

PROP 127



Consortium for Science,
Policy & Outcomes
at Arizona State University

Mapping Arizona's Energy Future

Proposition 127, or the [Clean Energy for a Healthy Arizona Initiative](#), would amend Arizona's Constitution to mandate that electric utilities get 50% of electricity from renewable sources like solar and wind by 2030.

This guide describes Arizona's energy systems, challenges those systems face in the future, and the uncertainties that make large changes to energy systems difficult. This guide is not meant to convince voters to support or reject the proposition. It focuses on important considerations, tradeoffs, and factors that complicate our energy future.

The Basics

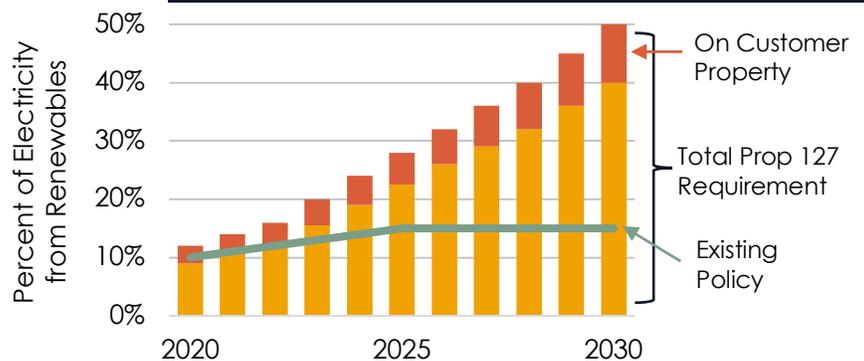
Prop 127 would require **50% of electricity to come from renewable sources**, like solar and wind. Ten percent must come from sources located on customer property, such as roof top solar. Prop 127 would create a renewable energy credit system. Utilities and electricity generators could buy and sell credits to meet the 50% requirement.

Existing Arizona regulations require **15%** of electricity to come from renewable sources by **2025**.

This guide outlines three considerations about the impacts of Prop 127. Unexpected developments could change these considerations from positive to negative, or negative to positive. Twenty years ago, for example, few experts predicted that natural gas prices would be as low as they are today. The "Key Uncertainties" sections highlight some big question marks about the future.

Question: What do you find appealing about renewable energy? What concerns you?

Renewable Requirements in Prop 127



Using this Guide

This guide includes questions, like the one below, to help you sort your own values and opinions about the issues presented. Answer them by yourself or use them as discussion questions with neighbors, coworkers, or friends and family. The last page has suggestions for discussing the issue with others.

Arizona's Electricity System: The Grid, Utilities, & Markets

Electricity generated at power plants is fed into a large grid of transformers, substations, and power lines. Making the grid work is more than just turning on a power plant and plugging in a TV. The amount of electricity used by homes and businesses must be matched by output from power plants. Too much demand can cause outages. Too little demand (and too much supply) can damage equipment and lead to grid failures. Grid managers use forecasts to predict demand and manage power plants accordingly. Forecasts use information about the weather and times people turn on major appliances like stoves and A/C to predict demand. Despite this complex task, U.S. electricity grids are *incredibly* reliable.

In the U.S., electric utilities evolved in the late 1800's to provide reliable and affordable access to electricity. In Arizona, we have investor-owned utilities and non-profit co-operatives that are owned by their customers.

Investor-owned means that for-profit companies own those utilities. Utilities are different from other companies because the state government guarantees utilities access to customers. In exchange, utilities must meet regulations requiring them to provide reliable and affordable access to electricity.

The Arizona Corporation Commission, or ACC, regulates most utilities in Arizona. The ACC, for example, must approve changes to rates that utilities charge customers and the construction of new power plants. The five members of the ACC are elected in statewide elections. Other agencies, like the Federal Energy Regulatory Commission and federal and state environmental agencies, also regulate utilities.

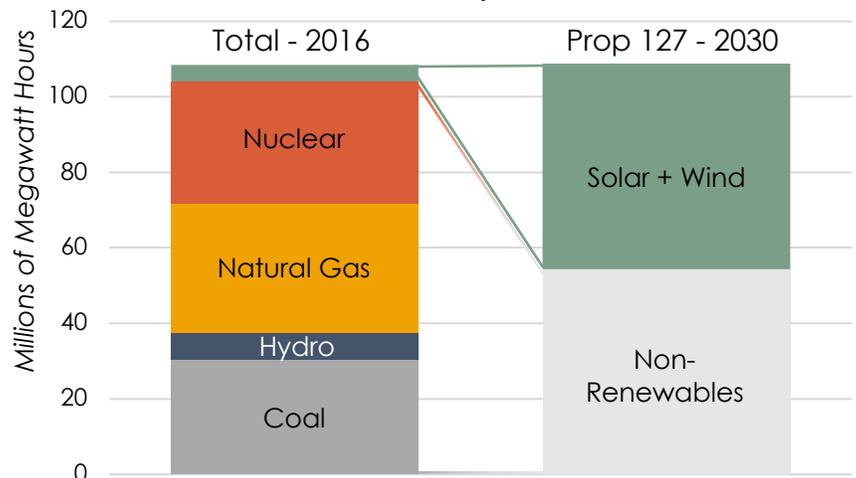
Some parts of electricity systems are managed like markets. For example, utilities will pay for electricity from other generators to help meet demand. The price of electricity on the market can in turn impact the price consumers pay on their utility bills.

Electricity in Arizona

Most coal burned for electricity in Arizona came from mines in Arizona (38%), New Mexico (29%), and Wyoming (27%) in 2016. Almost all natural gas used in Arizona comes from wells in other states. Oil for transportation fuels comes from California and Texas. About 90% of uranium for nuclear power generation in the U.S. comes from sources outside the country, mostly in Canada, Australia, Russia, and Kazakhstan.

Source: US Energy Information Administration

Arizona Electricity Generation



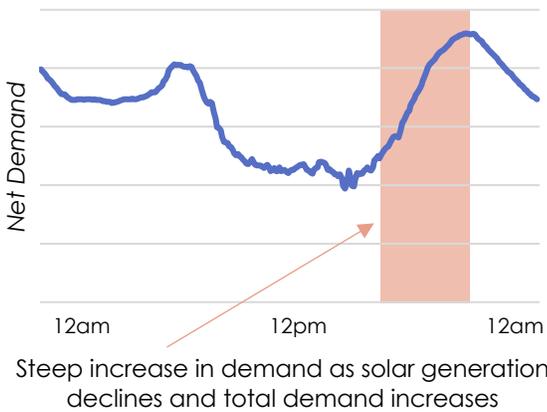
Prop 127 excludes existing hydroelectric plants from the 50% renewable goal. Data for 2016 includes power generated by utilities not impacted by Prop 127.

In 2016, 4% of Arizona's electricity came from solar and wind. If electricity demand does not change, a 50% goal would require about 12 times as much solar and wind by 2030. Experts expect demand to rise.

Consideration 1: Technical Challenges

Prop 127 presents technical challenges for utilities.

Net Electricity Demand (example)
(Total demand minus solar & wind generation)



Renewable Generation and Electricity Demand

Electricity demand is usually highest in the mornings and evenings when people turn on stoves, A/C, and TVs. Output from solar panels is highest near noon and decreases as the sun gets lower in the sky. During hot Arizona summers, a lot of solar generation could help meet demand for electricity as homes and businesses run A/C. As temperatures fall, demand for electricity midday is much lower. A large amount of solar generation during spring and fall can lead to *too much* electricity on the grid, which forces utilities to ramp down production from other sources. But ramping down production from large coal, natural gas, and nuclear plants can be costly and is not always feasible.

Storage

Pumped water storage and batteries are two proposed methods of storing energy to help match solar generation to demand. Pumped water storage involves pumping water uphill when lots of electricity is available and running it through a hydroelectric power plant to generate electricity when it's needed. Utilities can also use large batteries to store electricity. Utilities are beginning to deploy batteries at costs comparable to other energy sources, like small natural gas plants.

Key Uncertainties

Changes in Demand: Many factors impact electricity demand. Electric vehicles could greatly increase electricity demand, straining the grid. But the batteries in electric vehicles could provide electricity storage on the grid. Population growth and economic changes also impact demand.

Technology & Markets: Some experts point to new battery projects and falling battery costs as evidence that battery storage will be more widely deployed and affordable over the coming decade. Others highlight that utilities could face challenges deploying batteries across the grid due to existing regulations, market rules, and technical concerns.

Questions: What hopes and concerns do you have about these technical challenges?

What developments would change your hopes and concerns?

Consideration 2: Economy, Jobs, & Costs

Prop 127 could impact the economy, jobs, and costs for utilities and consumers.



Navajo Generating Station a coal burning plant Near Page, AZ. Photo: Alex Proimos, 2009

Retiring Old Power Plants, Building New Ones

Utilities plan to build power plants years in advance and operate those plants for decades. Closing a fossil-fuel power plant early can translate to a loss of investment. Building new renewable power plants requires investment even though costs of renewable technologies continue to fall. These investments would impact rates for consumers.

Jobs

According to the [US Energy Information Administration](#), the number of solar and wind jobs are far greater than those associated with fossil fuel power plants. But fossil-fuel burning power plants employ many people, meaning a switch from fossil fuels to renewables could mean a shift of some jobs. In Arizona, the proposed closure of the Navajo Generating

Station (left), a closure planned independent of Prop 127, concerns local residents and leaders. Jobs at the plant and the coal mines that supply its fuel might leave the community.

Creating New Industries

Much of the fuel that powers Arizona's coal and natural-gas plants comes from outside the state. An industry for renewable energy and power storage in Arizona could drive economic and job growth through selling renewable energy to other states. Within Arizona, Prop 127's renewable energy credit system could incentivize businesses to provide renewable energy.

Key Uncertainties

Questions: What hopes and concerns do you have about Prop 127 and the economy?

What developments would change your hopes and concerns?

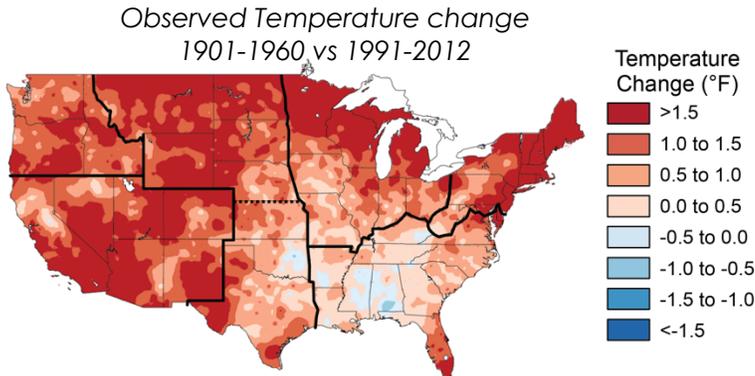
Policy: Renewable standards in other states could drive up demand for renewable energy produced in Arizona. Climate change or carbon policy could push fossil fuel plants to shut down or drive up operation costs. Federal and state tax credits make some renewable energy technologies more affordable. The price of renewable energy technologies could increase if those credits expire.

International Markets: Electricity systems depend on complex global trade for things like fuels and batteries. Changes to the economy in China or Europe, for example, could impact costs here.

Consideration 3: Environment & Human Health

Prop 127 electricity could affect the environment in numerous ways.

Air quality: The burning of coal and natural gas contributes materials to the atmosphere that harm air quality. Those materials can reduce visibility, impact the health of plants and animals, and worsen some health conditions, like asthma and heart disease. Switching from coal power plants to renewables can improve regional air quality and human health.



From the National Climate Assessment, 2014
nca2014.globalchange.gov

Water use: Conventional power plants use a lot of water. Both wind and solar require very little water to operate, meaning switching from conventional power plants to renewables could save a lot of water.

Climate change: Burning coal and natural gas creates carbon dioxide that contributes to climate change. Climate change could make heat waves, droughts, and severe storms worse for future Arizonans. Coal emits more carbon dioxide than natural gas to

create the same amount of power. Both solar and wind produce very few emissions even when emissions from manufacturing and construction are considered.

Key Uncertainties

Impact on existing capacity: Some experts worry that a large deployment of renewables could make nuclear power plants too expensive to operate. Nuclear power plants generate few carbon emissions, like renewables, and provide consistent generation. If a nuclear plant's capacity was replaced by something like a natural gas plant, emissions would increase.

Effectiveness for climate: Policies like Prop 127 have helped reduce emissions in some states. But unforeseen factors have challenged efforts elsewhere. Germany invested heavily in renewables over the last two decades. But output from solar and wind, as discussed on page 3, varied without a way to store energy. Steep daily changes in output, along with an emissions trading market that priced emissions too low and the retirement of nuclear plants, caused German utilities to burn more low-quality coal. This prevented Germany from achieving its emission reduction goals.

Questions: What hopes and concerns do you have about Prop 127 and the environment?

What developments would change your hopes and concerns?

Discussing the Issue with Others

Here are some ground rules to help lead a discussion:

1. Read each section of the guide and allow equal time to discuss each section.
2. Be respectful of others' opinions, and allow everyone to share their ideas.
3. Review the conversation. What common ground emerged? Which tradeoffs were most difficult?

Plotting a course for the future is not easy. It involves weighing uncertainty and tradeoffs to navigate from where we are now to the goals, values, and aspirations we hope to achieve. Prop 127 and the environmental and economic issues surrounding it will affect all Arizonans. We think it's best if all Arizonans deliberate about the issue with neighbors, coworkers, and friends and family.

Questions:

What concerns you about Prop 127 over the next 5 years? What about over the next 15 years?

What makes you optimistic about Prop 127 over the next 5 years? What about over the next 15 years?

How might Prop 127 affect you or people you know?

What else can Arizona do to address energy issues, the environment, and the economy?

About this Guide

This guide was developed by Arizona State University's Consortium for Science, Policy & Outcomes. ASU researchers conducted interviews with several energy and policy experts to create this guide.

The Consortium of Science, Policy & Outcomes, a research center at Arizona State University's Institute for the Future of Innovation in Society, is an intellectual network aimed at enhancing the contribution of science and technology to society's pursuit of equality, justice, freedom, and quality of life. For more information about the consortium, please visit www.cspo.org.