What We Modeled: Inputs, Assumptions, and Methodology

The Natural Resources Defense Council (NRDC), NextGen Policy Center, and GridLab commissioned an analysis conducted by renowned energy firm ICF to examine the effects of strengthening renewable energy standards across the Southwest. Resource decisions in one state can impact another state in the interconnected Western grid, so this study considered both the regional and state-by-state impacts of strengthened renewable portfolio standards (RPS) in Arizona, Colorado, Nevada, and New Mexico. The analysis use ICF's Integrated Planning Model (IPM®).

IPM is a detailed model of the electric power system routinely used by the electricity industry and regulators, including the U.S. Environmental Protection Agency, to assess the effects of environmental regulations or policies. It integrates extensive information on power capacity and generation, technology performance, transmission, energy demand, electricity and fuel prices, energy-related policies, and other factors. IPM then determines the most cost-effective way to meet electricity needs based on its detailed representation of the U.S. electricity system. The model can simulate building new power plants, retiring existing plants, or ramping them up and down to meet demand, reliably, in the least-cost way.

NRDC, NextGen Policy Center, and GridLab developed assumptions that ICF populated into its modeling platform to project outcomes under a Reference Case and two policy cases.

1. In the **Reference Case**, also known as the business-as-usual (BAU) Case, only policies and power plant additions and retirements already approved are explicitly modeled. Any additional capacity expansion or retirements reflect changes driven purely by economics.
2. In the **Renewable Portfolio Standard (RPS) Case**, utilities in Arizona, Colorado, Nevada, and New Mexico are all subject to strengthened RPS requirements. For each state, the definition of renewable resources matches the language of existing renewable energy policies. This case also includes a requirement that the renewable energy resources used to meet state RPS requirements be located within the applicable state. The state targets are as follows:
    a. Arizona: Investor-owned utilities must supply 50 percent of retail sales with renewable sources by 2030, with a 10 percent carve-out for distributed generation (DG, such as rooftop solar) by 2030. Salt River Project must achieve a 25 percent standard by 2030.
    b. Colorado: Investor-owned utilities must meet a 65 percent RPS, with a 6.5 percent carve-out for DG, by 2030. Large electric cooperatives (co-ops) must meet a 55 percent RPS, with a 5.5 percent carve-out for DG, and small co-ops

and municipal utilities (munis) must meet a 45 percent RPS, with a 4.5 percent carve-out for DG, by 2030.

c. Nevada: Investor-owned utilities must supply 50 percent of retail sales with renewable sources by 2030.
d. New Mexico: Investor-owned utilities must supply 50 percent of retail sales with renewable sources by 2030, with a 2 percent carve-out for DG. Co-ops and munis in New Mexico must supply 40 percent of retail sales with renewables by 2030. In New Mexico, all the state's electricity providers must also ramp up their energy efficiency spending to meet a 1.8% annual savings target by 2025.

3. In the **Utility Plans or Gas Expansion Case**, we modeled the utilities' new planned fossil additions as firm builds and kept each state's existing RPS targets. New natural gas builds were drawn from the latest integrated resource plans (IRPs) for utilities in New Mexico and Arizona. For Colorado and Nevada, we instead specified that when power plants retire or demand increases, utilities must meet at least two-thirds of the electricity "demand gap" with new gas-fired power plants. We also refer to this case as the IRP Case or the Utility Plans Case because it reflects the future envisioned by the investor-owned utilities in these states.

Assumptions for the policy cases relied primarily on publicly-available cost, performance, and macroeconomic projections from various parts of the U.S. Department of Energy (DOE). For gas prices and energy demand, the model reflects business-as-usual projections from the Energy Information Administration (EIA), an independent statistical agency of the DOE. For power plant costs, we relied on the EIA for the costs of building new fossil-fuel-fired generation and new nuclear plants; we used the Annual Technology Baseline report, from the DOE's National Renewable Energy Laboratory, for the costs of building new wind and solar projects, which represent the lab's expert view on the future costs of renewable technologies. Limits on variable renewable generation were incorporated to approximate the amount of solar and wind the Western grid could accommodate without significant additional transmission capacity or reliability issues. The variable renewable energy limits are shown below:

Constraint Name	2018	2020	2025	2030
Solar	25%	30%	35%	40%
Wind and Solar	**40%**	**50%**	**55%**	**60%**
Wind	30%	40%	40%	40%

The results of this power sector modeling allow us to evaluate the energy and cost impacts of environmental policies, like renewable portfolio standards, on power producers, grid systems, and ratepayers in different states. A comparison of the different policy cases gives us the means and data to understand how various policy approaches impact energy flows, plant decisions,

energy prices, retail bills, systemwide costs, and air pollution emissions. This allows us to more thoroughly and completely study specific policy approaches to understand what policies are better for a particular state or region of U.S.