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Alternative Policies – Utility Rate Structure

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Utility Rate Structure

Distributed generation technologies such as solar photovoltaics (PV) are increasingly used to reduce electricity purchases for buildings from the grid. As more homes incorporate solar PV, electric utilities and state utility commissions continually evaluate ways to equitably compensate solar PV system owners for generation. Changing compensation rates lead to growing uncertainty about future solar PV adoption.

The alternative utility rate structure cases incorporate *wholesale* or *marginal* electricity prices as compensation for *all* residential solar PV generation, whether consumed onsite or sold back to the grid, in place of the assumptions used in the AEO2020 Reference case and core side cases that compensate all residential PV generation at *retail* electricity rates. EIA does not have an opinion on policies to compensate PV generation. These alternative assumptions provide boundary cases that examine how the uncertainty in net metering policy might affect solar PV adoption across the United States compared with higher or lower economic growth, renewable equipment costs, or oil and gas supply.

Distributed PV systems are typically roof-mounted and operate behind the meter, which could reduce utility investment in transmission and distribution infrastructure when compared with centrally deploying equivalent solar PV assets. In the AEO2020 Reference case, residential sector solar PV capacity increases by an average of 6.1% per year through 2050. Adoption grows as installed equipment costs[1] decline and the federal investment tax credit (ITC)—scheduled to phase down through 2022—further reduces costs.

Much of the electricity generation from residential PV systems is consumed onsite, avoiding the retail purchase of electricity. Generation that is not used onsite is sold back to the electric utility. Most states[2] have net metering utility tariffs that allow residential customers, within the billing period, to reduce the billed volume of electricity supplied by the grid by the volume of electricity that the customer sold back to the grid during times that self-generation exceeded consumption. The solar PV generation is usually reimbursed at the same retail electricity rate that consumers would be charged to purchase electricity from the grid.

In some regions, including those with higher levels of variable renewable energy capacity, utilities reimburse consumers for excess electricity sold to the grid at rates that value solar PV generation closer to the wholesale price of electricity instead of the retail rate, in part, to manage the amount of variable energy capacity added to the grid. Wholesale electricity rates—the prices at which electricity is traded on regional electricity markets—are significantly lower than retail electricity rates because they do not account for transmission or distribution costs. Reimbursing at the wholesale electricity rate can lead to longer payback periods for residential solar PV equipment than if consumers received compensation at the retail electricity rate.

How utilities compensate solar PV generation has changed in some states in recent years. In 2019, Maine switched from a policy of *gross metering*—in which all generation, whether used onsite or sold

[1] The Assumptions to AEO2020 summarize residential solar PV costs used in all cases except the Low Renewables Cost and High Renewables Cost cases. The former assumes 40% lower solar PV installed equipment costs—also known as overnight capital costs—than the Reference case by 2050, while the latter holds PV costs at the 2019 level through 2050.

[2] The Database of State Incentives for Renewables and Efficiency includes the latest state-level distributed generation policies.

back to the grid, is compensated below the retail price of electricity—back to net metering. New York grandfathers residential systems built before 2020 into net metering agreements; however, new systems will fall under Value of Distributed Energy Resources (VDER) compensation. In Arizona, new solar PV generation is valued at a rate below retail electricity that is based on utility-scale solar prices.

Methodology

The alternative utility rate structure cases consist of seven individual cases:

- Reference with Wholesale PV Rate
- High Economic Growth with Wholesale PV Rate
- Low Economic Growth with Wholesale PV Rate
- High Oil and Gas Supply with Wholesale PV Rate
- Low Oil and Gas Supply with Wholesale PV Rate
- High Renewables Cost with Wholesale PV Rate
- Low Renewables Cost with Wholesale PV Rate

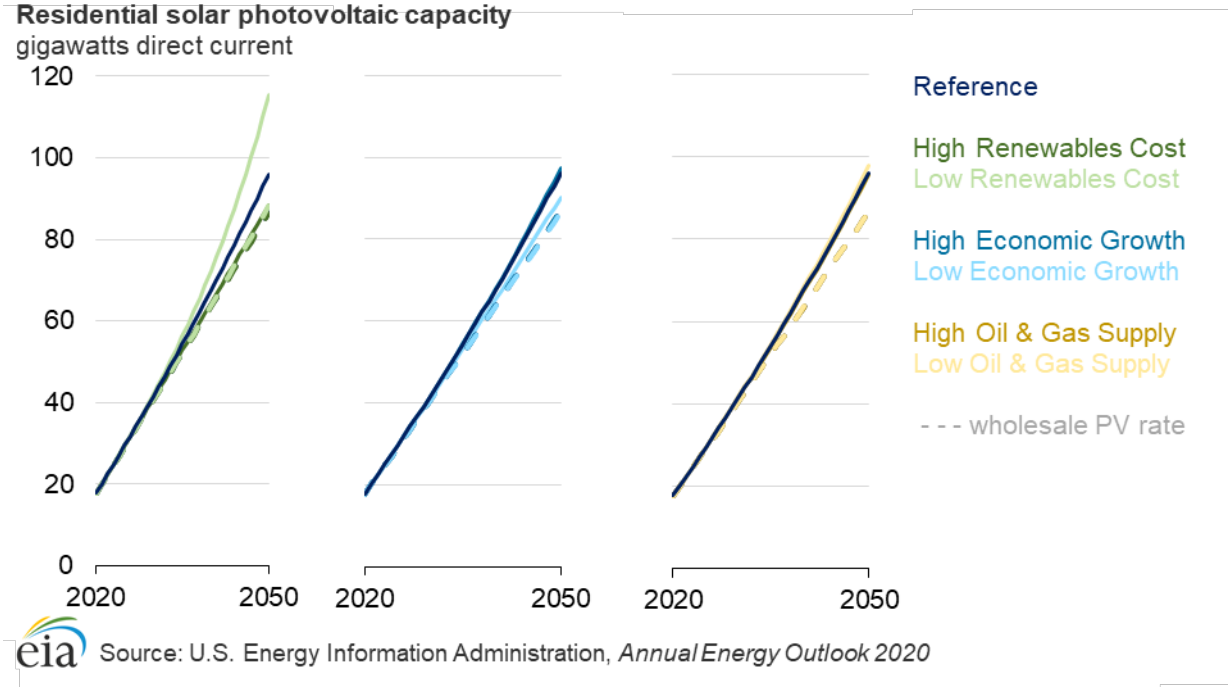
These seven cases are modeled by varying the price at which residential solar PV generation is compensated in the AEO2020 Reference, High Economic Growth, Low Economic Growth, High Oil and Gas Supply, Low Oil and Gas Supply, High Renewables Cost, and Low Renewables Cost cases, respectively. That is, all residential solar PV generation from 2020 onward is valued at the wholesale rate rather than the residential retail price of electricity.

Electricity rates continue to vary by census division as in all other cases. Assumption changes were made only to the residential model, so any variation in other sectors—including utility sector projections—in the Reference case and side cases with the alternative utility rate structure case assumptions are a result of the changes in residential solar PV adoption.

Results

Because wholesale PV rates are generally lower than retail rates, residential solar PV capacity decreases in all alternative utility rate structure cases. As a result, the Reference with Wholesale PV Rate case shows 10% less capacity when compared with the Reference case in 2050 (Figure 1). Of all the cases examined in this analysis, the Low Renewables Cost case—where installed equipment costs are 40% lower than in the Reference case by 2050—shows the greatest difference in residential solar PV capacity when the wholesale PV rate case assumptions are applied. There is 24% less residential solar PV capacity in 2050 in the Low Renewables Cost with Wholesale PV Rate case than in the Low Renewables Cost case (with retail rate compensation). In fact, there is less residential solar PV capacity in 2050 in the Low Renewables Cost with Wholesale PV Rate case than there is in the Reference case, which includes retail rate compensation. For residential solar PV, the change in the utility rate structure has a greater impact than a 40% decrease in the cost by 2050.

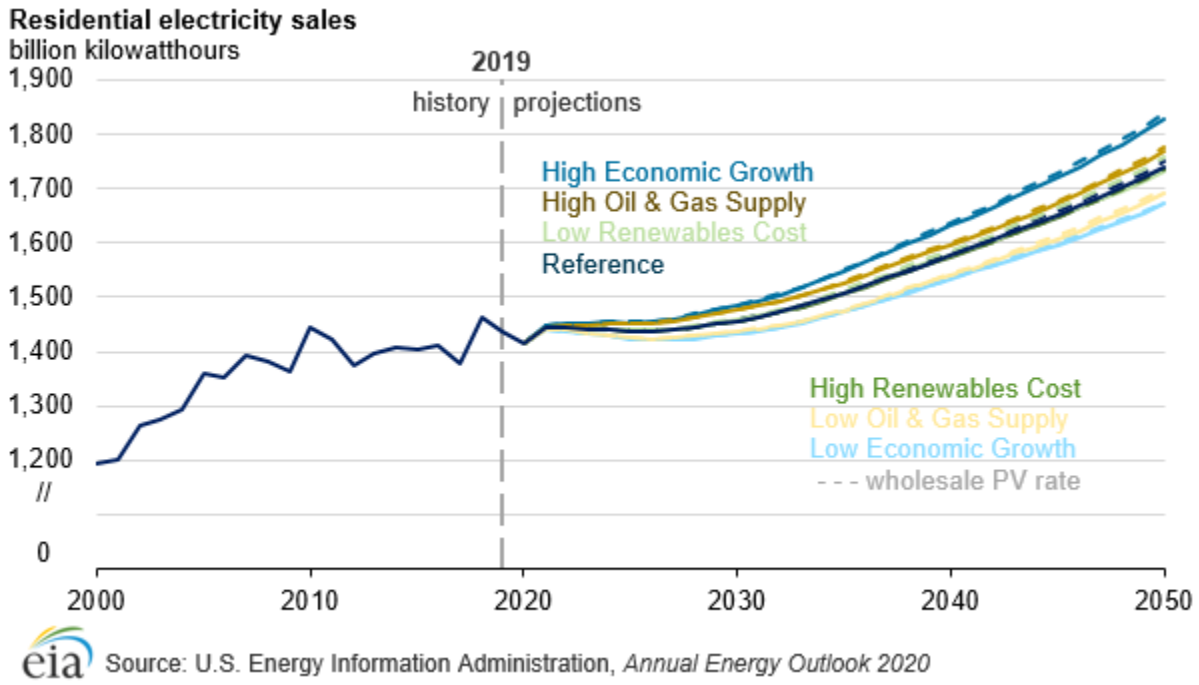
Figure 1. Residential solar photovoltaic capacity from select alternative cases, 2020–2050



The wholesale utility rate structure assumption causes residential solar PV capacity to decrease and sector electricity sales to increase when compared with cases using retail PV rates (

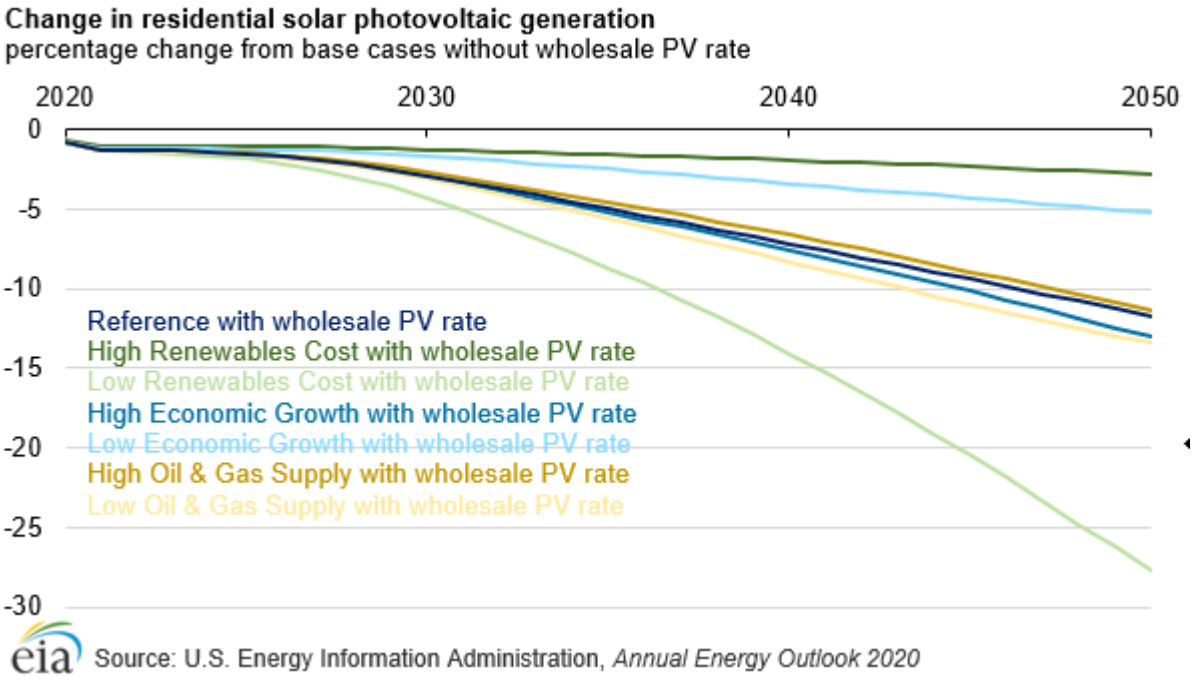
Figure 2). However, differences between the AEO2020 side cases have a greater effect on residential electricity sales than the utility rate structure does. These differences include the level of economic growth in the United States, which drives disposable income and the number of new housing units throughout the projection period; the cost of renewables in all sectors; and the supply of oil and gas, which affects natural gas prices. The effects of the alternative utility rate structure assumptions vary from 0.1% higher retail sales in 2050 in the High Renewables Cost with Wholesale PV Rate case (compared with the corresponding retail rate case) to 1.5% higher in 2050 in the Low Renewables Cost with Wholesale PV Rate case (compared with the corresponding retail rate case). The differences are determined by the changes in generation based on the residential solar PV capacity shown in Figure 1. By comparison, residential electricity sales in the AEO2020 High Economic Growth and Low Economic Growth cases are 5% higher and 4% lower, respectively, in 2050 than in the Reference case.

Figure 2. Residential electricity sales in Reference case and select alternative cases, 2000–2050



Residential solar PV generation with wholesale PV rate assumptions decreases when compared with cases using retail PV rates (Figure 3). Changing the amount of residential solar PV by switching rate structures can also impact the deployment of utility-scale solar. The amount, and even the direction, of change in utility-scale solar PV generation varies among the alternative utility rate structure cases. The change in utility-scale solar does not always offset the decrease in residential solar. Sometimes, utility-scale solar generation even decreases, in part, because increased demand for electricity sales from the grid created by less residential generation can be met by increases in both non-renewable utility generation as well as utility solar PV, and the relative competitiveness of these non-renewable resources varies across the AEO2020 side cases. Because the amount of utility-scale solar PV is so much greater than residential sector solar PV, changes resulting from switching the utility-rate compensation have a much larger relative impact on residential solar PV than they do on utility-scale solar PV. For example, although residential PV generation is 28% less in 2050 in the Low Renewables Cost with Wholesale PV case than it is in the corresponding retail rate case, total power sector generation increases by only 0.9% in 2050 in the Low Renewables Cost with Wholesale PV Rate case than it does in the corresponding retail rate case.

Figure 3. Change in residential solar photovoltaic generation in alternative cases, 2020–2050



Solar PV growth is sensitive to electricity prices; however, the effect of wholesale PV rate compensation on residential average retail electricity prices is minimal when compared with cases assuming retail rates. Throughout the projection period, the Low Oil and Gas Supply and High Oil and Gas Supply cases yield the greatest average differences in residential electricity prices from the AEO2020 Reference case, with 4.7% lower and 9.7% higher, respectively, in 2050. Assuming wholesale compensation of residential solar PV, residential retail electricity prices in 2050 are 0.3% higher in the Low Oil and Gas Supply with Wholesale PV Rate case and are 0.5% lower in the High Oil and Gas Supply with Wholesale PV Rate case as compared with retail compensation in the Low Oil and Gas Supply case and High Oil and Gas Supply case, respectively. Although the impact on prices is minimal, the impact on electricity costs for owners of existing solar PV systems could be significant under a change in compensation.