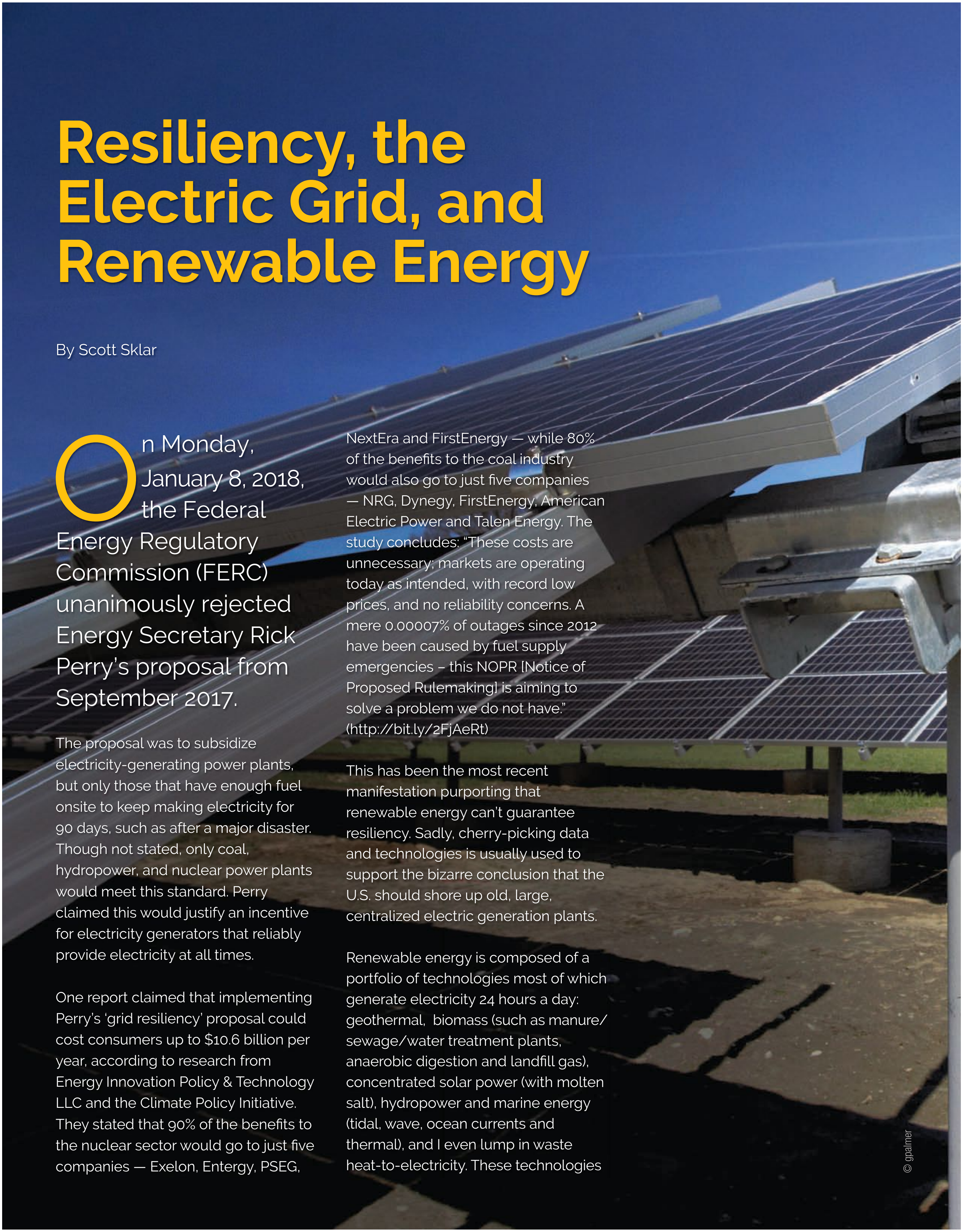


© gpalmer

Resiliency, the Electric Grid, and Renewable Energy

By Scott Sklar

On Monday, January 8, 2018, the Federal Energy Regulatory Commission (FERC) unanimously rejected Energy Secretary Rick Perry's proposal from September 2017.

The proposal was to subsidize electricity-generating power plants, but only those that have enough fuel onsite to keep making electricity for 90 days, such as after a major disaster. Though not stated, only coal, hydropower, and nuclear power plants would meet this standard. Perry claimed this would justify an incentive for electricity generators that reliably provide electricity at all times.

One report claimed that implementing Perry's 'grid resiliency' proposal could cost consumers up to $10.6 billion per year, according to research from Energy Innovation Policy & Technology LLC and the Climate Policy Initiative. They stated that 90% of the benefits to the nuclear sector would go to just five companies — Exelon, Entergy, PSEG, NextEra and FirstEnergy — while 80% of the benefits to the coal industry would also go to just five companies — NRG, Dynegy, FirstEnergy, American Electric Power and Talen Energy. The study concludes: "These costs are unnecessary; markets are operating today as intended, with record low prices, and no reliability concerns. A mere 0.00007% of outages since 2012 have been caused by fuel supply emergencies – this NOPR [Notice of Proposed Rulemaking] is aiming to solve a problem we do not have." (http://bit.ly/2FjAeRt)

This has been the most recent manifestation purporting that renewable energy can't guarantee resiliency. Sadly, cherry-picking data and technologies is usually used to support the bizarre conclusion that the U.S. should shore up old, large, centralized electric generation plants.

Renewable energy is composed of a portfolio of technologies most of which generate electricity 24 hours a day: geothermal, biomass (such as manure/sewage/water treatment plants, anaerobic digestion and landfill gas), concentrated solar power (with molten salt), hydropower and marine energy (tidal, wave, ocean currents and thermal), and I even lump in waste heat-to-electricity. These technologies

are as robust and reliable as natural gas, coal, and nuclear, but without the waste and emissions of these conventional fuels/technologies.

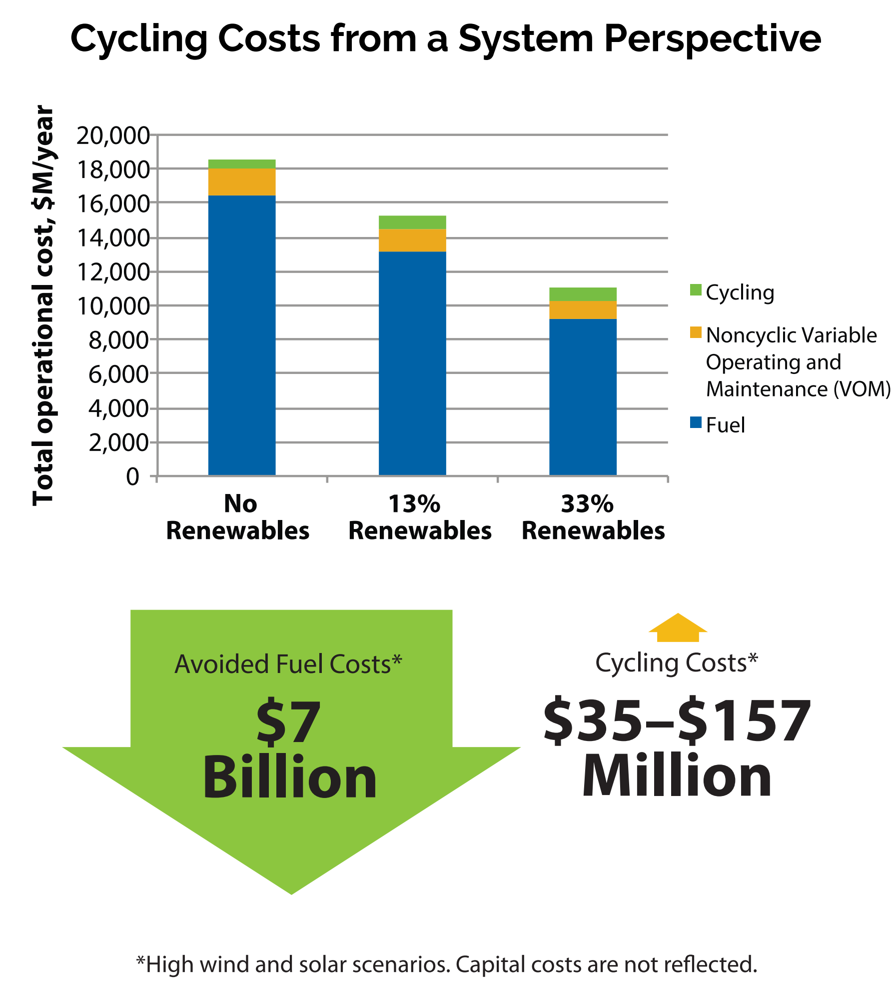
While Secretary Perry and others broad-brush reliability issues regarding “renewable energy,” they really mean the two variable renewables -- wind and solar (photovoltaics). There are several ways to address the value of these two variable renewables, such as when utility companies need midday electric power for air-conditioning. Solar energy, by definition, makes electricity midday – it's naturally compatible with the electricity demand. Some have maintained that these variable renewables still require electric utilities to have back-up peaker plants “spinning” to compensate for lack of solar and wind during demand times thus raising costs to electricity ratepayers.

A 2014 study by the Lawrence Berkeley National Lab (LBNL) and the National Renewable Energy Lab (NREL) on the value of solar and wind on the western U.S. electric grid shows the overall reductions in emissions that would result from higher levels of wind and solar electricity. The study finds that the high wind and solar scenarios (33% of electric generation) reduce carbon dioxide emissions by 29% to 34% across the Western Interconnection, which ranges from the western tip of Texas to California and up into the Canadian provinces. Utilities would have a maximum of $160 million in extra costs but save $7 billion in fuel costs for traditional electric generation.

Variable renewables can also be tied to energy storage, which is composed of a wide range of technologies including pumped hydro, battery banks, fuel cells, compressed air and liquids, and even renewably-produced hydrogen. As of April 2017, the U.S. had over 24.2 gigawatts (GW) of rated power in energy storage compared to 1,081 GW of total in-service generation capacity. Globally, installed energy storage totaled 175.9 GW (U.S. DOE [2017], *Global Energy Storage Database Projects*). About 2.5% of delivered electric power in the U.S. is cycled through a storage facility. For comparison, 10% of delivered power in Europe and 15% of delivered power in Japan are cycled through energy storage facilities (Electric Power Research Institute and U.S. DOE [2003], *Handbook of Energy Storage for Transmission and Distribution Applications*).

Energy storage allows variable renewable energy generation to have enhanced capacity factors and compensates for outages from traditional electric generation, providing greater reliability; it also allows the electric grid to have frequency control, addressing electric power quality issues such as sags, surges, and transients that destroy digital equipment, appliances and controls.

There are numerous other studies on valuing distributed solar and wind generation and there is no way I can



From a system perspective, wind and solar can increase annual operating costs for fossil-fueled generators by $35 million to $157 million, while reducing fuel costs by $7 billion.

discuss them all, but I will highlight a few.

Over the last few years, electric utilities and anti-renewable groups have pushed to undercut net-metering and Renewable Energy Portfolio Standards (RPS's), forcing state utility commissions to sponsor studies on the value of solar and some other renewables. Foundations, trade associations, and think tanks have also jumped onto this bandwagon. This has all been good, because it underpins the value of more flexible electric load and customer-driven electric generation.

Without increased understanding of the benefits and costs of distributed energy resources, there is little ability to make effective tradeoffs between investments.

A comprehensive NREL study released in March 2015 (http://bit.ly/2EIp8bF) reviews 15 distributed photovoltaics (DPV) benefit/cost studies to assess what is known and unknown about the categorization, methodological best practices, and gaps around the benefits and costs of DPV, and to begin to establish a clear foundation from which additional work on benefit/cost assessments and pricing structure design can be built. This followed a September 2013 Rocky Mountain Institute (RMI) second edition of *A Review of Solar PV Benefit & Costs Studies*, which updated the original with the inclusion of Xcel Energy's May 2013 study, *Costs and Benefits of Distributed Solar Generation on the Public Service Company of Colorado*, as well as clarifies select descriptions and charts.

In 2016, the prestigious Brookings Institution completed a 'value of solar' study in which the authors state, "A growing number of academic and think tank studies have found that solar energy is being undervalued and that it delivers benefits far beyond what solar


© buhanovskiy

Biomass consists of manure/ sewage/water treatment plants, anaerobic digestion and landfill gas.

customers are receiving in net-metering credits." The report delivers more data to indicate that solar net metering benefits all ratepayers - even if they don't have solar themselves (http://brook.gs/2HD4gAI).

The Solar Energy Industries association (SEIA) lists the studies for solar valuation on its website (https://www.seia.org/initiatives/solar-cost-benefit-studies).

On the American Wind Energy Association's (AWEA) website, in April 2017, the regional transmission authority PJM's study (http://bit.ly/2sJjUHn) quantifies wind's value for a reliable, resilient electricity system. PJM, which operates the power system across all or part of 13 Great Lakes and Mid-Atlantic states as well as the District of Columbia, had previously found that large amounts of renewable energy can be reliably integrated. According to the study, "Wind was able to go much higher, reliably providing the vast majority of PJM's electricity in some scenarios." In fact, PJM found no maximum on the amount of wind it could accommodate. In the study, scenarios in which wind provided nearly all of the generation on PJM's system (15-25% of unforced capacity) maintain reliability at levels comparable to those on today's power system.

The state of Arizona has four studies on the value of distributed generation from 2009 through 2016. The 2016 study (http://bit.ly/2FkgKfv) shows cost-benefit charts for both residential and commercial customers, and in each value area – participant test, Ratepayer Impact Measure (RIM) test, total resources cost test, and societal cost test – the benefits exceeded the costs in ALL cases.

One of the earliest 'value of solar' studies was completed in 2005 for California (http://bit.ly/2EK55cY), and the factors of value were:

1. deferral of investments in new peaking power capacity;
2. avoided purchase of natural gas used to produce electricity;
3. avoided emissions of carbon dioxide and nitrogen oxides that impact global climate and local air quality;
4. reduction in transmission and distribution system power losses; and
5. deferral of transmission and distribution investments that would be needed to meet growing loads.


THE SOLAR LIGHT BULB
CHANGING LIVES
ACROSS THE GLOBE.

In 2017, the Institute for Energy Innovation issued *Solar Energy in Michigan: The Economic Impact of Distributed Generation on Non-Solar Customers* (http://bit.ly/2EIp8bF). Some of the key findings were as follows: 1) The majority of studies conducted to date find that customers participating in net metering programs represent a net benefit to the grid; 2) While net energy metered (NEM) customers receive credits that reduce or eliminate their monthly utility bills, solar distributed generation (DG) provides measurable and monetizable benefits to the power system that should be considered when evaluating the true impact of solar DG and NEM on all ratepayers; 3) Solar DG both reduces demand for power from the utility and provides power to the grid when the systems generate more power than is used at a residential or commercial site, and this surplus power is generated at or near peak times when the cost to the utility of procuring additional power is most expensive; and 4) Net energy metering represents an attempt to balance the true costs and benefits of the energy being produced and that which is consumed in a way that is simple, fair, and convenient for both the utility and its customers.

In all, over 48 studies covering the entire United States and 24 individual states report that incorporation of high-value energy efficiency, the entire portfolio of distributed renewable energy, and the portfolio of energy storage makes the electric grid more resilient, uses less precious water, and provides electricity at lower cost with significantly less waste and fewer emissions.

Over a third of the states and 200 cities are pushing full speed ahead for energy choices for the 21st century rather than looking backwards at the energy choices from the 1800's and 1900's. ■

About the Author

Scott Sklar runs The Stella Group, Ltd., a strategic technology optimization and policy firm. He is an Adjunct Professor at The George Washington University teaching two unique interdisciplinary sustainable energy courses. He's also an Affiliated Professor with CATIE, an international graduate University in Costa Rica. He was re-appointed onto the US Department of Commerce Renewable Energy & Energy Efficiency Advisory Committee (RE&EEAC) and serves as Vice Chair through June 2018.

Recent technological advancements (e.g. enhanced geothermal systems) have made more resources exploitable and lowered costs