

# POLICY POINTS

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## Arizona's Use of Renewable Energy: 15 Percent by 2025

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As Arizona's population continues to grow, so does the need for electricity. Retail sales of electricity in Arizona have increased along with the population, although sales per person have declined since peaking in 2007, a sign of decreased use and increased efficiency. As we progress in the twenty-first century, action must be taken to increase the sustainability of our energy resources by continuing to conserve and by shifting to the greater use of energy from renewable sources. In addition, we must work to mitigate climate change by reducing greenhouse gas emissions.

### Arizona's Renewable Energy Standard

In 2006, the Arizona Corporation Commission had the foresight to adopt the Renewable Energy Standard (RES), requiring that fifteen percent of the energy sold by regulated Arizona utilities must be produced or procured from renewable resources by 2025<sup>1</sup>. Currently, less than ten percent of the electricity generated in Arizona is from renewable sources, with the majority of that from hydroelectric power. For purposes of the RES, renewable sources include solar, wind, biomass, biogas, geothermal and other similar technologies. Hydroelectric production is not allowed to count toward the RES requirement, except in certain circumstances. This stipulation was included to encourage the development of other renewable sources in Arizona, such as solar and wind.

Although the RES does not prohibit regulated utilities from purchasing renewable power generated out of state, for example wind power generated in New Mexico, this energy must be deliverable over transmission lines. The amount of renewable energy purchased from out of state sources is expected to drop as Arizona utilities increase their own renewable sources. The RES also requires that by 2025 thirty percent of each utility's total renewable portfolio (4.5 percent of total retail sales) come from distributed generation, meaning non-utility

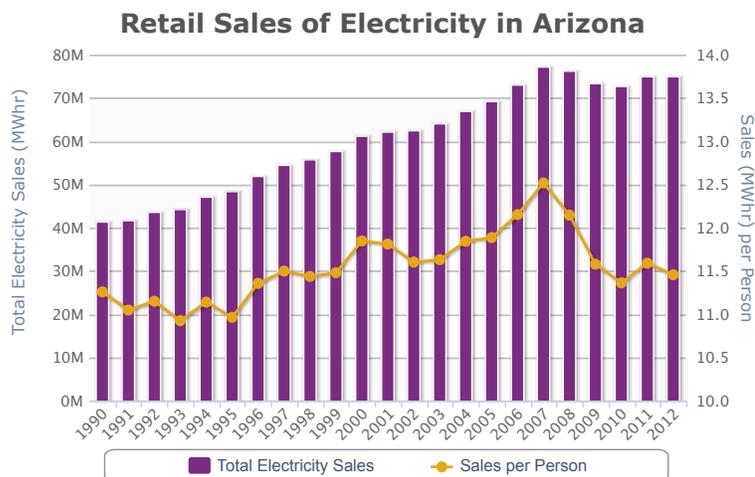


Figure 1 - Retail Sales of Electricity in Arizona. Source: Energy Information Administration, U.S. Department of Energy

<sup>1</sup> Note that the RES applies only to regulated (public) utilities, although the figures provided in this report are for electric power produced by all Arizona utilities (as reported by the US Energy Information Administration).



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owned installations, of which 50% must be from commercial sources and 50% from residential sources. The distributed energy requirement particularly encourages solar development, as solar panels are easily installed at residential and commercial sites. While a household solar installation may have a capacity of 10 kilowatts, the current capacity of the solar panels installed across the four campuses of Arizona State University is over 20 megawatts.

Up until recently, hydropower accounted for almost all of the renewable energy generated in Arizona; however, both the increase in energy derived from other renewable sources and the decrease in hydropower production due to the effects of the continuing drought have led to a decline in the percentage that hydropower contributes to renewable energy production in the state. In the future, the Southwest is predicted to become hotter and drier due

to climate change, which could mean continuing decreases in hydropower production as reservoir levels drop. Although solar and wind energy combined for just over one percent of the total electric power produced in Arizona in 2012, this was an all-time high for the state and contributed to a significant amount (17.7%) of the total renewable energy generated during the year. Solar and wind production have greatly increased in Arizona as large solar installations, such as Solana Generating Station near Gila Bend, and wind farms, such as Dry Lake Wind Power Project near Holbrook, have gone online and now produce a greater share of the energy produced in the state. In addition, forest thinning, performed to lessen wildfire risk, contributes wood as another renewable fuel source for energy production.

## Coal, Natural Gas, and Nuclear Power: The Unsustainable Big Three

Why is it important to increase the amount of energy that is produced from renewable sources? Currently, over ninety percent of the energy produced in Arizona comes from three sources: coal, natural gas, and nuclear power. Although these sources could continue to provide the bulk of energy generated in Arizona for some time to come, none of the big three sources of energy are renewable, as all have fuel—coal, natural gas, and uranium for nuclear power—that are not replaceable on a human time scale. In addition to the environmental and health ramifications of mining these fuels, there are other reasons that a switch to renewables makes good sense. Coal-fired power plants emit a large amount of carbon dioxide, as well as other pollutants such as sulfur dioxide, nitrogen oxides, particulate matter, and mercury. Carbon dioxide is the primary greenhouse gas emitted through human activities, and atmospheric concentrations have increased about forty percent since the start of the Industrial Revolution. As greenhouse gasses build up in the atmosphere, they cause it to warm, leading to changes in the climate. Coal plants are also responsible for pollution from nitrogen oxide, resulting in ozone and particulate pollution. As a result, the U.S. Environmental Protection Agency (EPA) has required that emission-control devices be installed on coal-fired power plants to cut down on greenhouse gases and other pollutants. There has been much debate on the installation of these devices

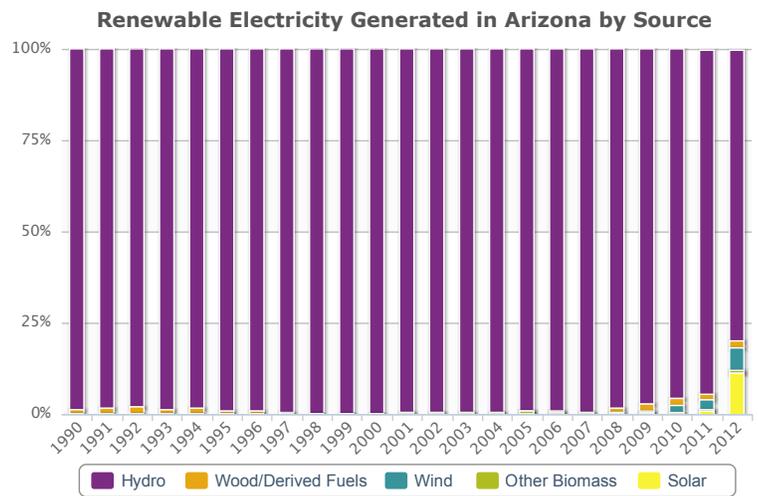


Figure 2 - Renewable Electricity Generated in Arizona by Source. Source: Energy Information Administration, U.S. Department of Energy

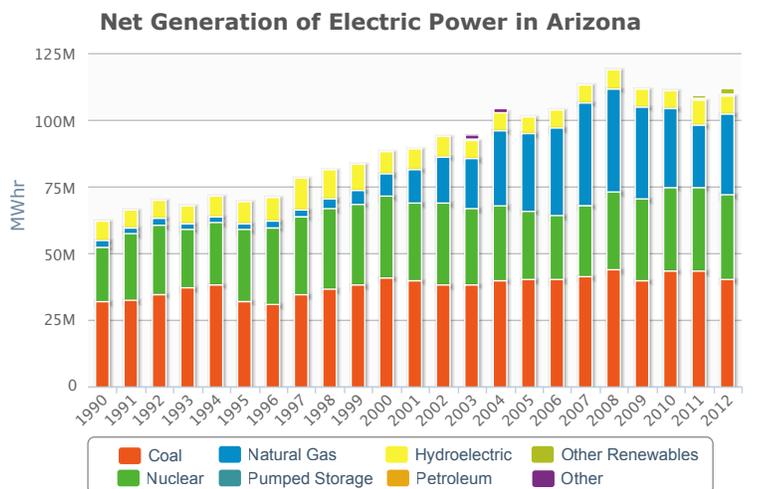


Figure 3 - Net Generation of Electric Power in Arizona. Source: Energy Information Administration, U.S. Department of Energy

at the Navajo Generating Station (NGS), a large coal-fired power plant near Page, Arizona. NGS has been blamed for a visible haze impacting views at Grand Canyon National Park, but some people have argued that the cost of installing the emission-control devices would greatly increase the cost of the energy generated from the plant. Because almost all of the energy used to pump Central Arizona Project (CAP) water from the Colorado River uphill to the Phoenix and Tucson areas comes from the NGS, an increase in energy costs could translate to an increase in the cost of water as well. Recently, the EPA approved a plan put forth last year by a working group of diverse stakeholders that would reduce emissions without installing the emission-control devices. By taking advantage of the intentions of two out-of-state utilities to divest their interests in the plant, this plan would shut down one of the three units at NGS by 2020, reducing energy generation and the accompanying emissions by one-third. Emission reductions for the two remaining generators would still be required by 2030, allowing the power plant to continue to operate until 2044. This compromise plan could be a step in the right direction, as clearly the status quo cannot be maintained in coal-produced energy. However, there are also long-term economic issues that need to be considered as part of this transition. New local jobs, with comparable skills and wages, would need to be created so that displaced NGS workers, who are primarily from the Navajo Nation, would not suffer any economic hardship. Ideally, these jobs would come from clean energy industries, an idea that was included in the collaborative proposal. And as coal-powered energy is phased out, a substitute must be found to take its place and provide the energy needed to power the CAP.

Natural gas is touted as a clean energy source and is much cleaner burning than coal; however, natural gas-fueled power plants also emit greenhouse gases, although about 50 percent less carbon dioxide than coal-fired power plants. Natural gas is not actually extracted in Arizona, but is transported to the state from New Mexico and Texas via pipelines for use in natural gas-fueled power plants and for other applications. In the eighteen years from 1990 to 2007, natural gas went from fueling less than four percent of the energy produced in Arizona to almost thirty-four percent. However beginning in 2008, the amount of electricity produced from natural gas in Arizona dropped, perhaps due to decreased energy consumption resulting from the economic downturn and the ability of contracts utilizing coal and nuclear energy to satisfy baseload demands. On a national level, natural gas production has remained strong due to low prices and a good market for the product.

Nuclear power provided forty percent of the energy produced in Arizona in 1996. However, a subsequent dip in production, accompanied by the increase in energy produced from natural gas, caused this percentage to decrease. But energy production from nuclear power has been increasing since 2006 and it is now contributing almost thirty percent of the energy generated in Arizona. While nuclear power plants have little or no carbon emissions, and therefore do not contribute to climate change, the issue of radioactive waste and where to store it is still being debated.

## The Water-Energy Nexus

An additional consideration of coal, gas, and nuclear power production is the amount of water used by these power plants for energy generation, something to consider as climate change diminishes Arizona's fresh water supply. Most coal-fired power plants and all nuclear plants use large amounts of water, but the Palo Verde Nuclear Generating Station, located about 45 miles west of Phoenix, uses treated wastewater from the Phoenix metropolitan area to satisfy its cooling needs, thus eliminating the need for a fresh water input. Natural gas-fueled power plants also use water for cooling, although less per unit of electricity produced than coal or nuclear plants.

Water may also be needed for energy production using renewable energy sources. Hydropower production loses large amounts of water to

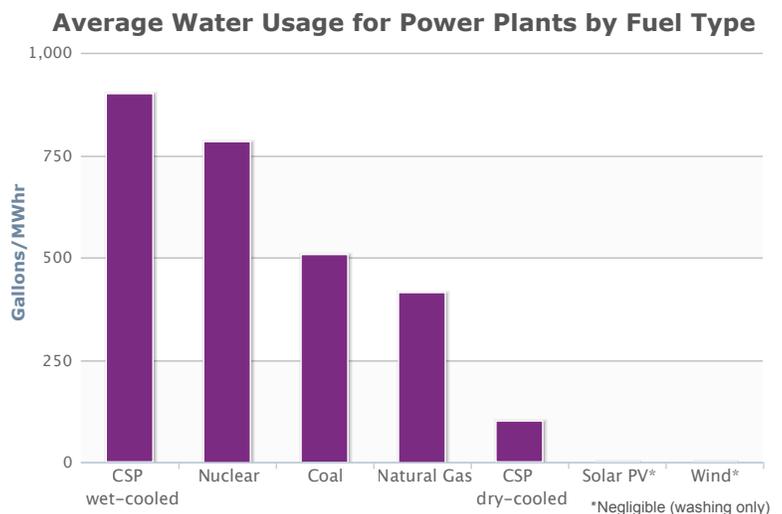


Figure 4 - Average Water Usage for Power Plants by Fuel Type. Source: Arizona Water Institute [http://wsp.arizona.edu/sites/wsp.arizona.edu/files/Pasqualetti fact sheet.pdf]

evaporation from reservoirs. Hydropower is also dependent on water flowing through turbines built into dams; however, this water can still be used to satisfy downstream water demand. Nevertheless, the amount of water flowing in rivers such as the Colorado River and the Salt/Verde river system may decrease dramatically due to drought and climate change, impacting the amount of energy that can be provided by hydropower. In 2012, hydropower supplied about 80% of the renewable energy produced in Arizona, a large drop from its historical percentage of supplying 95-100% of the renewable energy produced in the state.

The amount of water used for solar energy production depends on the type of solar plant that produces the energy. Wet-cooled concentrating solar power plants use large amounts of water, even more per unit of energy produced than nuclear and coal plants, both for steam generation to power turbines and for cooling. However, photovoltaic (PV) solar cells (i.e., solar panels) use no water for energy production and only a small amount to keep them clean. PV energy production can be from large centralized solar power plants as well as from decentralized residential and commercial locations (e.g., rooftop solar panels). Wind energy also uses only a small amount of water for cleaning and none for energy production and the amount of wind energy produced in Arizona has continued to increase each year since the first Arizona wind farm opened near Holbrook in 2009. Biomass energy production can require large amounts of water for irrigation of fuel crops, such as in the case of corn grown for ethanol; but, in Arizona, biomass fuel can be a beneficial side effect of forest thinning, a strategy being used for wildfire protection.

## A Sustainable Energy Future

Currently, renewable energy sources only provide a small amount of the energy produced in Arizona, less than ten percent including hydropower. But as the regulated utilities continue to increase production from solar, wind, and biomass to meet the RES requirements, this percentage will increase. As renewable sources increase, we can decrease our dependence on traditional sources that require great amounts of water and have a large carbon footprint, such as coal. Natural gas power production is a better alternative than coal, but still requires large amounts of water and produces carbon dioxide, although on a smaller scale.

In 2006, the Corporation Commission had the foresight to set a firm goal to help Arizona move towards the greater use of renewable resources to meet our energy needs. In order to proceed in a sustainable manner, we must conserve both our energy and water resources and continue to develop technologies that use renewable energy sources, consume little or no water, and do not emit greenhouse gases and other pollutants. We also need to make certain that this transition does not result in lost job opportunities and that we have methods in place to train workers in renewable energy production. By working towards these goals, we can make certain that we are meeting our future energy needs in a responsible manner that will carry us through this century and beyond.