Lower Electric Costs in a Low-Emission Future

States can achieve CO_2 emissions reductions even greater than those called for by EPA's proposed Clean Power Plan while making electricity less expensive for consumers.

Tommy Vitolo, PhD, Patrick Luckow, Spencer Fields, Patrick Knight, Bruce Biewald, Elizabeth A. Stanton, PhD July 2015

Big reductions in greenhouse gas emissions from the U.S. electric sector need not result in high costs for consumers. Indeed, analysis performed by Synapse Energy Economics shows that consumers can save $41 billion in the year 2040 if states aggressively pursue clean energy options (see Figure 1). States that take advantage of better energy efficiency programs, smarter energy management options, and shrinking renewable energy costs will be able to shutter aging coal plants that are becoming more and more expensive to run. Our analysis shows that market forces, policy trends, and technology advancements are converging to produce a key result: reducing electric-sector emissions lowers electricity costs.

A Clean Energy Future

Synapse's Clean Energy Future scenario shows 70 percent of the nation's electric needs being generated by renewables in 25 years. Renewables added by 2040 include 308 GW of utility-scale solar panels, 253 GW of on-shore wind, 197 GW of distributed solar panels, 18 GW of concentrated solar, 14 GW of geothermal, and 4 GW of off-shore wind. Electricity sales are 25 percent lower than in a Reference—or business-as-usual—scenario in 2040, as a result of savings from energy efficiency measures and standards, as well as "demand response" programs that pay participating consumers to curtail their energy use at times of peak demand.

All electric-generating resources continue to operate throughout their useful lifetimes in the Clean Energy Future. Nuclear plants retire after 60 years of operation and most coal plants retire by 2040. Synapse also assumes that 25 percent of U.S. cars and light trucks will

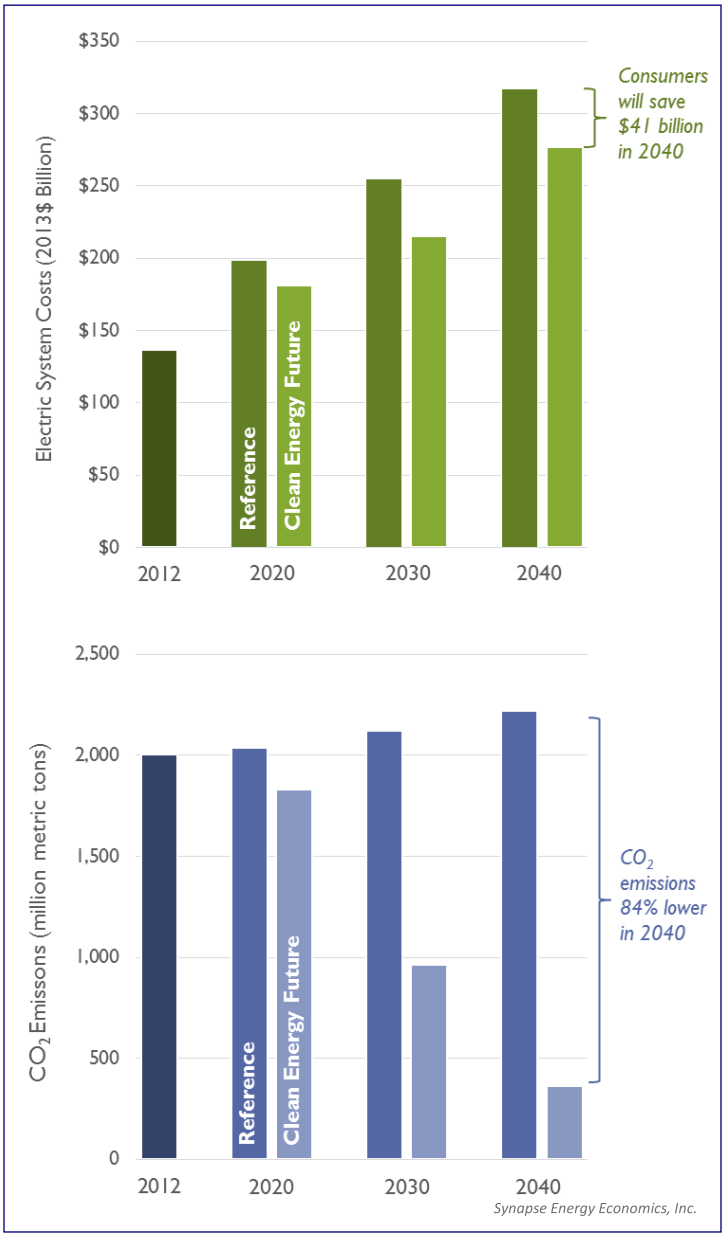

Figure 1. U.S. costs and CO_2 electric sector emissions in the Clean Energy Future and Reference scenarios

The Clean Power Plan calls for emissions to fall 30 percent from 2005 levels. In Synapse's Clean Energy Future emissions fall 58 percent by 2030.

be electric by 2040 and accounts for this additional electric demand in its modeling. (We do not, however, account for the associated emission reductions from fossil fuel-powered vehicles, or the difference in the cost of transportation infrastructure.) Figure 2 illustrates the implications of these assumptions on generation in the two scenarios.

The Clean Energy Future scenario is contrasted to a Reference scenario in which new investments in electric capacity continue to be dominated by natural gas-fired generators and CO_2 emissions grow steadily over time. By 2040, this scenario results in a 14 percent increase in coal-fired generation, and a 11 percent increase over 2012 CO_2 emissions.

The Clean Energy Future does not model EPA's proposed Clean Power Plan. EPA's plan calls for a 30 percent reduction in national electric sector emissions compared to 2005 by 2030. Synapse's Clean Energy Future achieves a 58 percent reduction nationwide over this timeframe.

Cost Savings by Region

Both electric cost savings and CO_2 emission reductions vary across the regions of the United States. In 2040, greenhouse gas emissions in the electric sector are 84 percent lower in the Clean Energy Future than in the Reference scenario nationwide, with emission and cost reductions in every region.

Figure 3 compares average dollar savings per household in 2040 (on the horizontal axis) to total regional CO_2 emission reductions in that same year (on the vertical axis). The average household experiences cost savings of up to $1,860 in 2040, depending on the region. The electric-sector costs of the Southwest are virtually identical in the Clean Energy Future and Reference scenarios. In this region, the Clean Energy Future involves significant imports of electricity from adjacent

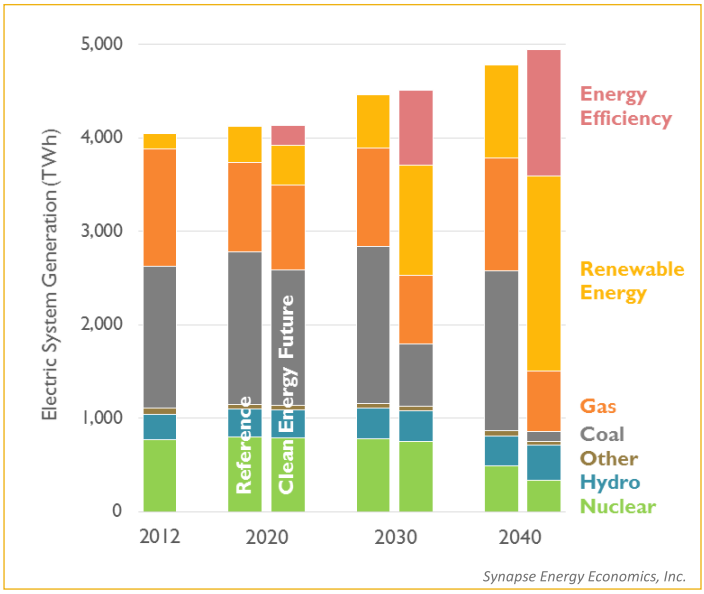

Figure 2. U.S. electric generation in the Clean Energy Future and Reference scenarios

regions. Note that payments associated with these imports are accounted for in the costs presented in Figure 3.

Regions like the Great Lakes / Mid-Atlantic, the Southeast, and the Midwest achieve very high levels of CO_2 reductions by reducing electric sales through energy efficiency and by displacing existing natural gas and coal generation with renewable generation.

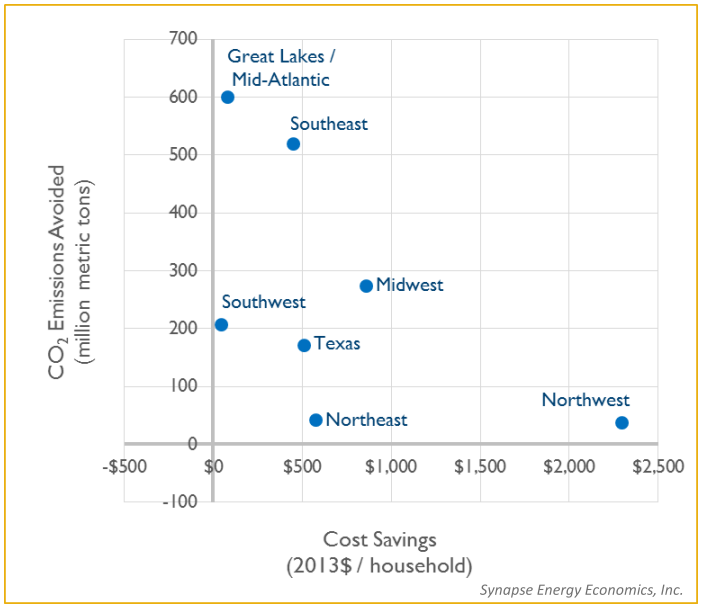

Figure 3. Regional cost savings per household compared to emission reductions in 2040

The Northeast and Northwest are already well on their way to generating much of their electricity from low- or zero-carbon emitting sources. For this reason, these regions see much smaller differences in avoided CO_2 emissions savings per household between the Clean Energy Future and the Reference scenarios, and see high levels of savings as they become net exporters of clean electricity to neighboring regions.

Similar Findings in Other Studies

Table 1 describes several other studies that have reached a similar conclusion: reducing CO_2 emissions results in net savings to consumers.

Note that neither our analysis nor the studies presented here include a monetary value for the social or health costs of increased carbon emissions. There are a number of additional studies that include the value of avoiding the social cost of carbon and find net benefits to society of a low-emissions future.

Methodology and Assumptions

Synapse used National Renewable Energy Laboratory's (NREL's) ReEDS model and public data sources for this analysis. In the Reference scenario, energy efficiency levels are low following assumptions made by the U.S. Energy Information Agency that exclude existing state policies. Renewable energy meets the requirements of state renewable portfolio standards and other existing state policies. Coal retirements are limited to the 50 GW of future retirements announced by plant owners as of this publication. Demand response programs, which compensate customers for reducing their electric use at times of peak demand, reach 10 percent of peak sales by 2040. Additional hydroelectric generating capacity in the form of new run-of-river dams improvements and expansions at existing dams total 10 GW. All nuclear units are assumed to receive one license extension from the Nuclear Regulatory Commission, allowing all units to operate for 60 years. There are 13 GW of new electric

Institution	Summary of Findings	URL
Stanford University (May 2015)	Found that a switch to 100% renewable energy in all sectors by 2050 produces energy cost savings of about $260 per person per year, as well as savings in U.S. health and global climate costs.	http://web.stanford.edu/group/efmh/jacobson/Articles/I/USStatesWWS.pdf
Bipartisan Policy Center (April 2015)	Found a wide range of predicted costs across modeled scenarios. Certain policy scenarios had lower costs to deliver energy services under certain treatment of end-use energy efficiency.	http://bipartisanpolicy.org/wp-content/uploads/2015/04/BPC-Clean-Power-Plan-Slides.pdf
Energy and Environmental Economics (November 2014)	Modeled emissions reductions achieved through energy efficiency, decarbonization of electric generation, end-use electrification, and switching other end uses to lower carbon fuels. Found an incremental cost to the energy system equal to less than 1% of GDP in the base case, not including potential non-energy benefits.	http://unsdsn.org/wp-content/uploads/2014/09/US_DDPP_Report_Final.pdf
World Resources Institute (October 2014)	Found that reducing the carbon intensity of power generation, improving energy efficiency, building more fuel-efficient vehicles, improving natural gas production, and reducing consumption of HFCs can reduce emissions and, if done right, lead to net economic benefits.	http://www.wri.org/sites/default/files/seeingisbelieving_working_paper.pdf
Synapse Energy Economics (May 2013)	Found that consumers see a significant net benefit from doubling the level of wind that had been projected in PJM by 2026, on the order of $6.9 billion per year.	http://www.synapse-energy.com/wind-benefits-PJM
Analysis Group (November 2011)	Concluded that the RGGI program added $1.6 billion in net present economic value to the region's economy over the first three years of the emissions reduction program.	http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/economic_impact_rggi_report.pdf

Table 1. Additional studies finding economic benefits to electric sector CO_2 reductions

storage capacity. The ReEDS model selects the number of new gas-fired plants built and the amount of gas-fired generation in any year. As a result, an additional 24 GW of new gas-fired generating capacity is in place by 2040 in the Reference scenario.

In the Clean Energy Future scenario energy efficiency levels reach 2 percent annual incremental savings by 2029, based on observed savings in existing programs. Renewables grow rapidly to reach 70 percent of all generation by 2040, including nearly 200 GW of rooftop solar panels. All coal-fired units built before 2005 are retired by 2040. Electric vehicles that connect to the grid to provide electric storage when not in use make up 25 percent of all cars and light trucks based on assumptions used in a recent NREL study. Demand response programs reach 15 percent of peak sales by 2040 following a strong policy modeled in a recent Navigant study. New run-of-river and improved capture of hydro resources total 18 GW based on research by the Idaho National Laboratory. All nuclear units operate for 60 years. To better integrate and balance expanded generation from renewables, ReEDS builds 56 GW of new electric storage facilities. In the Clean Energy Future scenario, ReEDS responds to low prices and sufficient availability of zero-carbon resources by reducing gas-fired generating capacity by 86 GW. For a more detailed description of our methodology and assumptions see www.synapse-energy.com/consumer-costs-low-emissions-futures.

	Reference Scenario	Clean Energy Future Scenario
Energy Efficiency	Existing federal appliance and building standards, minimal state efficiency policies	Incremental efficiency savings of 2% each year by 2029
Renewables	Renewables comply with existing state laws	70% of generation from renewable resources by 2040
Gas and oil	Net 24 GW new gas-fired capacity built by 2040	Net 86 GW gas- and oil-fired capacity retired by 2040
Coal	Coal plant retirements limited to announcements to date	All coal plants built before 2005 retired by 2040
Other	No electric vehicles integrated as electric-grid storage	25% of cars and trucks integrated as electric-grid storage by 2040
	Demand response reaches 10% maximum sales by 2040	Demand response reaches 15% maximum sales by 2040
	13 GW new storage resources by 2040	56 GW new storage resources by 2040
Hydro	10 GW new run-of-river and improved capture of hydro resources by 2040	18 GW new run-of-river and improved capture of hydro resources by 2040
Nuclear	All nuclear units operate for 60-year lifetimes	All nuclear units operate for 60-year lifetimes

Table 2. Comparison of Clean Energy Future and Reference scenario assumptions

This brief is the first in a series exploring the impacts of the proposed Clean Power Plan on consumers. In the coming weeks, we will describe new analysis showing how the plan could affect household electricity costs in every state. We expect good news for consumers who worry about both the environment and household electricity costs.

About Synapse

Synapse Energy Economics, Inc. is a research and consulting firm specializing in energy, economic, and environmental topics. Since the Clean Power Plan was proposed in June 2014, Synapse staff have been actively analyzing and modeling the impacts of the rule. This work includes analyzing state-specific compliance options and providing planning support and resources to non-governmental organizations and state agencies. Synapse developed its open source Clean Power Plan Planning Tool, or CP3T, to assist state agencies and other stakeholders in planning for compliance (www.cp3t.com).

Acknowledgements

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