operating costs and in charging consumers higher prices to reap higher guaranteed profits manifests itself in a number of ways. One manifestation is NV Energy's financial self-interest in building and operating expensive new power plants rather than buying lower-cost electricity from existing third-party suppliers.[2]

Another way NV Energy seeks to reap higher guaranteed profits is by supporting and championing renewable power mandates. Wind and solar power are significantly more expensive

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[1] "Service Territory," NV Energy, https://www.nvenergy.com/company/territory.cfm

[2] "New NV Energy power plant would raise customers' rates, study shows," Las Vegas Review-Journal, October 6, 2015, http://www.reviewjournal.com/business/energy/new-nv-energy-power-plant-would-raise-customers-rates-study-shows

than conventional power,[3] so investing in expensive wind and solar power guarantees NV Energy higher profits than investing in lower-priced energy sources.

The monopoly utility regime is essential to the success of the renewable power industry. Because wind and solar power are so much more expensive than other power sources, utilities would generate or purchase little of their power mix from these sources if they faced market competitors.

With a common interest in renewable power mandates and a monopoly utility regime, NV Energy and the renewable power industry have forged a powerful alliance. Presenting their alliance as evidence that all stakeholders agree that renewable power mandates are good for the economy and the environment, the alliance leaves out the most important stakeholders of all — Nevada's 2.8 million electricity consumers. Forcing 2.8 million Nevadans to pay unnecessarily high electricity prices merely to line the pockets of NV Energy and the renewable power industry is decidedly harmful, rather than beneficial, to the Nevada economy. This is especially the case considering NV Energy is owned by Warren Buffett's Berkshire Hathaway Energy and sends much of its profits back to Buffett's hometown of Omaha, Nebraska. Similarly, most renewable power equipment manufacturers are out-of-state and overseas companies, creating their much ballyhooed renewable power jobs in places like China and Germany.

NV Energy's financial self-interest in paying out higher costs for expensive wind and solar power is evident in NV Energy's reports on meeting Nevada's renewable power mandates. NV Energy is currently required to generate 20 percent of its power from renewable sources,[4] yet the utility proudly reports it generates 21 percent of its southern Nevada power from renewable sources and 31 percent of its northern Nevada power from renewable sources.[5] This helps explain why Nevada households pay the highest residential electricity prices in the U.S. Energy Information Administration's Mountain States Region.[6]

C. Less than Vigorous Oversight

While a large number and variety of electricity consumers have occasional reason to interact with their watchdog PSC, there is a one entity that interacts with the PSC on a consistent and regular basis — NV Energy. With regular interaction between the staff of NV Energy and the staff of the PUC, friendships and comradery between the watchdog and the monopoly utility inevitably form. These regular interactions may explain why so many NV Energy customers feel the PUC is nothing more than a tool of NV Energy.

The windfall captured by NV Energy due to its monopoly status and close ties to the PUC might sting a little less if NV Energy's profits remained in Nevada and were spent here. However, as noted above, much of NV Energy's profits are sent back to Omaha, Nebraska. Every time the

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[3] "Why the Best Path to a Low-Carbon Future is Not Wind or Solar Power," Brookings Institution, May 20, 2014, http://www.brookings.edu/blogs/planetpolicy/posts/2014/05/20-low-carbon-wind-solar-power-frank

[4] "Nevada Energy Portfolio Standard," DSIRE, updated January 20, 2016, http://programs.dsireusa.org/system/program/detail/373

[5] "NV Energy Exceeds Renewable Requirement for 2015," NV Energy, April 5, 2016, https://www.nvenergy.com/company/mediaroom/newsdetail.cfm?n=136939

[6] "Electric Power Monthly," U.S. Energy Information Administration, February 2016, http://www.eia.gov/electricity/monthly/current_year/february2016.pdf

PUC issues a ruling favorable to its friends at NV Energy and unfavorable to Nevada consumers, the result is to drain money from Nevada and sent it to Nebraska.

D. Policy Prescription — Consumer Choice

More than a dozen states have abandoned the government-enforced utility structure and given consumers more freedom of choice regarding their electric providers. In these states, electricity prices are rising at a slower pace than in states without such freedom of choice. In states like Illinois and Texas, electricity prices are actually falling.[7] Electricity service remains as reliable as ever. Policymakers can reduce Nevada electricity prices and strike a blow against the cozy relationship between NV Energy and the PUC by breaking up Nevada's government-enforced electric monopolies and give consumers freedom of choice.

II. Utility Disputes

The PUC is embroiled in two high-profile disputes that are substantially impacting Nevada energy policy and the state economy. One involves Nevada casino resorts seeking to purchase electricity from alternative providers and the other involves the owners of rooftop solar equipment seeking favorable terms to sell their excess power to the electric utilities.

A. Casinos Seeking to Leave NV Energy

1. High Prices

Despite — or perhaps because of — the PUC watching over NV Energy, Nevada households pay the highest residential electricity prices in the U.S. Energy Information Administration's eight-state Mountain States Region.[8] NV Energy also saddles Nevada businesses with higher electricity prices than they could obtain from other providers. This is particularly harmful to the state's largest employer — the casino resort industry — because electricity is a primary component of each casino resort's operating expenses.

2. Legal Right to Alternative Providers

Legislation passed by the Nevada legislature in 2011 attempted to encourage more electricity supply and give large businesses choices among electricity suppliers. The legislation, under Section 704b in the Nevada Revised Statutes, allows large businesses to purchase electricity from sources other than their regional utility monopoly. The legislation authorizes, but does not require, the PUC to assess exit fees on businesses leaving the utility if the PUC determines the utility will experience undue economic hardship from the business's decision to leave and fairness warrants such compensation.

3. PUC's Poison Pill

Three Nevada casino groups — MGM Resorts, Las Vegas Sands and Wynn Resorts — determined they could save tens of millions of dollars in electricity costs by purchasing power from suppliers other than NV Energy. The casino groups filed a request with the PUC to leave

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[7] "Electric Power Monthly," U.S. Energy Information Administration, February 2016, http://www.eia.gov/electricity/monthly/current_year/february2013.pdf

[8] "Electric Power Monthly," U.S. Energy Information Administration, February 2016, http://www.eia.gov/electricity/monthly/current_year/february2016.pdf

NV Energy, but the PUC assessed $127 million dollars in exit fees on the casino groups. Adding insult to injury, the PUC delivered a poison bill of punitive additional conditions upon any electricity provider selling power to the casino groups. The effective result of the PUC decision was to "approve" the casinos leaving NV Energy through terms and conditions punishing the casinos for doing so.

Curiously, the PUC asserted the monopoly utility is the victim in the relationship, even though NV Energy charges the casinos much higher energy prices than other willing suppliers. NV Energy received monopoly supplier rights over the captive casino groups, NV Energy charged higher electricity prices than other potential electricity suppliers and yet the PUC ruled the casinos must pay "compensatory" fees to NV Energy upon procuring power from other suppliers.

Despite the staggering exit fees, MGM Resorts and Wynn Resorts have decided to follow through on their plans to leave NV Energy and pay a cumulative $100 million in exit fees to do so. The casino groups' willingness to pay such huge exit fees is proof positive how much Nevada's government-enforced monopoly system is draining money from businesses and consumers.

4. Policy Prescription — End Punitive Exit Fees

Policymakers can end the practice of the PUC assessing unjustified and punitive exit fees upon companies that find more affordable power suppliers by eliminating the state-enforced electric monopoly structure. Short of that, policymakers can take away the PUC's authority to assess exit fees on companies leaving NV Energy for lower-cost power providers.

B. Rooftop Solar

1. Net Metering Subsidies

Under Nevada law, owners of rooftop solar power equipment are entitled to sell much of their excess power to utility companies, even if the utility has no need or use for the excess power. The entitlement is known as "net metering." Up until 2015, rooftop solar owners were also entitled to receive higher prices for their excess power than utilities paid on the wholesale market. The effective result was a large subsidy for the owners of rooftop solar equipment, on top of numerous other federal, state and local subsidies that already pay for at least 30 percent of the cost of rooftop solar equipment.[9] The people paying for the net metering subsidies are every electric customer who doesn't own rooftop solar power equipment. Not only does this raise electricity prices throughout the state, but it also redistributes money from people with lower incomes to the wealthy — as few lower-income households can afford the upfront costs of rooftop solar power equipment, even after factoring in substantial federal subsidies.

2. Reduction in Solar Subsidies

In 2015, the Nevada legislature passed a bill reducing the amount of rooftop solar power utilities would have to purchase. The bill also lowered the price paid to rooftop solar equipment owners to be more in line with normal wholesale prices. In response, the renewable power industry and

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[9] "Solar Investment Tax Credit," Solar Energy Industries Association, http://www.seia.org/policy/finance-tax/solar-investment-tax-credit

the owners of rooftop solar power equipment launched widespread protests. Those protests have culminated in Gov. Sandoval's New Energy Industry Task Force drafting proposed legislation to grandfather in full retail prices paid to owners of existing rooftop solar equipment. Also, a political action committee misleadingly named "No Solar Tax" seeks to put a similar initiative on the November ballot.

3. Policy Prescription — Maintain Wholesale Compensation Prices

Rooftop solar equipment owners already receive substantial government subsidies amounting to at least 30 percent of the cost of their rooftop solar power equipment. Nevada's net metering laws provide yet another layer of subsidies on top of the direct financial subsidies rooftop solar owners receive when they purchase their equipment. These subsidies are financed by every Nevadan who has not purchased rooftop solar equipment. Nevada policymakers can give solar power producers and consumers greater freedom of choice by allowing rooftop solar power producers to sell electricity to whomever they like at whatever prices they can negotiate, while simultaneously eliminating requirements for any utilities or consumers to purchase such power if they choose not to. This would be an extension of the Consumer Choice Policy Prescription in Section 1.D. above. If Nevada policymakers decline to provide such consumer choice, they should at least hold the line against rooftop solar power producers receiving more than wholesale market prices for the power utilities are required to purchase from rooftop solar equipment owners.

III. Renewable Power Mandates

A. Costs of Competing Power Sources

Nevada is one of 28 states with renewable power mandates (RPMs) forcing consumers to purchase a specified minimum percentage of their electricity from designated renewable sources. Nevada's RPM requires 20 percent of the state's current electricity mix to come from renewable sources, rising to 25 percent by 2025.

The three energy sources providing the most renewable power in compliance with Nevada's RPM are, in order: geothermal, wind and solar power.[10] Hydroelectric power would be second on the list if Nevada allowed hydropower to count toward the RPM as some other states do.

The practical impact of renewable power mandates is to impose the most expensive energy sources on consumers. The higher costs of renewable power are documented in a 2014 study published by the left-of-center Brookings Institution. According to the study, replacing conventional power with wind power causes a 50 percent increase in electricity prices. Replacing conventional power with solar power triples electricity prices.[11] The Obama administration's Department of Energy confirms these higher costs and forecasts that new wind facilities built this year with the latest and most cost-effective technologies will provide power that is still 50 percent more expensive than conventional power. Solar facilities this year will provide power at

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[10] "Sources of Energy," NV Energy, accessed May 31, 2016, https://nvenergy.com/bill_inserts/2015/Power_Content_Insert_NVE-South_2015-06_web.pdf

[11] "Why the Best Path to a Low-Carbon Future is Not Wind or Solar Power," Brookings Institution, May 20, 2014, http://www.brookings.edu/blogs/planetpolicy/posts/2014/05/20-low-carbon-wind-solar-power-frank

triple the cost of conventional power, according to the Obama Department of Energy.[12] Even these numbers are overly rosy for wind and solar, as wind and solar power are unpredictable and require the construction and operation of backup conventional power plants for when the wind isn't blowing and when the sun isn't shining. They also force conventional power plants to run less efficiently, since the conventional power plants must ramp up and down rapidly to meet the fluctuations in wind speeds and cloud cover. The Department of Energy, noticeably, fails to take these factors into consideration. Also, the Department of Energy numbers assume power-generating facilities of all types will have an operational life of 30 years, while in the real world wind and solar equipment is more likely to last just 20 or 25 years, while coal, natural gas, nuclear and hydro power facilities typically remain operational for 40 years, 50 years, or longer. The Department of Energy's 30-year lifespan assumptions assess lower capital costs to wind and solar power than occur in the real world, while assessing higher capital costs to conventional power than occur in the real world.

The high cost of Nevada's renewable power mandate is evident in Nevada electricity prices. As noted above, Nevada residential electricity customers pay the highest rates in the EIA's Mountain States Region. Moreover, Nevada electricity prices continue to soar disproportionately under the state's renewable power mandates. For example, in 2012 Nevada residential power averaged 11.82 cents per kilowatt hour, which was below the national average of 11.88 cents per kilowatt hour.[13] With Nevada's renewable power mandate jumping from 15 percent to 20 percent between 2012 and 2015, Nevada residential electricity prices jumped above the then national average, at 12.77 cents per kilowatt hour in Nevada compared to 12.67 cents per kilowatt hour nationally.[14]

Solar power advocates often make the claim that Nevada should be leading the nation in solar power due to its abundant sunshine. Regardless of Nevada's abundant sunshine, the Brookings Institution and Energy Department numbers show solar power still does not make economic sense relative to conventional power. If it did so, solar power providers would not require disproportionate subsidies and renewable power mandates to force Nevada consumers to buy their product.

The assertion that solar power makes more sense in Nevada than in most other states does not necessarily mean that solar power makes more sense than conventional power. By analogy, scientists have the technological know-how to put rats on very small treadmills and turn rat power into electricity. The assertion that New York City is the rat capital of the world doesn't change the fact, however, that rat power makes little economic sense in New York City or anywhere else. The same analogy applies to solar power, in that solar power is prohibitively expensive compared to conventional power even in southern Nevada.

The wind may blow for free and the sun may shine for free but the expense of turning these energy sources into usable electricity is immense. Moreover, the energy in coal, natural gas, running water and uranium is very concentrated, but the energy in breezes and ambient sunlight

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[12] "Levelized Cost of New Generation Resources in the Annual Energy Outlook," U.S. Energy Information Administration, November 2010, http://www.eia.gov/oiaf/aeo/electricity_generation.html
[13] "Electric Power Monthly," U.S. Energy Information Administration, February 2013, http://www.eia.gov/electricity/monthly/current_year/february2013.pdf
[14] "Electric Power Monthly," U.S. Energy Information Administration, February 2016, http://www.eia.gov/electricity/monthly/current_year/february2013.pdf

is quite diffuse. A great deal of expensive technology and equipment are required to turn diffuse wind and solar energy into usable electricity. This is the reason why wind and solar power are so much more expensive than conventional power even though the wind blows for free and the sun shines for free.

B. Environmental Impacts

A purely economic assessment of comparative energy sources overlooks the environmental impacts of each energy source. It is impossible to objectively quantify the economic value of negative environmental impacts because much of the environmental value is subjective. Nevertheless, it is possible and quite useful to compare the environmental impacts of energy sources relative to each other.

Nevada's renewable power mandate designates geothermal, wind and solar power for favorable treatment at the expense of natural gas, coal, hydro and nuclear power. The "renewable" designation is quite arbitrary, as large hydroelectric dams turn renewable rainfall and streamflow into usable power. Moreover, forcing consumers to purchase expensive "renewable" power makes little sense from a resource-conservation standpoint, given that Nevada and the United States have sufficient natural gas, coal and uranium resources to power the economy for centuries to come. Natural gas, coal and uranium resources may not be "renewable," but there is little foreseeable scarcity to their abundance.

In reality, the "renewable" designation for certain favored power sources has nothing to do with resource scarcity or sustainability. Instead, the label is designed to bestow market advantages upon certain power sources asserted to be environmentally superior to other power sources. With this in mind, to the extent government regulation will bestow market advantages upon some power sources at the expense of others, it is appropriate and necessary to conduct an objective, full-spectrum environmental assessment of comparative energy sources.

This Nevada Energy Policy Guide analyzes environment impacts under five separate categories: traditionally defined air pollutants, land disruption, species impacts, carbon dioxide emissions and miscellaneous environmental impacts. Despite the efforts of wind and solar advocates to market wind and solar power as environmentally superior to their competitors, an objective full-spectrum environmental impact assessment shows solar power is only mildly environmentally friendly and wind power is more environmentally damaging than most of its competitors.

The chart below shows the environmental impacts of coal, natural gas, nuclear, hydro, wind, solar and geothermal power. Each energy source's environmental impact is rated on a scale of 1 (best) to 10 (worst) for each category.

Source:	Air	Land	Spec	CO2	Misc	TOTAL
Coal	8	7	4	10	7	36
Natural gas	2	2	1	5	3	13
Nuclear	1	2	1	1	7	12
Hydro	1	2	4	2	1	10
Wind	2	8	7	2	7	26
Solar	2	4	3	2	2	13

Geothermal	2	5	3	1	3	14

A full-spectrum environmental impact assessment shows geothermal, hydro, solar, nuclear and natural gas comprise the top tier of "green" energy. Wind and coal power are clearly the most environmentally damaging. Despite this, wind power receives favorable treatment under Nevada's renewable power mandate, while environmentally superior hydro, nuclear and natural gas are discouraged under the mandate.

Coal

Coal has long been the workhorse of America's power supply, with vast domestic coal resources keeping prices significantly lower than competitive power sources. Low-cost coal power was a central factor in America's economic prosperity and high living standards during the 20th century. Coal's negative environmental impacts, however, also outpace its competitors, scoring 36 in this full-spectrum environmental impact comparison

Air — Coal power emits higher quantities of the U.S. Environmental Protection Agency's Six Principal Pollutants than any other widely used power source.[15] Technological advances in recent decades have significantly reduced emissions from coal power plants, but coal power still emits more emissions than its competitors.

Land — Coal power results in substantial negative impacts on land resources, with coal mining often decimating landscapes for long periods of time during mining operations — including decimating much scenic mountain terrain. Coal operations occasionally result in ash spills that also degrade the environment.

Species — Coal's substantial land disruption significantly impacts plant and animal species in the disrupted regions.

CO2 — Coal emits more carbon dioxide than any other widely used power source.[16] There is substantial scientific evidence casting doubt on fears of imminently dangerous global warming,[17] but this full-spectrum environmental analysis recognizes there is debate in the scientific community about the potential future impacts of global warming and many policymakers would like to reduce carbon dioxide emissions.

Miscellaneous — Coal mining can be a dangerous activity, resulting in a relatively high number of dangerous workplace accidents and long-term negative health impacts.

Natural Gas

The recent discovery of substantial natural gas resources trapped in shale rock, combined with technological advances in hydraulic fracturing (fracking) and directional drilling, have resulted in a dramatic increase in natural gas production. These factors, collectively known as the fracking revolution, have during the past several years driven natural gas prices down to be cost-

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[15] "Natural Gas and the Environment," U.S. Environmental Protection Agency, http://www.eia.gov/pub/oil_gas/natural_gas/analysis_publications/natural_gas_1998_issues_trends/pdf/chapter2.pdf
[16] "Natural Gas and the Environment," U.S. Environmental Protection Agency, http://www.eia.gov/pub/oil_gas/natural_gas/analysis_publications/natural_gas_1998_issues_trends/pdf/chapter2.pdf
[17] *Climate Change Reconsidered*, Nongovernmental International Panel on Climate Change, http://climatechangereconsidered.org/

competitive with coal. Natural gas resources, moreover, are abundant enough to assure these lower prices will continue for many decades to come unless government imposes market impediments. This newfound natural gas abundance is especially fortuitous because natural gas scores quite well in a full-spectrum environmental impact analysis.

Air — Natural gas is a very clean burning fuel. Compared to coal, natural gas cuts each of EPA's Six Principal Pollutants by at least 80 percent.[18] For all practical purposes, natural gas power is an emissions-free power source for traditionally defined air pollutants.

Land — Natural gas production and power generation have a very small impact on land resources. Energy producers can drill from a single pad multiple wells fanning out in several different directions. Natural gas power plants, moreover, have a small footprint and can be located close to urban centers, reducing the need to disrupt additional land with transmission wires.

Species — Natural gas's relatively small impact on land resources results in a relatively small impact on plant and animal species.

CO2 — Natural gas power emits approximately half as much carbon dioxide as coal. Advanced natural gas power plants are able to cut emissions by 70 percent in relation to coal. Natural gas accordingly reduces carbon dioxide emissions significantly relative to coal, but does not achieve the zero-emissions power production of hydro, nuclear, solar and wind power. Natural gas power plants can ramp power production up and down rapidly, allowing them to supplement variable wind and solar power. In this regard, natural gas power is an enabler of some zero-carbon power sources.

Miscellaneous — Some environmental activists fear the natural gas production, when done through the fracking process, poses a pollution risk to groundwater and causes earthquakes. Federal, state and local environmental officials have tested thousands of water sites near fracking operations and have yet to identify a single instance in which the fracking process caused water pollution. Lisa Jackson, who served as President Obama's first EPA Secretary, has repeatedly testified to Congress that EPA has not identified a single occurrence in which the fracking process caused water pollution.[19] There have been some instances in which the storage and transportation of natural gas — including natural gas produced from the fracking process — has caused some water pollution, but such instances are relatively minor compared with stated fracking fears. Regarding earthquakes, an increase in smaller earthquakes has been noted near many fracking sites. Assuming there is a connection between the increased earthquake activity and fracking, scientists report the increased earthquake activity is much more likely to be caused by certain post-fracking underground water storage procedures than fracking itself.[20] These challenges can be addressed through appropriate regulation. Viewed together, water pollution and earthquake impacts are much less severe than some people fear, but they do warrant ongoing study and monitoring.

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[18] "Natural Gas and the Environment," U.S. Environmental Protection Agency, http://www.eia.gov/pub/oil_gas/natural_gas/analysis_publications/natural_gas_1998_issues_trends/pdf/chapter2.pdf
[19] Fox News Channel, May 24, 2011, https://www.youtube.com/watch?v=L4RLzlcox5c
[20] "Oklahoma earthquakes linked to oil and gas wastewater disposal wells, say Stanford researchers," Stanford News, June 18, 2015, http://advances.sciencemag.org/content/1/5/e1500195

Nuclear

Nuclear power is an emissions-free power source that is not subject to variables such as wind speed and cloud cover. Without such limitations, nuclear power is a valuable baseload power source. Nuclear power is somewhat more expensive to produce than coal, natural gas and hydro power, but it is more economical than wind and solar power.

Air — Nuclear power generation emits no air pollutants. Unlike wind and solar power that require other power sources — which often emit significant air pollution — to back them up, nuclear power does not require backup power to quickly kick in when the wind fades or variable clouds obscure solar panels. Accordingly, nuclear power reduces air pollution even more than "zero-emissions" variable power sources such as wind and solar.

Land — Uranium mining for nuclear power plants disturbs a much smaller area of land per unit of power production than alternatives such as wind turbines and solar power panels. The total footprint for uranium mining, nuclear power plants and transmission lines is relatively small compared to several other power options.

Species — Nuclear power's minimal land footprint correlates with a minimal impact on plant and animal species.

CO2 — Nuclear power generation emits no carbon dioxide. Unlike wind and solar power that require other power sources — which often emit significant amounts of carbon dioxide — to back them up, nuclear power does not require backup power to quickly kick in when the wind fades or variable clouds obscure solar panels. Accordingly, nuclear power reduces carbon dioxide emissions even more than "zero-carbon" variable power sources such as wind and solar.

Miscellaneous — Nuclear power generation poses a unique challenge regarding potential radiation events and long-term storage of nuclear waste. Nevertheless, the 2011 Category 9.0 Fukushima earthquake and tsunami that decimated the region surrounding several nuclear power generators illustrated the relative safety of modern nuclear reactors. Despite the earthquake and tsunami causing over 15,000 deaths,[21] not a single person died or was made seriously ill from damage to the nuclear reactors.[22]

Hydro

Hydro power, where available, is among the lowest-cost power sources and is frequently cost-competitive with coal. It is also a very green energy source, resulting in no air pollution and mitigating its minor environmental footprint with unique environmental benefits.

Air — Hydro power emits no air pollution. Unlike wind and solar power that require other power sources — which often emit significant air pollution — to back them up on a minute-by-minute basis, hydro power does not require quick-start backup power to kick in when the wind fades or variable clouds obscure solar panels. Accordingly, hydro power reduces air pollution even more than "zero-emissions" variable power sources such as wind and solar.

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[21] "2011 Tohoku earthquake and tsunami," Wikipedia, https://en.wikipedia.org/wiki/2011_T%C5%8Dhoku_earthquake_and_tsunami

[22] "Fukushima Accident," World Nuclear Association, updated April 2016, http://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/fukushima-accident.aspx

Land — Hydro power does not impose environmental harms through the mining or drilling of land. While a large hydro dam may alter the landscape by replacing a flowing river with a large lake (Lake Mead, for example, is 247 square miles), this alteration of the landscape merely replaces one environmentally valuable resource with another. The case can easily be made that land and water alterations caused by creating a lake in a river basin brings more environmental benefits than harms. Lakes support a wide variety of marine life and waterfowl, adding more habitat for such species. Lakes also support marine recreation activities. Moreover, the alteration of land resources caused by hydroelectric dams pales in comparison to the alteration of land resources caused by wind turbines. Wind farms require 300 square miles of land to replace a single conventional power plant,[23] while even Hoover Dam alters much less landscape while producing substantially more power.

Species — Unlike most other energy sources where environmental impacts are uniformly negative in their impact upon resident plant and animal species, hydroelectric dams affect resident species in positive as well as negative ways. Lakes created by hydroelectric dams provide habitat for fish, crustaceans, waterfowl and aquatic plant species. To the extent some migratory fish face impediments from hydroelectric dams, modern fish ladders and other technological devices minimize such impact. This mix of positive and negative impacts effectively evens out, as opposed to the uniformly negative impacts of wind turbines that kill 1.5 million birds and bats in the United States each year,[24] including many protected and endangered species.

CO2 — Hydro power generation emits no carbon dioxide. Unlike wind and solar power that require other power sources — which often emit significant amounts of carbon dioxide — to back them up, hydro power does not require backup power to quickly kick in when the wind fades or variable clouds obscure solar panels. Accordingly, hydro power reduces carbon dioxide emissions even more than "zero-carbon" variable power sources such as wind and solar.

Miscellaneous — Hydro power is unique among power sources in that its environmental impacts are positive as well as negative. It can be persuasively argued that hydropower results in net environmental benefits. Regardless of whether this is true, hydro power's negative environmental impacts are similar in kind but much less severe compared to wind power. From a land resource perspective, hydroelectric dams alter the land by turning rivers into lakes. However, a hydroelectric dam produces much more power with much less land alteration than a large industrial wind turbine complex. From a species perspective, hydroelectric dams can create impediments to fish migration. However, a hydroelectric dam's impact on fish migration compares favorably to the aviary devastation posed by wind turbines producing smaller amounts of electricity. To the extent hydro power imposes some negative environmental impacts, these impacts call attention to the much higher environmental impacts imposed by other power sources.

Wind

Some environmental activist groups promote wind power as an extremely "green" energy source. Wind power's real-world negative environmental impacts, however, are substantial. Even

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[23] "Huge Wind Turbines," The Energy Advocate, http://www.energyadvocate.com/big_trbn.htm

[24] "Comparing bird and bat fatality-rate estimates among North American wind-energy projects," *Wildlife Society Bulletin*, March 26, 2013, http://onlinelibrary.wiley.com/doi/10.1002/wsb.260/abstract

accounting for wind power's lack of air pollution and carbon dioxide emissions, wind power is still more environmentally damaging than most competing power sources.

Air — Wind power emits no air pollution. However, wind power's intermittency and unpredictability require other power sources — which often emit significant pollution — to back up wind power on a minute-by-minute basis. Accordingly, wind power is a "zero-emissions" power source but is not as effective at reducing emissions as more reliable zero-emissions power sources such as nuclear and hydro power.

Land — Wind power requires the development of vast land resources. Hundreds of square miles of wind turbines are required to provide the same amount of power as a single conventional power plant. These land resources also tend to be of high ecological and aesthetic value. For example, wind power often is most productive along mountain ridges, open plains and coastal shorelines. Wind projects also tend to be far from urban population centers, requiring the development of additional land resources for transmission lines.

Species — The development of large swaths of land for the placement of wind turbines and transmission lines is disruptive to plant and animal species. Wind turbines kill approximately 1.5 million birds and bats each year in the United States, including many protected and endangered species. For this reason, many national and local environmentalist groups voice strong opposition to wind turbine projects.

CO2 — Wind power emits no carbon dioxide. However, wind power's intermittency and unpredictability require other power sources — which often emit significant amounts of carbon dioxide — to back up wind power on a minute-by-minute basis, Accordingly, wind power is a "zero-emissions" power source but is not as effective at reducing carbon dioxide emissions as more reliable zero-emissions power sources such as nuclear and hydro power.

Miscellaneous — The mining and processing of rare earth materials, which are essential components of wind turbines, create devastating environmental impacts. Rare earth processing "requires a cocktail of chemical compounds and produces a 'tremendous amount' of solid waste, according to the U.S. Environmental Protection Agency," Yale University Environment 360 reports.[25] Additionally, some public health advocates claim vibrations and low-frequency noise caused by wind turbines have significant harmful impacts on nearby humans and animal species.

Solar

Solar power lives up to its "green" environmental billing much more than wind power. Nevertheless, every energy source — including solar power — presents some negative environmental impacts.

Air — Solar power emits no air pollution. However, solar power's intermittency and unpredictability require other power sources — which often emit significant amounts of pollution — to back up solar power on a minute-by-minute basis. Accordingly, solar power is a "zero-emissions" power source but is not as effective at reducing emissions as more reliable zero-emissions power sources such as nuclear and hydro power.

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[25] "Boom in Mining Rare Earths Poses Mounting Toxic Risks," Yale Environment 360, January 28, 2013, http://e360.yale.edu/feature/boom_in_mining_rare_earths_poses_mounting_toxic_risks/2614/

Land — Solar power projects require the development of large amounts of land, often in ecologically valuable arid landscapes. It can take up to 40 square miles of solar panels to produce the same amount of power as a single conventional power plant.[26] Solar power projects also tend to be far from urban population centers, requiring the development of additional land resources for transmission lines.

Species — Solar power's large developmental footprint can be very disruptive to desert species, including protected desert tortoises. Moreover, concentrated solar projects such as the Ivanpah facility outside Las Vegas are aviary death traps, with solar panels luring in birds with a shimmering oasis that appears to be water, and then incinerating the birds in mid-flight when the birds stray too close to the concentrated light. At the Ivanpah facility alone, approximately 3,500 birds were killed in 2015.[27]

CO2 — Solar power emits no carbon dioxide. However, solar power's intermittency and unpredictability require other power sources — which often emit significant amounts of carbon dioxide — to back up solar power on a minute-by-minute basis, Accordingly, solar power is a "zero-emissions" power source but is not as effective at reducing carbon dioxide emissions as more reliable zero-emissions power sources such as nuclear and hydro power.

Miscellaneous — Solar power presents the same question as does wind power: Should the "green" or "clean" nature of a power source be measured solely by its air emissions? If so, nuclear and hydro power are equal or superior to wind and solar power. If not, wind and solar power impose environmental harms in other areas that are more severe than many of their competitors.

Geothermal

Geothermal power is an expensive source of energy that would produce little if any commercial-scale power without substantial government subsidies. Even with government subsidies, federal auctions for geothermal power rights attract few buyers.[28] Environmentally, geothermal power is a mixed bag of environmental advantages and harms.

Air — Geothermal power can be produced in closed-loop or open-loop facilities. Closed-loop facilities capture and reinject water and toxic pollutants underground. They are also more expensive than open-loop facilities. Closed-loop production emits just a few percent of air pollutants emitted by coal power.

Land — Geothermal power has a significant land impact, requiring 13 acres of land to produce just a single megawatt of power. The Union of Concerned Scientists notes "many geothermal sites are located in remote and sensitive ecological areas."[29] The U.S. Energy Information Administration notes, "Many geothermal features are national treasures."

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[26] "A Cost-Effective Bridge to Florida's Energy Future," James Madison Institute, September 2009, http://www.jamesmadison.org/pdf/materials/2009-62.pdf

[27] "3,500 birds died at Ivanpah 'power towers' in first year – report," E&E News, April 24, 2015, http://www.eenews.net/stories/1060017406

[28] "Why Northern Nevada's status as a geothermal mecca is in danger," Reno Rebirth, February 23, 2013, http://blogs.rgj.com/renorebirth/2013/02/23/why-northern-nevadas-status-as-a-geothermal-mecca-is-in-danger/

[29] "Environmental Impacts of Geothermal Energy," Union of Concerned Scientists, http://www.ucsusa.org/clean_energy/our-energy-choices/renewable-energy/environmental-impacts-geothermal-energy.html#.V0xqh77yk2x

Species — Geothermal power entails significant land disruption, often in areas that are remote and ecologically sensitive. This negatively impacts resident plant and animal species.

CO2 — Closed-loop geothermal power is essentially a zero-carbon power source, emitting less than 1 percent of the carbon dioxide emissions of a conventional coal power plant.

Miscellaneous — Geothermal power has been linked to increased earthquake activity.[30] These are the same concerns voiced about oil and natural gas production through hydraulic fracturing.

C. Policy Prescriptions

As the economic analysis above shows, Nevada's existing renewable power mandate promotes expensive energy sources that raise prices, kill jobs and reduce Nevada living standards. Moreover, a full-spectrum environmental impact analysis shows Nevada's existing renewable power mandate promotes some environmentally destructive energy sources at the expense of much greener options. Nevadans deserve better policy than this. The following options would simultaneously improve Nevada's economy and environment.

1. Repeal the Renewable Power Mandate

Nevada could follow the lead of Kansas and West Virginia, each of whom have recently repealed their renewable power mandates. Eliminating a statewide mandate favoring expensive energy sources that have a mixed impact on the environment would be a significant improvement in Nevada energy and environment policy. Lower energy prices, more jobs and higher living standards would economically benefit all Nevadans. The extra wealth generated by such a policy change would also place more money in Nevadans' pockets to purchase better housing, nutrition, education, health care, consumer goods and truly beneficial environmental goods and services.

2. Replace the Renewable Power Mandate with a Full-Spectrum Environmental Impact Structure

Simply repealing Nevada's existing renewable power mandate would improve Nevada's economy and environment, but it would not be a perfect solution. There would still exist no mechanism to credit environmentally friendly energy sources and assess appropriate economic costs on environmentally harmful energy sources. A full-spectrum environmental impact mechanism could address this shortcoming either through market forces such as an environmental impact fee or through regulatory forces that favor environmentally friendly sources over environmentally damaging ones.

Repealing the existing renewable power mandate and replacing it with a full-spectrum environmental impact mechanism would allow price competition among competing power sources while simultaneously accounting for the full range of environmental externalities. Consistent with the above full-spectrum environmental analysis, a new regulatory mechanism might designate a certain percentage of the state's energy mix to come from top environmental performers hydro, nuclear, solar, geothermal and natural gas. Perhaps an even better solution would be to impose a graduated fee system reflecting full-spectrum environmental externalities.

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[30] "Geothermal power facility induces earthquakes, study finds," Union of Concerned Scientists, July 11, 2013, http://news.ucsc.edu/2013/07/geothermal-earthquakes.html

Such a system might impose no environmental impact fee on hydro, nuclear, solar, geothermal and natural gas, a 20% fee on wind and a 40% fee on coal. This would allow market pricing to determine the state's power mix while simultaneously recognizing and accounting for full-spectrum environmental impacts.

3. Replace the Renewable Power Mandate with a Carbon Dioxide Mechanism

Global warming concerns are increasingly presented as the primary justification for renewable power mandates. Even if we accept for the sake of argument that carbon dioxide emissions bring the possibility of dangerous global warming, Nevada's renewable power mandate makes little sense as a means to address carbon dioxide emissions. While not as desirable as simply repealing Nevada's renewable power mandate or repealing Nevada's renewable power mandate and replacing it with the full-spectrum environmental mechanism outlined above, Nevada policymakers can still improve Nevada's economy and carbon dioxide footprint by repealing the state's renewable power mandate and replacing it with a carbon dioxide reduction mechanism.

Either through a pricing structure or a regulatory structure, a carbon dioxide reduction mechanism would favor all energy sources that substantially reduce carbon dioxide emissions. This would include hydro, nuclear, wind, solar and geothermal. Natural gas without carbon capture would be subject to modest carbon dioxide impact fees or regulatory impacts, while coal power would be subject to higher carbon dioxide impact fees or regulatory impacts. Again, this mechanism would be an improvement over Nevada's existing renewable power mandate, but inferior to a straight-up repeal of Nevada's renewable power mandate or repealing and replacing the existing renewable power mandate with a full-spectrum environmental impact mechanism.