

# Value and Costs of State Renewable Portfolio Standards

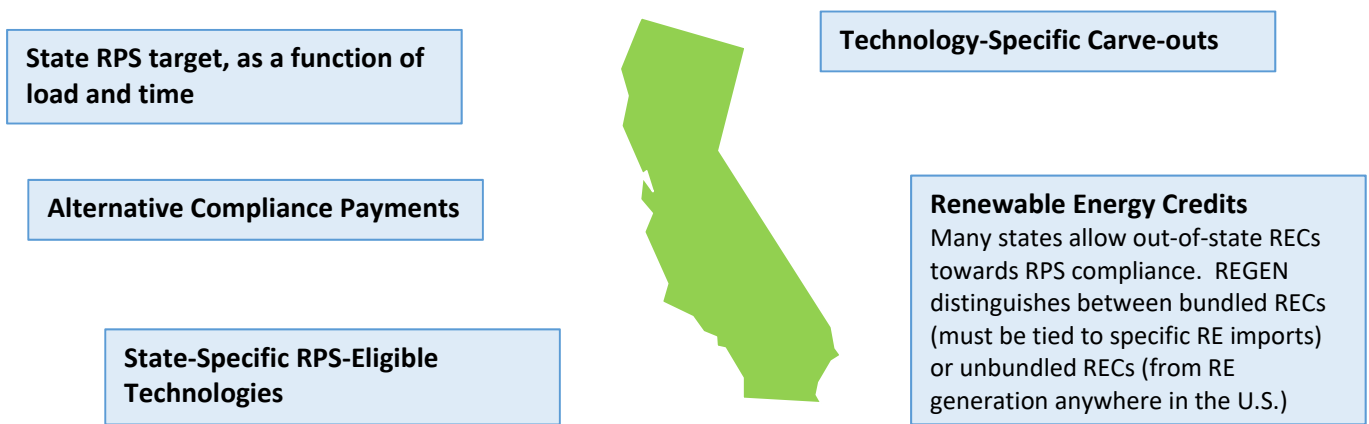
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**Renewable portfolio standards (RPS)** are common policy instruments deployed in many U.S. states and other countries. Arguably the primary driver for these standards is their use as a tool to **reduce carbon dioxide (CO<sub>2</sub>) emissions from the electric sector**, by having new renewable generation displace fossil-fired generation.

Requiring new renewable generation is only one of many options to reduce CO<sub>2</sub> in the electric sector. Other mitigation options may be available at lower cost. One way to evaluate the **cost effectiveness of renewable portfolio standards as a means of reducing CO<sub>2</sub>** is to compare the cost of building and dispatching the portfolio incentivized by the RPS with the **least-cost resource portfolio that achieves equivalent CO<sub>2</sub> reductions**.

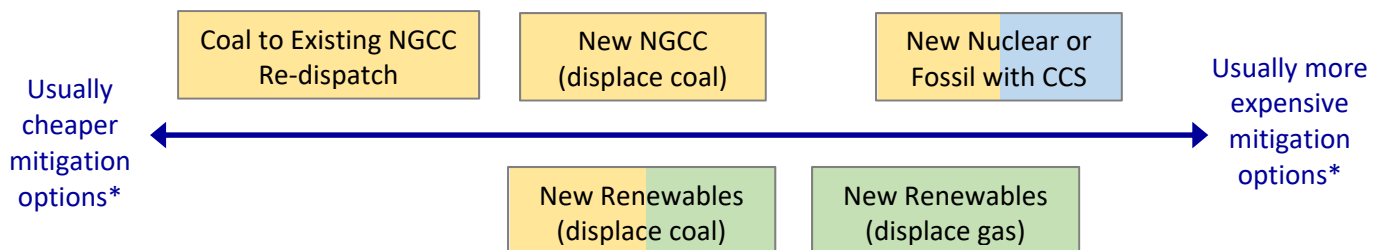
## EPRI Analyzed the Value and Costs of State RPS Using the US-REGEN Model

Renewable portfolio standard design varies widely by state. US-REGEN captures five key features common to many renewable portfolio standards, for each of the lower 48 states where an RPS exists.



For a detailed overview of the US-REGEN model, full documentation and other reports are available at <http://eea.epri.com/usregen>.

## Renewable Portfolio Standards Omit Potentially Lower Cost CO<sub>2</sub> Mitigation Options



Least cost portfolios in US-REGEN choose these CO<sub>2</sub> mitigation options

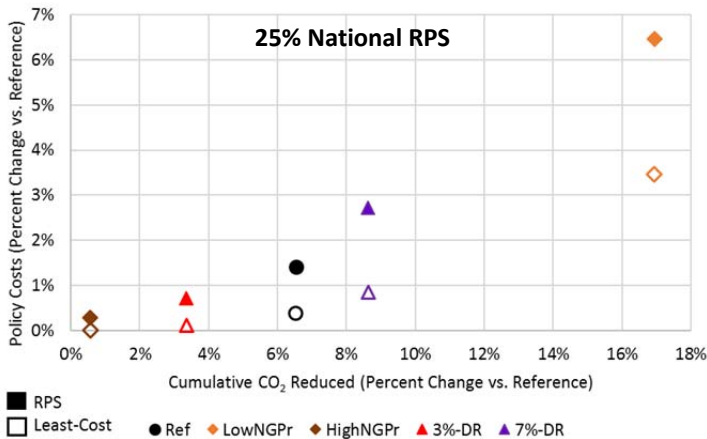
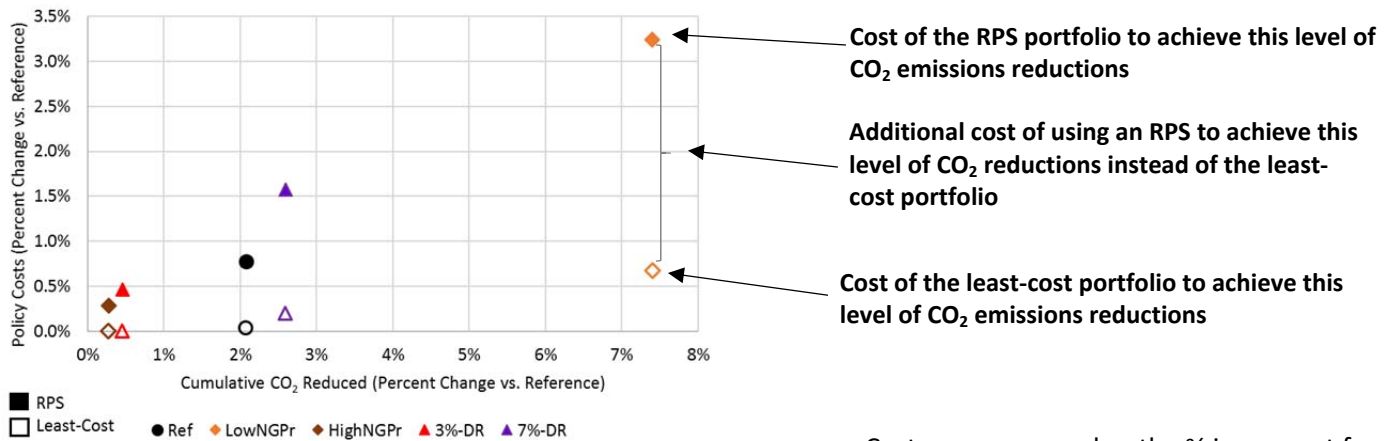
\* Assumes reference or lower natural gas price paths. Chart is indicative only, and not to scale. Relative costs vary by region, time, existing capacity mix, and policy stringency. Many mitigation options are not included.

RPS portfolios in US-REGEN choose these CO<sub>2</sub> mitigation options

## Results Considered Across Five Sensitivities

| # | Sensitivity Name | Natural Gas Price Path                  | Discount Rate |
|---|------------------|---|---------------|
| 1 | Ref              | AEO 2017 Reference Case                 | 5%            |
| 2 | LowNGPr          | AEO 2017 High Oil and Gas Recovery Case | 5%            |
| 3 | HighNGPr         | AEO 2017 Low Oil and Gas Recovery Case  | 5%            |
| 4 | 3%-DR            | AEO 2017 Reference Case                 | 3%            |
| 5 | 7%-DR            | AEO 2017 Reference Case                 | 7%            |

## Renewable Portfolio Standards are Typically Twice the Cost of the Least-Cost Portfolio that achieves Equivalent CO<sub>2</sub> Reductions



- Costs are measured as the % increment from a scenario with no policy for each sensitivity, to allow comparison across sensitivities
- For very small CO<sub>2</sub> reductions, least-cost portfolio cost is close to zero (re-dispatching existing NGCC units in place of coal units)
- As RPS targets rise, the equivalent least-cost portfolio contains more renewables, so the cost premium of using an RPS over the equivalent least-cost portfolio is lower
- Even at high natural gas prices, decreasing returns to additional renewable penetration imply that the least cost mitigation options are not just new renewable capacity

The US-REGEN electric sector only model was used for this analysis, so projections of rooftop solar are excluded. The modeling includes a representation of the existing Investment and Production tax credits as of September 2017.

This is a summary of EPRI analysis. More detail can be found in "The Costs and Value of Renewable Portfolio Standards in Meeting Decarbonization Goals", *Energy Economics* 73:337-351, June 2018, available at <https://www.sciencedirect.com/science/article/pii/S0140988318301427>.

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