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An Analysis of Electric Cooperative Industry Trends

A Look at Renewable Energy CapEx

EXECUTIVE SUMMARY

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Despite policy hurdles, the renewable energy industry will continue to install new projects at a blistering pace. Developers are advertising projects that are cost-competitive with high-efficiency combined cycle natural gas units on an unsubsidized basis. Federal tax incentives for wind power will expire soon, but investors recognize there is still money on the table.

Wind and Solar Increasingly Competitive

According to a recent report from Lazard, due to technology improvements and cost declines, wind and solar are competing favorably on an unsubsidized basis with existing marginal costs of production for thermal generation. Additionally, Lazard's all-in cost calculations show renewables running fairly close to new combined cycle natural gas units.

According to the National Renewable Energy Laboratory (NREL), renewables are competitive due to a year-to-year cost drop of 29 percent for fixed-tilt utility-scale photovoltaic systems. NREL attributes a portion of the reductions to increased market competition, and says the 2011 U.S. Department of Energy SunShot Initiative goal of \$1 per watt for solar has been met for large-scale arrays, effectively making solar cost-competitive with other forms of electric generation.

UNSUBSIDIZED ALL-IN COSTS

Generation Type	Cost Range per MWh
Wind	\$30 - \$60
Solar Photovoltaics	\$43 - \$53
Nuclear	\$112 - \$183
Coal	\$60 - \$143
Combined Cycle Natural Gas	\$42 - \$78

Source: Lazard

Renewable Spending Remains Brisk

As noted by Bloomberg New Energy Finance, NextEra Energy, American Electric Power (AEP), Xcel Energy, Duke Energy and Alliant Energy recently rolled out renewable energy capital expenditures for 2018 through 2020. NextEra Energy Resources, the wholesale supply subsidiary of NextEra Energy and North America's largest owner and operator of wind and solar generation assets, continues to lead utilities with a renewables investment pipeline of \$12.65 billion. AEP has earmarked \$1.3 billion, accounting for 10 percent of its total capital expenditures budget.

Other large power companies are cultivating similar plans in an attempt to take advantage of federal production tax credits for wind farms and investment tax credits for solar projects before they expire.

ESTIMATED RENEWABLES CAPEX (in millions)

Utilities	2017	2018	2019	2020
Alliant Energy	\$180	\$655	\$850	\$140
American Electric Power (AEP)	\$500	\$600	\$600	\$600
Avangrid, Inc.	\$939	\$936	\$791	\$720
Duke Energy	\$245	\$340	\$760	\$632
NextEra Energy	\$3,650	\$4,380	\$4,620	\$4,890
Xcel Energy	\$610	\$1,410	\$1,869	\$880

Source: Bloomberg New Energy Finance

Big Bet by First Solar

First Solar, a solar photovoltaic solutions company that designs, produces and markets modules using thin film semiconductor technology, will unveil the Series 6, a new solar panel that's more efficient and less costly than its predecessor, the Series 4. First Solar hasn't provided the sunlight conversion rate yet, but says the Series 6 will be three times bigger and generate more than three times as much energy per panel.

Production costs for the new panel are expected to fall to about 25 cents per watt, and First Solar believes it can keep its pricing at 35 cents to 40 cents per watt for the next few years. That will allow the firm to stay competitive with Asian manufacturers and still remain profitable.

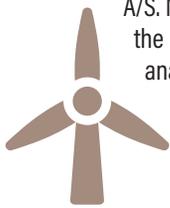


Utility Renewables Spending Keeps Soaring

S&P Global forecasts U.S. utilities will invest \$9.6 billion in renewable energy in 2018, up from \$6.9 billion last year, and add another \$10.4 billion in 2019. From 2017 to 2040, the International Energy Agency estimates \$817 billion in U.S. renewables investment compared with \$270 billion for fossil fuel-fired generation. Other outlets indicate utilities will continue to make renewable energy expenditures a big portion of future budgets.

Offshore Wind Could See a Boost

According to Bloomberg New Energy Finance, the United Kingdom recently disclosed its cheapest 15-year purchase power agreement for offshore wind yet—£57.50 (\$79.50) per MWh, handed out to the Danish utility Dong Energy



A/S. News of the price rippled through the industry, encouraging Bloomberg analysts to adjust predictions for the U.S. offshore wind market.

The United States is now slated to install 6,200 MW of offshore wind by 2030.

T&D Deferral on Battery Energy Storage

Last summer, Arizona Public Service Company decided to implement a new energy storage asset to help defer a transmission and distribution (T&D) investment. The 2 MW, 8 MWh battery array will be installed near Punkin Center, a town of 600 people in Tonto National Forest about 90 miles northeast of Phoenix, and will generate power using frequency response and capacity reserves for the local ancillary services market. The investment deferral will last up to six years, and is being accomplished without a state mandate,



unlike battery storage projects currently being developed in California and New York.

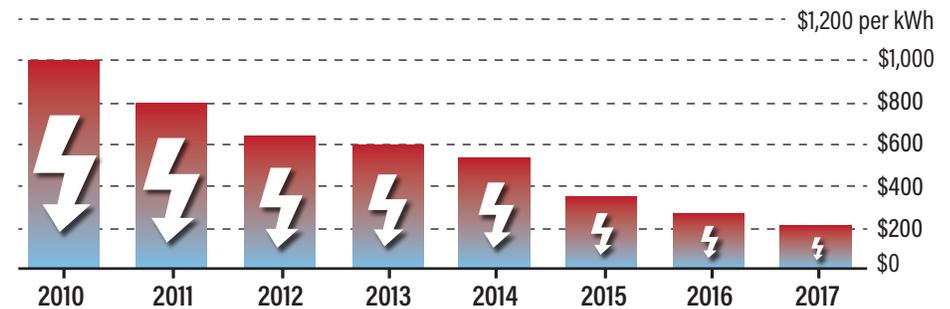
Battery Prices Keep on Tumblin'

Lithium-ion battery pack costs dropped another 24 percent in 2017 due to increased manufacturing capacity and improved economies of scale. Bloomberg New Energy Finance reported a weighted average capital cost of \$209 per kWh for the battery packs, a reduction of 79 percent since 2010.

Meanwhile, GreenTech Media (GTM) reports a 46 percent year-to-year growth in battery energy storage installations, with the majority coming from utility-scale projects. GTM believes such installations will double in 2018 and reach 1,000 MW annually by 2019.

Cheaper Batteries

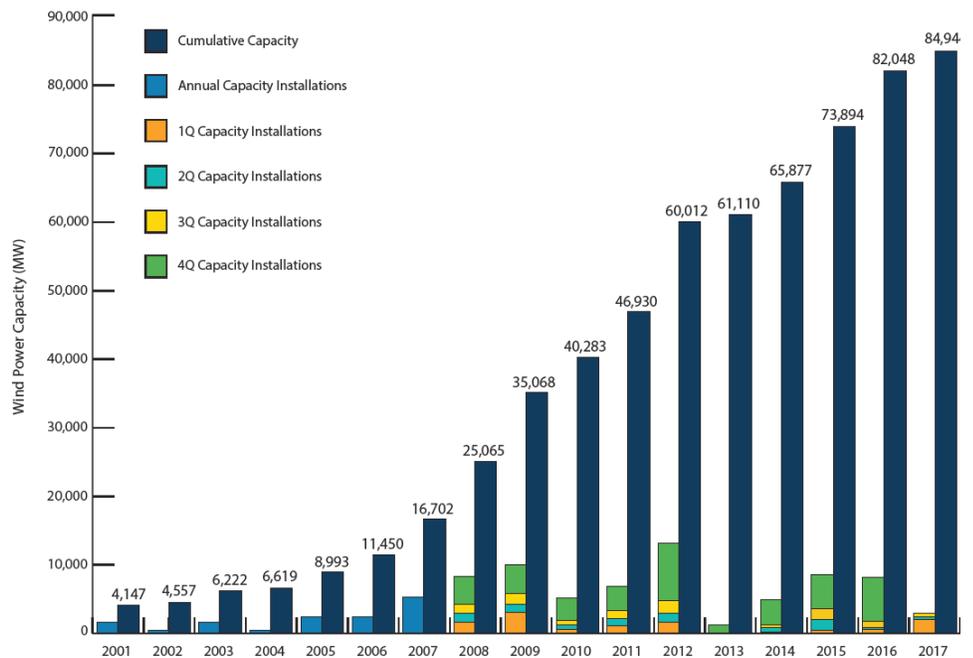
(Lithium-ion battery prices keep falling. They're down 24 percent from 2016 levels.)



Wind Market Update

Wind generation saw another banner year for 2017, with capacity climbing by 2,892 MW through September, including 534 MW in the third quarter alone. The rise brought U.S. installed wind capacity to 84,944 MW. According to the American Wind Energy Association, the United States now boasts than 52,000 wind turbines in 41 states.

U.S. Wind Power Capacity Installations (2001 through Q3 2017)



Information provided here has been excerpted from the "Quarterly Newsletter" published by Carmel, Indiana-based National Renewables Cooperative Organization (NRCO).