

Assessing Nevada's Renewable Power Production Potential

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What is Nevada's renewable power production potential? Answering this seemingly simple question is not at all straightforward. In fact, a definitive answer is not possible. When considering projections of energy production and use, there are many assumptions and uncertainties that drive the final estimates. These include not only technical issues, but also social, economic and political issues. Nevertheless, to shed some light on the topic, I've reviewed several information sources and summarized some key points below. For additional insights, other organizations within Nevada should be consulted – including the Nevada State Office of Energy, the Public Utilities Commission of Nevada, and the utility companies that operate within the State.

One important factor to be aware of is the units used to report electricity production and use. Typically, the rated capacity of a power plant is expressed in units of MW, meaning the maximum output that can be expected at full operating power. However, power plants do not always operate at full power due to variations in demand, scheduled maintenance, and (especially for renewables) variations in resource availability. Typical capacity factors for coal, natural gas, and geothermal power plants are 85-95%; capacity factors for wind and solar plants are much lower -- usually around 25-35%.

The total amount of electricity generated and consumed is usually expressed as kWh (or MWh). Actual power production and consumption are generally used when considering a renewable energy portfolio standard (RPS) or other instruments that require tracking renewable energy utilization. Some useful statistics regarding growth of Nevada's electricity consumption (obtained from the EIA^{1,2}) are shown below in Table I:

Table I

Recent Growth in Nevada's Electrical Power Consumption

Power Source	Electric Power Consumption, Million MWh		Fraction of Power (in 2004)	Growth in Power Usage, 1990 to 2004
	1990	2004		
Coal	15.053	18.257	48.5%	21%
Hydroelectric	1.735	1.615	4.3%	-7%
Natural Gas	2.217	16.386	43.5%	639%
Geothermal, Solar, Wind	0.761	1.298	3.4%	70%
Petroleum	0.284	0.096	0.3%	-66%
Total	20.051	37.652	100.0%	88%

In the above figures, the renewables (geothermal, solar, and wind) are all lumped together. However, virtually all of this renewable power was generated by geothermal power plants. It was not until the present year (2007) that any significant solar-generated power was produced in Nevada. The currently operating Nevada Solar One Plant is rated at 64 MW, and is expected to produce approximately 0.13 million MWh per year.

Another factor to bear in mind is that not all of the electrical power used in Nevada is produced within the State. Currently, Nevada is a net importer of electrical power, with about 30% of its total usage coming from out of state. The strategic plans of the Nevada utility companies call for increasing amounts of in-state production, and less reliance on imports in the future. To meet these plans will require even greater increases in power production than would be necessary to just keep up with total demand growth in the State.

Nevada’s per-capita electrical consumption is about 13,400 kWh per year, and has been nearly constant for the past 25 years. (U.S. per-capita consumption is 12,000 kWh per year.) Using this as a rough guide, future electricity demand in Nevada can be estimated to increase linearly with population. A recent report estimates that Nevada’s electrical power consumption in 2020 will be approximately 50 million MWh.²

Perhaps the most optimistic outlook for Nevada’s renewable power potential comes from the *Renewable Energy Atlas of the West*.³ Based upon some simplistic assumptions of natural resources, it is estimated that 169 million MWh/year of renewable power could be produced in the State. (These figures are shown in Table II, which also includes estimates for neighboring states). This amount is 4-times Nevada’s total current power consumption.

However, some of the assumptions used in the *Atlas* assessment are rather unrealistic. For example, solar photovoltaic (PV) systems are assumed to be installed on 0.5% of Nevada’s total land area (550 sq. mi.) and commercial wind development is assumed to occur on approximately 900,000 acres (about 1400 sq. mi.). Furthermore, these *Atlas* figures do not consider economics, manufacturing and installation limitations, load balancing, transmission issues, or other factors that would constrain development of renewable energy projects. Because of all these limitations, I do not consider the *Atlas*’ projections to be meaningful for the foreseeable future.

Table II

Potential Electricity Production from Renewable Sources, million MWhr/year
(Taken from Renewable Energy Atlas of the West³)

	Nevada	Arizona	California	Idaho	Oregon	Utah
Geothermal	20	5	59	5	17	9
Solar	93	101	128	60	68	69
Wind	55	5	45	49	70	23
Biomass	1	1	14	9	10	1
Total	169	112	246	123	165	102

A more realistic assessment of renewable power generation potential was recently conducted by the American Council on Renewable Energy (ACORE).⁴ Renewable power production capacity throughout the entire U.S. was compiled for 2006, and was projected for 2025. These projections, shown below in Table III, indicate tremendous growth (1-2 orders of magnitude) in each of the four major renewable energy categories over the next 20 years. The total production capability of all four renewable categories together is projected to increase by a factor of 25. This is huge growth, but given concomitant increases in transmission, and favorable economics and regulatory policy, this level of growth may be achievable. Unfortunately, this ACORE report does not provide data for individual states.

Table III

Total U.S. Renewable Energy Power Capacity, GW
(Taken from ACORE Report⁴)

Renewable Resource	2006	2025
Geothermal	3.1	100
Solar	0.5	164
Wind	10.5	248
Biomass	10.0	100
Total	24.1	612

In Nevada, the only well-established renewable energy industry is geothermal. Consequently, the estimates of resource potential and future commercial development are probably more reliable for geothermal than for solar, wind, or biomass. Current installed geothermal power capacity in Nevada is approximately 0.3 GW. A recent assessment by the Western Governors' Association concluded that this capacity could be increased to 1.5 GW by 2015, and to 2.9 GW by 2025.⁵ Similar projections (taken from the same WGA report) have been made by Glitner, a Nordic financial group specializing in energy projects.⁶

Other useful information about Nevada's electrical power supply and demand comes from the Nevada State Office of Energy report to the Governor and Legislature⁷ and the Integrated Resource Plans submitted to the Public Utilities Commission of Nevada by Sierra Pacific Power Company⁸ and Nevada Power Company.⁹ These 20-year plans (submitted every three years) provide detailed energy projections for the State and outline the companies' plans for supplying the required power, complying with Nevada's RPS, building of new capacity, need for transmission improvements, etc.

Taking into account all the information sources cited herein, and applying individual judgment and intuition, a set of projections for Nevada's renewable energy production was developed. Of all the renewables, it is believed that geothermal will dominate in Nevada, particularly in the earlier years. This is due to geothermal's advantages of existing technology, known resources, and economics. Wind and solar will play increasingly important roles in the future, with the extent of their development depending upon economics, availability of transmission lines, and severity of the RPS and other regulatory requirements.

Table IV summarizes my estimates of Nevada's electrical power consumption through 2035. [In this table, "conventional power" includes both fossil (coal and natural gas) and hydroelectric.] Some important assumptions used in deriving these projections are given below:

2015: Fully meet Nevada's RPS (20% renewable energy, with 5% of this being solar)

- Growth in total power demand is consistent with utilities' projections
- Mix of renewables (geothermal, solar, and wind) is speculative, but reasonably consistent with plans/projections already announced by utilities and others
- Assume permitting processes and construction resources allow for timely completion of all projects
- Geothermal growth will not fully meet WGA projection of 5-fold increase during this time due to practical limitations in plant construction and transmission lines

2025: Effective RPS requirement of 25%

- Assume aggressive development of renewables
- Growth in total power demand is consistent with utilities' projections
- Assume adequate transmission line growth to handle all renewables
- Assume no limitations due to permitting or construction resources
- Geothermal growth reaches WGA projections for 2015

2035: Effective RPS requirement of 30%

- Assume very aggressive development of renewables
- Total growth in power demand assumed to slow, due to efficiency improvements
- Assume adequate transmission line growth to handle all renewables
- Assume no limitations due to permitting or construction resources
- Geothermal growth approaches WGA projection for 2025

Table IV

Nevada's Potential Electric Power Consumption, Million MWh

Power Source	2004		2015		2025		2035	
	Power	%	Power	%	Power	%	Power	%
Conventional	36.3	96	38	80	40	75	41	70
Geothermal	1.3	4	6	13	8	15	10	17
Solar	0.0	0	0.5	1	1	2	3	5
Wind	0.0	0	2	4	3	6	3	5
Biomass	0.0	0	0.5	1	1	2	1	2
Total	37.6	100	47	99	53	100	58	99

- Notes:
1. Most figures are shown without decimal places to emphasize uncertainties in these estimates
 2. Due to rounding, % values do not always add to 100
 3. Although an important component of Nevada's RPS, demand-side management is ignored here

Summary and Conclusions

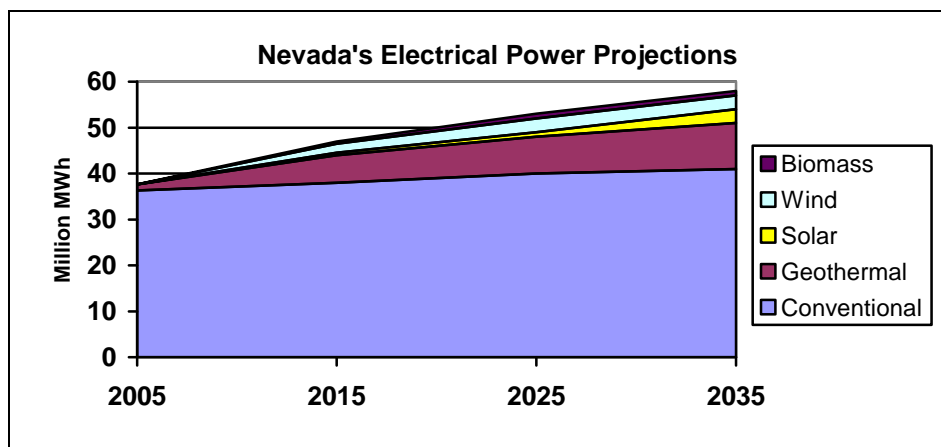
Nevada has considerable renewable energy potential in the form of geothermal, solar, and wind resources. While at present these resources contribute only about 5% of Nevada's total power generation, their contributions are expected to increase substantially over the next few decades. Commercial development of renewable power is likely to be limited by economics, transmission deficiencies, and construction capacity – not by resource availability.

Nevada's rapid population growth results in ever-increasing power demands. While the growth in power demand can be moderated slightly by improved energy efficiency (as already assumed in the utility companies' plans) continued increases in power production capacity will be required far into the future. With very aggressive promotion of renewable energy (by means of enhanced RPS, stronger incentives, tax policies, etc.) it may be possible for renewable power to satisfy most of Nevada's increased demand.

Nevada’s total electrical power demand is expected to increase by about 50% over the next 30 years (see Table IV and Figure 1). One set of projections – based upon aggressive renewable energy development – indicates that conventional power may increase by only about 10% over this period, with most of the increase coming from renewables. Achieving this level of renewable power is approximately equivalent to attaining a theoretical RPS requirement of 30%.

Although these projections show only a small increase in power produced from conventional sources over the next 30 years, there is still a need for new, cleaner conventional power plants to replace aging existing plants. While perhaps not as desirable as new renewable energy plants, cleaner conventional power plants will still provide environmental and efficiency benefits compared to the plants they replace.

Figure 1



References

1. DOE EIA Electric Power Annual Data
2. Center for Climate Strategies, “Nevada Greenhouse Gas Inventory and Reference Case Projections, 1990-2020,” Final report, July 2007.
3. Renewable Energy Atlas of the West, <http://www.energyatlas.org/>
4. American Council on Renewable Energy (ACORE): “The Outlook on Renewable Energy in America Volume II: Joint Summary Report,” March 2007.
5. WGA Report on geothermal energy potential, <http://www.westgov.org/wga/initiatives/cdeac/Geothermal-full.pdf>
6. Glitner U.S. Geothermal Energy Market Report, http://docs.glitnir.is/media/files/Glitnir_USGeothermalReport.pdf
7. Status of Energy in Nevada, Report to Governor Gibbons and Legislature, Nevada State Office of Energy, May 21, 2007.
8. Sierra Pacific Power Company’s Integrated Resource Plan (2008-2027) submitted to the State of Nevada Public Utilities Commission, June 29, 2007.
9. Nevada Power Company’s Integrated Resource Plan (2007-2026) submitted to the State of Nevada Public Utilities Commission, June 30, 2006.