

# Solar Surge Set to Drive Much of Remaining Texas Coal-Fired Fleet Offline

## *Growth in Utility-Scale PV Production Is Rapidly Changing the ERCOT Market*

### Executive Summary

Coal-fired power generation in Texas, pumelled by clean, no-fuel-cost wind over the past 10 years, is about to be hit by a second wave of competition from renewables as utility-scale solar power, which is still only a small component of the state's generation mix, stands to gain significant market share over the next few years.

While installed solar power capacity in the U.S. has grown by almost 4,000% over the past 10 years, its growth rate in Texas—specifically across the vast footprint of the Electric Reliability Council of Texas (ERCOT), has been even faster, with installed capacity increasing from just 15 megawatts (MW) in 2010 to 2,281MW at the end of 2019, a 15,107% increase. ERCOT's installed capacity could climb at a comparable annual rate this year, with current projections showing solar topping 5,800MW by the end of 2020.

Because Texas is a highly competitive electricity market, utility-scale solar will deal a potentially crippling blow to the 11 remaining coal-fired generators across ERCOT, where the surge described in this report will almost certainly and irreversibly alter the market's daily dynamics.

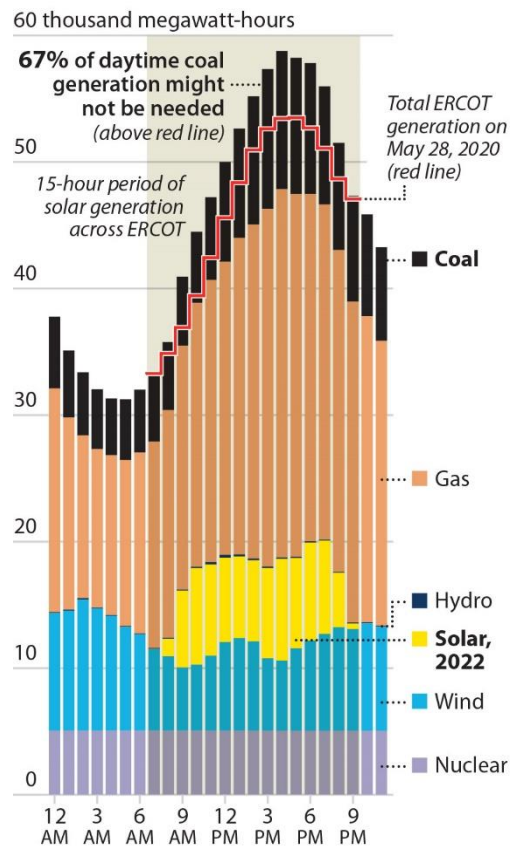
Last year, solar for the first time supplied 1% of ERCOT's overall generation, just three years after the grid operator began independently tracking solar generation. That market share is likely to double this year, driven by the continuing surge in new capacity.

Even though solar is still a small percentage of ERCOT's overall numbers, both in terms of generation and

### How More Solar Power Across ERCOT Would Push Out Coal Generation

The significant amount of utility-scale solar expected to come online by early 2022 will put upward of two-thirds of coal's more expensive daytime electricity generation at risk.

Likely solar generation in ERCOT in May 2022 (other fuels: actual generation on May 28, 2020)



Source: Energy Information Administration

installed capacity, it is beginning to have a noticeable impact. This June, for example, solar generation supplied 4-5% of daytime electricity demand on many occasions. Given its low cost, and given the Texas grid's energy-only business model, which pays for electricity produced rather than mere generation capacity, solar is gaining—and will continue to gain—market share. This will come at the expense of more costly generation, most likely coal-fired, which will be backed out of the ERCOT generation mix by a comparable amount.

This is clear in ERCOT's generation figures from this year through the end of June. Overall, ERCOT demand has increased slightly since last year, even with the pandemic and the oil price collapse. But there is a much bigger story behind these grid-wide totals. So far this year, coal-fired generation has fallen across ERCOT by more than 8.6 million megawatt-hours (MWh), while solar and wind generation has increased by just over 8.5 million MWh, an increase of almost 21%.

This is a harbinger. IEEFA research shows that the nascent daytime threat posed by rising solar capacity to the ERCOT system's 11 remaining coal-fired coal plants is going to increase rapidly over the next two years.

By calculating the capacity factor of the state's existing solar capacity during two test periods in 2020, we were able also to calculate the expected generation from the capacity that is currently being built in ERCOT and will be online by Jan. 1, 2022.

These calculations yield two eye-popping takeaways.

First, daily solar generation in ERCOT likely will be well above 80,000 MWh during the long days of the early summer, putting as much as 70% of ERCOT's daytime coal-fired generation at risk—a loss of market share that would be hard to overcome.

Second, data compiled from this past January suggests that solar poses a similar daytime threat to coal even during the short daylight months of the winter. Looking specifically at generation for the month of January 2020, and overlaying expected solar generation beginning in January 2022, we found that solar could put 70% of coal's daytime generation at risk in just two years' time.

Coupled with expected continued increases in wind capacity, which totalled just under 24,000MW at the end of 2019 across ERCOT and is projected to top 34,000MW by the end of 2021, IEEFA sees a number of the 11 remaining ERCOT coal plants likely retiring by 2025.

The economic competitiveness of the ERCOT market makes such closures a near certainty.

Solar's impact will be further magnified by the rise of battery-storage technology, which is evolving quickly and being adopted by a growing number of utilities and independent power producers. By enabling companies to store solar-generated power if it is not needed during the daytime, battery storage will allow firms to use that power during higher demand periods, further increasing the amount of at-risk coal-fired generation within ERCOT.

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## Wind Power Has Set the Stage for Texas Solar

The impact from the rise in solar generation would not be nearly as dramatic without developments over the past 10 years that have set the stage for more renewables.

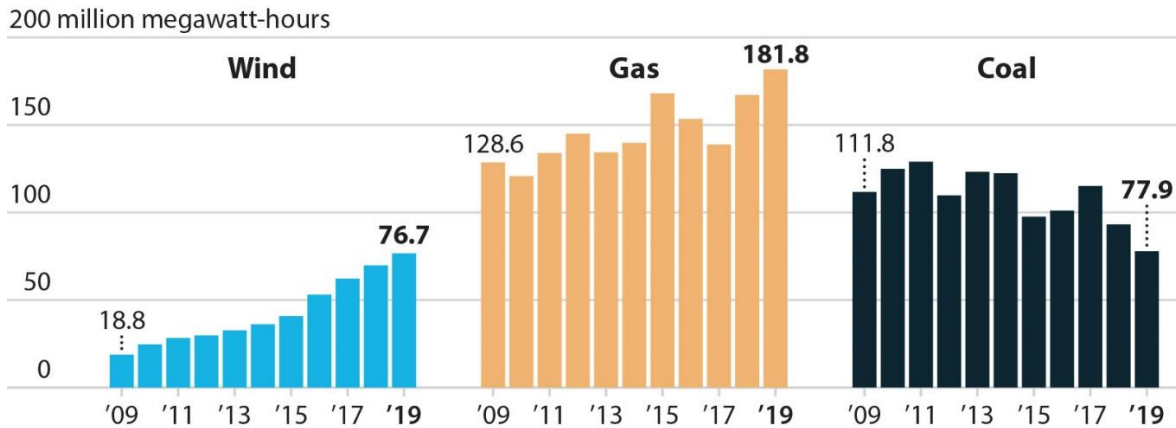
In 2009, coal-fired power plants generated 111.8 million MWh of electricity, accounting for 36.6% of ERCOT demand. By 2019, coal's output had dropped to 77.9 million MWh and its market share had fallen to 20.3%—even though electricity demand in ERCOT rose significantly over the same period of time (from 305.4 million MWh in 2009 to 384 million MWh by 2019, a 25.7% increase).

The reasons for the sharp decline in coal generation are straightforward: Developers built a significant amount of no-fuel-cost wind power. In addition, gas prices, driven by the surge in fracking, have remained consistently low.

Installed wind capacity in ERCOT grew by almost 15,000 MW over 10 years, pushing the total at the end of 2019 to 23,860 MW. This growth raised total wind generation from 18.8 million MWh to 76.7 million MWh, boosting wind's share of the ERCOT power generation market from 6.2% to 19.97% and putting it nearly on par with the state's coal generators.

### Wind, Gas, and Coal Across ERCOT

Wind-powered generation is paving the way for a second wave of renewable energy. Utility-scale solar, combined with gas-fired generation, is positioned to push more coal-fired plants out of business.



Source: Energy Information Administration

Gas-fired generation also grew substantially over the same 10 years, from 128.6 million MWh in 2009 to 181.8 million MWh at the end of 2019 (these numbers include gas combined-cycle units and other gas generators), as the market share of

gas-fired generation went from 42.1% in 2009 to 47.3% in 2019.<sup>1</sup>

Put another way, wind and gas generation have supplied all the electricity demand growth in ERCOT while taking a significant bite out of coal-fired generation.

This shift picked up speed in the first six months of 2020, with coal's share of the market shrinking to 16.4% while wind has climbed to 25.4%. And, as with the earlier market shifts, these changes are occurring even as the overall ERCOT market continues to grow

Looking ahead, significant new wind capacity additions are in the pipeline. ERCOT estimates a total of 35,000MW of wind generation could be online by the end of 2021, an almost 50% increase from current levels.<sup>2</sup>

Into this mix comes a surge of solar.

## **The ERCOT Solar Surge**

The solar surge is evident in two separate statistics—one showing the wave of new generation capacity expected to come online in the next two years and the other charting current solar generation.

At the end of 2019, 2,281MW of utility-scale solar capacity existed in ERCOT. This marked a 15,107% increase over 2010, when ERCOT had only 15MW of solar generation.<sup>3</sup>

By the end of May 2020, an additional 420MW had been added to the generation stack and another 1,057MW of solar had been synchronized with the grid in preparation for full deployment, effectively bringing ERCOT's total installed capacity to 3,748MW. An additional 2,053MW are in the queue and likely to be completed late this year or in early 2021, having secured interconnection agreements and project-specific financing needed for the transmission service provider (TSP) to complete any needed upgrades to bring the capacity online. While these 2,053MW are not certain to come online, an ERCOT official tells IEEFA that once projects reach this stage (tracked as 'IA signed-financial security posted' in the graphic below) they have a "strong likelihood" of entering commercial operation, although there may be some slippage from one year to the next, especially for projects with a projected online date late in any given year.<sup>4</sup>

For the sake of clarity, IEEFA has assumed in this analysis that all of this new capacity will come online as scheduled, which would push ERCOT's solar capacity to 5,801MW by the end of 2020 and, with another 5,326MW of advanced-stage

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<sup>1</sup> ERCOT did not break out gas generation by technology in 2009; in 2019, gas combined cycle units held a 40.2% market share while other gas turbines (peaking units and the like) accounted for 7.1%.

<sup>2</sup> As we discuss in greater detail later, the projected increase in wind capacity includes those projects that are most likely to come online by the end of 2021.

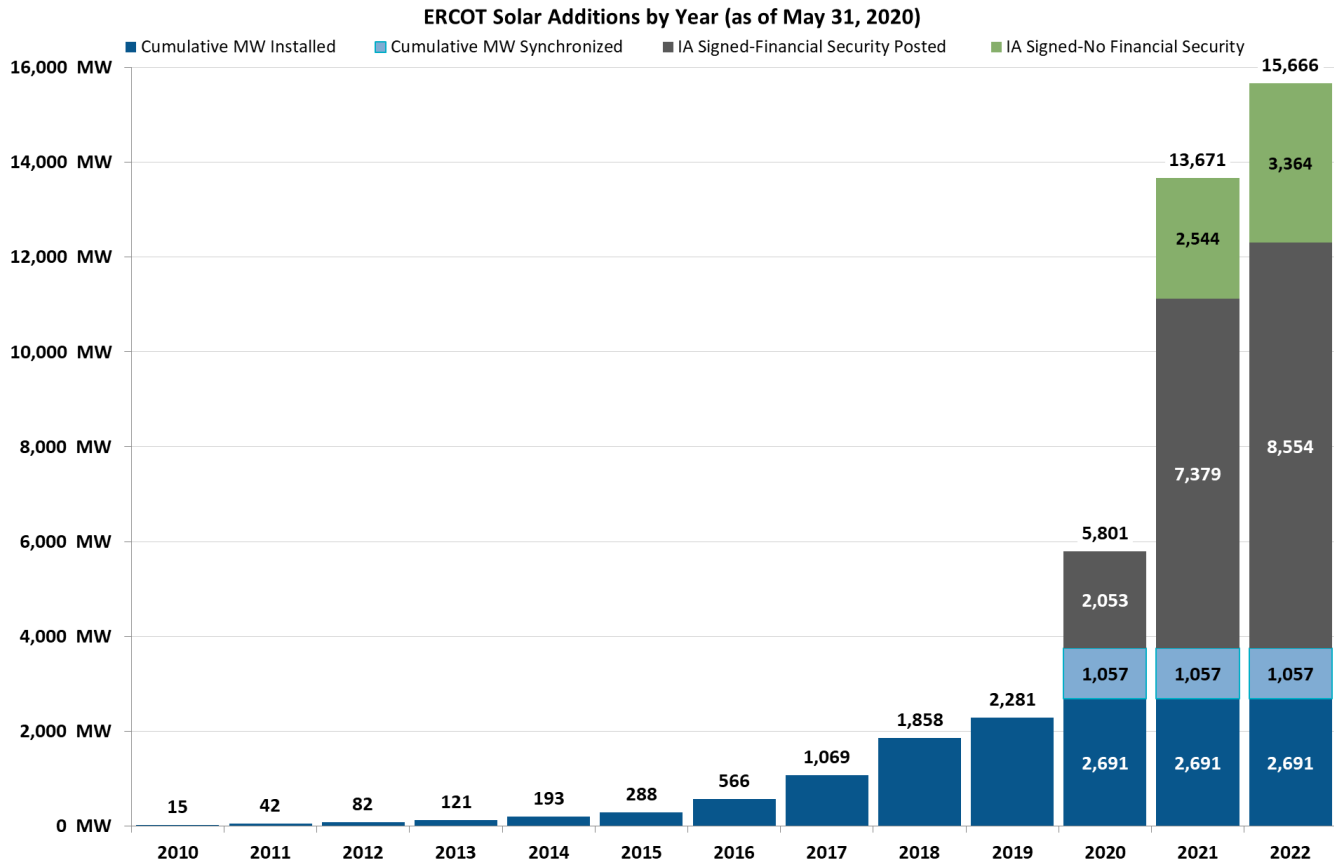
<sup>3</sup> ERCOT, [Capacity Changes by Fuel Type](#). May 2020.

<sup>4</sup> Author's email correspondence with ERCOT. June 10, 2020.

projects expected online next year, to 11,127MW by the end of 2021. The graphic below includes ERCOT projects that have signed a grid interconnection agreement with a TSP, but which have not yet funded the needed system upgrades to get the project's output onto the grid. In other words, these projects are slightly less likely to enter commercial operation as scheduled, but are still far along the development path. IEEFA believes it is realistic to assume in this analysis that 50% of these projects will enter commercial service. This would add another 1,272MW of solar capacity to the ERCOT grid by the end of 2021—bringing the system's solar total to 12,399MW.

Projects with an additional 1,175MW of capacity that are scheduled to begin commercial operation in 2022 already have posted the financing needed to pay for their needed transmission system upgrades, but they are not included in the current analysis. However, they are a clear indication that solar growth in ERCOT will continue in the years ahead, further stressing the system's already threatened coal plants.

Figure 1: ERCOT's Projection of New Solar Capacity to 2022



Notes:

- The data presented here is based upon the latest information provided to ERCOT by resource owners and developers and can change without notice.
- Installed capacities are based on nameplate rating of the commercially operational generation and reflect retirements or rating changes due to facility expansions or repowering as these occur.
- Installed capacities include only solar facilities that have registered with ERCOT (Those larger than one megawatt and supply power to the ERCOT system.)
- Other Planned capacity reflects registered projects under 10 MW in size that are not included in the Resource Integration and Ongoing Operations Interconnection Services (RIO-IS) System.
- This chart reports annual planned units with projected Commercial Operations Dates throughout the calendar year. In contrast, ERCOT's Capacity, Demand and Reserves (CDR) report shows planned capacity projected to be commercially available on or before the start of the Summer and Winter Peak Load seasons.
- Projects that have prior-year Projected CODs that have not been met, and for which ERCOT has not received COD updates, appear as planned projects for the subsequent year.
- Cumulative MW Synchronized pertains to projects that ERCOT has approved to generate energy for the grid but have not passed all qualification testing necessary to be approved for participation in ERCOT market operations.

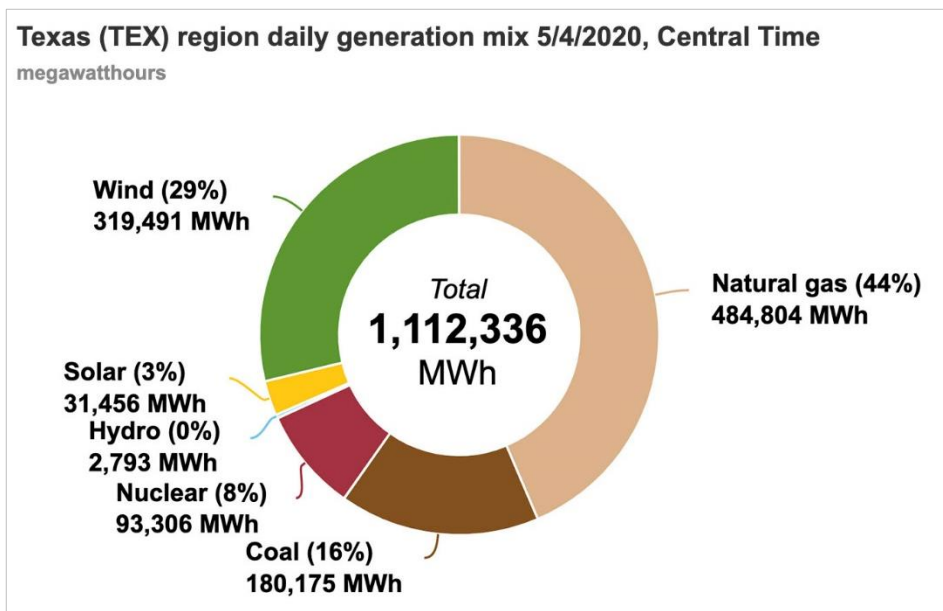
Source: ERCOT.

The generation trends are highlighted in the graphic below from EIA's hourly data browser showing market share by generation source on May 4, a date that marked the first time daily solar generation in ERCOT topped 30,000 MWh and just the second time solar accounted for 3% of the system's daily electricity demand. Just five days later, solar set another record, meeting more than 4% of total ERCOT demand on May 9. It is worth noting here that ERCOT did not separately track solar until 2016 and that it only just climbed above 1% of annual ERCOT demand in 2019. Now, solar is well on its way to topping 2%; through June of this year, solar had produced just under 2.1% of ERCOT's electricity.

Other indicators of solar's rapid rise (with data through the end of June):

- In 2019, solar topped 2% of ERCOT's daily demand only twice; through June 30 this year, solar has been above the 2% level 88 times (out of 182 days).
- Since topping 30,000 MWh for the first time on May 4, solar generation in ERCOT has been above that mark 37 of the subsequent 57 days.
- Since June 1, solar has averaged more than 32,000 MWh per day, with only six days below 30,000 MWh.
- Solar output has topped the previous ERCOT high of 17,551 MWh (set in 2019) all but three times since May 1 and 96 times overall through the first half of 2020.
- Total solar generation through the end of June 2020 was 88% higher than it was through the first six months of 2019.

**Figure 2: May 4, 2020 Was a Milestone Day for ERCOT Solar Generation**



Source: U.S. Energy Information Administration (EIA).

IEEFA expects these solar generation records to continue falling as additional capacity comes online, posing an ever-increasing threat to ERCOT's coal-fired generators.



## The Impact on Coal-Fired Generation

Solar's overall market share is important as a general indicator of the resource's importance across the ERCOT system. But given solar's unique daily cycle, an even more telling measure of its impact is its market share during daylight hours. As explained previously, low gas prices and a surge in wind power capacity have met growth in the region's electricity demand over the past decade and have significantly cut into coal's share of the market. IEEFA expects these trends to continue in the years ahead. Consequently, we believe that essentially every new MWh of solar that flows into the grid will push a MWh of coal (or gas) off the grid.<sup>5</sup> Given coal's position in ERCOT's generation dispatch curve—that is, dispatched after wind, solar, nuclear and, for the past decade, gas—solar poses a significant threat to the state's remaining coal-fired power plants.

Solar clearly is already beginning to have an impact on the ERCOT market. During the week of May 28-June 3, solar plants in ERCOT sent 218,540 MWh into the grid, accounting for just over 3% of the week's total generation, which was 7,279,545 MWh.<sup>6</sup> But just looking at the daytime figures pushes solar's share of the market up to 4.4%—market share that we believe would otherwise have been supplied by coal. These weekly losses for coal add up quickly: During the month of June, total solar generation across ERCOT topped 1 million MWh for the first time, more than double the amount from the same month a year earlier and up 13.6% from May, pushed up by longer days and by new solar generation coming online.

**During the month of  
June, total solar  
generation across ERCOT  
topped 1 million MWh  
for the first time.**

For the year through June, solar has generated 3.7 million MWh of electricity, an average of slightly more than 624,000 MWh a month. Using that average for the remainder of the year would push total solar generation to almost 7.5 million MWh—or just under 10% of coal's total generation in 2019. And that solar figure is almost certainly understated because of a significant jump in monthly solar generation from April to June reflecting the integration of 410MW of new solar capacity onto the ERCOT grid during the month. This means solar's average monthly generation for the whole year could end up being even higher than the current

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<sup>5</sup> In a 2018 presentation on a lengthy analysis of variable renewable energy resources' impact on electricity pricing, researchers at Lawrence Berkeley Laboratory noted: "VRE generation offsets conventional generation 1-1, except when curtailed." That presentation can be found at: <https://emp.lbl.gov/publications/impacts-high-variable-renewable/>

<sup>6</sup> Data in this analysis was downloaded from the Energy Information Administration's Hourly Electric Grid Monitor, which can be found at: <https://www.eia.gov/beta/electricity/gridmonitor/dashboard/custom/pending>

624,000 MWh through June, taking more market share from coal.

This year's changes, impressive though they are, are barely a ripple compared to the wave of solar generation that will reshape ERCOT's competitive marketplace as early as 2022.

## Battery-Storage Will Add to Solar's Momentum

While this report details the growing daytime effects of solar power generation, solar will become an increasingly round-the-clock force as developers and utility companies invest in a once-peripheral and now mainstream area of the electricity industry: Battery-storage technology, which has become *de rigueur* for many new utility-scale solar projects in states surrounding Texas and is being retrofit on a growing number of existing PV facilities.

**Solar will become an increasingly round-the-clock force as developers and utilities invest in battery storage.**

In Oklahoma, for example, NextEra last year signed a contract with Western Farmers Electric Cooperative to develop a 700MW wind-solar-battery project that will include 200MW of storage.<sup>7</sup> It will be the biggest project of its kind in the U.S.

In Arkansas, Entergy Arkansas gained approval in April for a solar-storage project that combines 100MW of generation with 10MW of storage.<sup>8</sup>

In New Mexico, Public Service Company of New Mexico is replacing its 560MW stake in the soon-to-be-retired 874MW San Juan Generating Station with a larger and more modernized mix of new generation sources that regulatory staff are advising include 650MW of solar and 300MW of battery storage.<sup>9</sup> In addition, the state's first tribally owned utility-scale solar project, developed on Jicarilla Apache land, pairs a 50MW panel array with a 20MW storage component.<sup>10</sup>

In Nevada, the Gemini Solar Project, which will be the biggest solar farm in the country, will include a 380MW solar-powered battery system tied to a 690MW array of collector panels.<sup>11</sup> Also in Nevada, NV Energy is building 1,200MW of solar

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<sup>7</sup> Greentech Media. 'Cheaper Than a Peaker': NextEra Inks Massive Wind+Solar+Storage Deal in Oklahoma, July 25, 2019.

<sup>8</sup> Energy Storage News. Arkansas 100MW solar project with 30MWh battery storage gets approval. April 29, 2020.

<sup>9</sup> Farmington Daily Times. Staff for New Mexico regulators pushes renewables for San Juan replacement. June 24, 2020.

<sup>10</sup> IEEFA. Tribal Utility-Scale Solar Initiatives Advance Across Southwest U.S. October 2019.

<sup>11</sup> Bureau of Land Management. Interior Approves Plan for the Largest Solar Project in U.S. History. May 11, 2020.

generation paired with 590MW of storage.

In Arizona, the state's biggest utility, Arizona Public Service, announced just last week that its recently minted plan to transition entirely from fossil-power generation will rely heavily on storage as "the backbone of replacement capacity and energy as we look to exit coal completely by 2031." APS will build at least 2,500MW of storage capacity by 2020 and as much as 10,500MW by 2035.<sup>12</sup>

PacifiCorp, which has a footprint in six Western and Northwestern states, this month issued a request for proposals that seeks 595MW of battery storage to complement 3,743MW of renewable energy capacity as it moves away from coal-fired generation.

In California, new storage installments have the grid operator California ISO expecting roughly 923 MW of battery storage in operation by the end of this year after the 250MW Gateway Energy Storage became operational in June.<sup>13</sup>

Texas utilities and project developers are only beginning to step into this market. In December, El Paso Electric published a resource development plan that includes 320MW of storage by 2023.<sup>14</sup> In June, a company called Broad Reach Power that has 3,000MW of solar and storage projects in five states said it would install 150MW of utility-scale storage this year across 15 sites in Texas.<sup>15, 16</sup>

**ERCOT has a battery  
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that advocates storage  
development.**

ERCOT itself has a battery energy storage initiative supervised by a task force whose mission is to advocate for electricity-storage development.<sup>17</sup>

Speaking to ERCOT electricity-storage policy, the CEO of Broad Reach Power said last month that ERCOT representatives are "open-minded" on the topic. "It just takes some time to learn about these things and to understand the capabilities and then amend the rules to allow this."<sup>18</sup>

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<sup>12</sup> S&P Global Market Intelligence. [Arizona Public Service sees energy storage as 'backbone' of coal exit.](#) July 1, 2020.

<sup>13</sup> S&P Global Market Intelligence. [Most powerful US battery system charges up in Calif. storage surge.](#) June 24, 2020.

<sup>14</sup> El Paso Electric Company. [El Paso Electric Plans to Add First Ever Utility-Scale Battery Storage, Hundreds of MWs of Solar Energy by 2023.](#) Dec. 19, 2020.

<sup>15</sup> Houston Chronicle. [Texas to get 15 utility-scale battery storage sites.](#) June 10, 2020.

<sup>16</sup> Broad Reach Power. [Broad Reach Power to Build 15 Battery Storage Projects Across Texas by End of 2020.](#) June 9, 2020.

<sup>17</sup> ERCOT. [Battery Energy Storage.](#) Accessed July 6, 2020.

<sup>18</sup> E&E News. [Storage CEO on coronavirus, Trump and federal 'constraint'.](#) June 23, 2020.

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## Projections for 2022

To take the measure of the coming solar wave, we examined ERCOT generation data for the month of January 2020, and for a week in late May and early June. That information enabled us to derive an estimate of electricity generation at higher levels of installed capacity.

We used data from both the U.S. Energy Information Administration (EIA) and from ERCOT.<sup>19</sup> EIA's hourly grid monitor was used to collect generation data for ERCOT's solar resources, while the installed capacity information was taken from ERCOT's monthly "Capacity Changes by Fuel Type" report. For ease of calculation, we assumed that 100% of the solar capacity was dispatched as it became available, so our capacity factor calculation was simply actual generation during the hour divided by the amount of installed capacity.

For our calculations for the May-June period, we opted to take what can be seen as a conservative approach, using the high end of installed capacity available from the ERCOT "Capacity Changes" report. Through the end of May 2020, ERCOT lists 2,691MW of solar as being installed, with an additional 1,057MW of capacity synchronized with the grid, for a total of 3,748MW. This almost certainly overstates the amount of actual capacity sending power into the grid, and thus lowers the capacity factor. Using the lower capacity factor reduces the amount of expected generation from the state's solar resources in the future, thereby understating the threat to coal.

Once we calculated the capacity factor, we could then substitute a higher, forward-looking amount of installed capacity to see how much additional solar-generated electricity was likely to be sent onto the Texas grid. As discussed earlier, based on ERCOT data, we believe it is likely that 12,399MW of solar capacity will be installed on the Texas grid by the end of 2021. However, in an effort to avoid overstating the solar effect, we have excluded the 1,272MW of projects that have yet to post financial security for their transmission upgrades. So, our analysis is based on 11,127MW of installed solar capacity by the end of 2021. We illustrate the impact this new capacity will likely have on the ERCOT grid in the following graphic.

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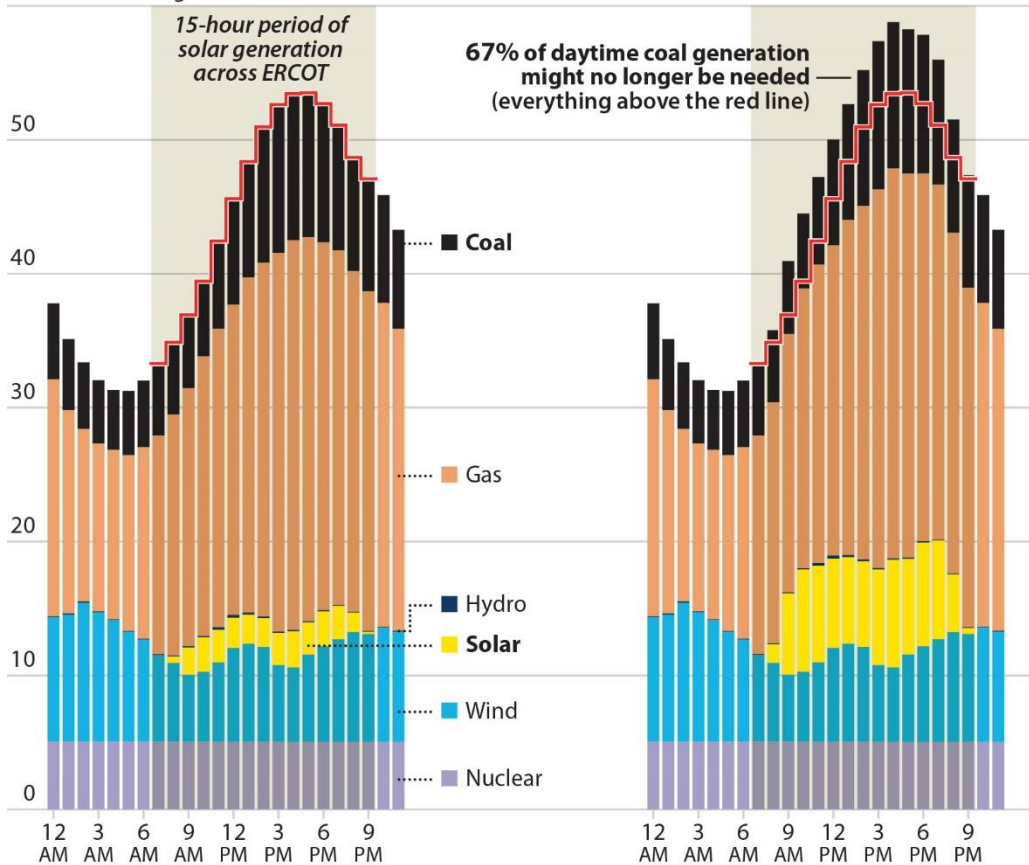
<sup>19</sup> ERCOT's generation data is published monthly and can be found at:  
<http://www.ercot.com/content/wcm/lists/197392/DemandandEnergy2020.xlsx>

### How More Solar Power Across ERCOT Would Push Out Coal Generation

The significant amount of utility-scale solar expected to come online by early 2022 will put upward of two-thirds of coal's more expensive daytime electricity generation at risk.

Generation in ERCOT on May 28, 2020 ... and with more solar power in early 2022

60 thousand megawatt-hours



Source: Energy Information Administration

### At Least 70% of Coal's Market Share Is At Risk

Our analysis of the January data shows 25 days when solar generation could knock more than 40% of any given day's coal output offline. Of those 25 days, seven show solar potentially replacing all of coal's daytime generation. In a somewhat surprising discovery, only one day in January had solar pushing anything less than 10% of coal's output offline. Overall, the January analysis shows at least 70% of coal's daytime output rendered potentially unnecessary in the long term, which would be a crippling blow for the ERCOT's remaining coal generators.

The week's worth of May-June data—while smaller than our January sample—shows a similar trend. By 2022, solar generation will likely put more than 50% of daytime coal-fired output in jeopardy. Also worth noting: Zero-fuel-cost solar is likely to have a significant dampening impact on overall ERCOT prices during higher-demand warm weather periods.

These samples from January and the May-June week suggest a two-pronged threat to coal: First, by pushing a significant portion of coal's output off the grid entirely and second, by lowering realized prices for the remaining generation.

## **An Alternate Method of Estimating Solar Generation Yields the Same Risk to Coal**

Our capacity factor calculation allows us to estimate solar's hourly impact on the grid and its threat to coal, but there is another way to approach the issue that, while less detailed, offers an equally worrisome result for operators of coal-fired plants.

In 2019, solar projects in ERCOT generated just under 4.4 million MWh of electricity. Taking the midpoint of the capacity online at the beginning of the year (1,858MW) and at the end of the year (2,281MW), we can use 2,069MW as the total approximate amount of solar online throughout the year. If that capacity had operated at 100% capacity throughout the year, it would have produced 18.1 million MWh of electricity. This puts the 2019 capacity factor for ERCOT's solar projects at roughly 24%. Some of the newer and larger solar projects in ERCOT have posted higher capacity factors, and it is reasonable to expect this figure to continue rising somewhat as more efficient hardware is installed in later generation projects, but for this exercise we will use 24%.

The 5,801 MW of total solar generation expected online by the end of 2020 translates to 12.2 million MWh of electricity. The numbers climb significantly during 2021. By the end of that year, if all 11,127MW of capacity are installed, solar will be able to produce an estimated 23.4 million MWh of electricity. This would amount to more than 6% of ERCOT's total 2019 demand, a striking increase from current levels. The real kicker here is that this 6% would amount to more than 30% of ERCOT's 2019 coal-fired generation, and, obviously, a much higher percentage of coal's daytime generation.

Perhaps more important, solar generation will be skewed toward the summer months, which are a crucial sales period for ERCOT's coal-fired power plants. For example, the Upton 2 solar farm, the largest project in the state at 180MW when it came online in late 2017, posted a capacity factor of 30.3% from May-September 2018 and a 31.3% capacity factor during the same period in 2019. The new capacity coming online can be expected to do about the same, undercutting what has increasingly become a key sales period for coal due to generally higher prices and tighter reserves margins.

In short, these developments serve as an early retirement notice for at least one and probably more of ERCOT's remaining coal-fired power plants, all of which are listed in Figure 5.

**Figure 3: ERCOT's Remaining Coal-Fired Power Plants**

Plant Name	Owner	Operating Year	Units	Capacity (MW)	2019 CF
Fayette Power Project	LCRA	1979	3	1615	67
J K Spruce	CPS-San Antonio	1992	2	1345	56.8
San Miguel	San Miguel Elec Co-Op	1982	1	391	60.6
Twin Oaks	Blackstone Group	1990	2	305	89.8
Coletto Creek	Dynegy/Vistra	1980	1	648	56.8
Martin Lake	Luminant/Vistra	1977	3	2410	56.5
Oak Grove (TX)	Luminant/Vistra	2010	2	1665	85
W A Parish	NRG	1977	4	2499	60.7
Limestone	NRG	1985	2	1689	58.8
Sandy Creek Energy Station	LS Power/Brazos Elec Co-Op	2013	1	933	61.5
Oklunion	AEP	1986	1	472	45.7
<b>Total</b>				<b>13972</b>	

## ERCOT's Coal Plants, Blow by Blow

The last round of coal plant retirements in Texas occurred in late 2017, when Vistra Energy moved forward with plans to close 2,408MW of capacity (Sandow Units 4 and 5, and Big Brown Units 1 and 2). In its press release announcing the decision, the company quoted Curt Morgan, Vistra's president and CEO as saying, "These two plants are economically challenged in the competitive ERCOT market. Sustained low wholesale power prices, an oversupplied renewable generation market, and low natural gas prices, along with other factors, have contributed to this decision."<sup>20</sup>

**The grace period for coal plants is about to end as solar and wind continue to expand.**

Since then, tight reserve margins—which effectively have created a fast-expiring grace period—have kept the remaining ERCOT coal plant online, but IEEFA believes that this grace period is about to end as solar and wind capacity and generation continue to expand across the region.

ERCOT's coal generators are also at risk from the sharp increase in daily and even hourly cycling of coal-fired plants to accommodate the rise in variable generation. Coal plants are not well-suited for this type of operation, which generally raises maintenance costs by speeding material degradation. However, to remain in the

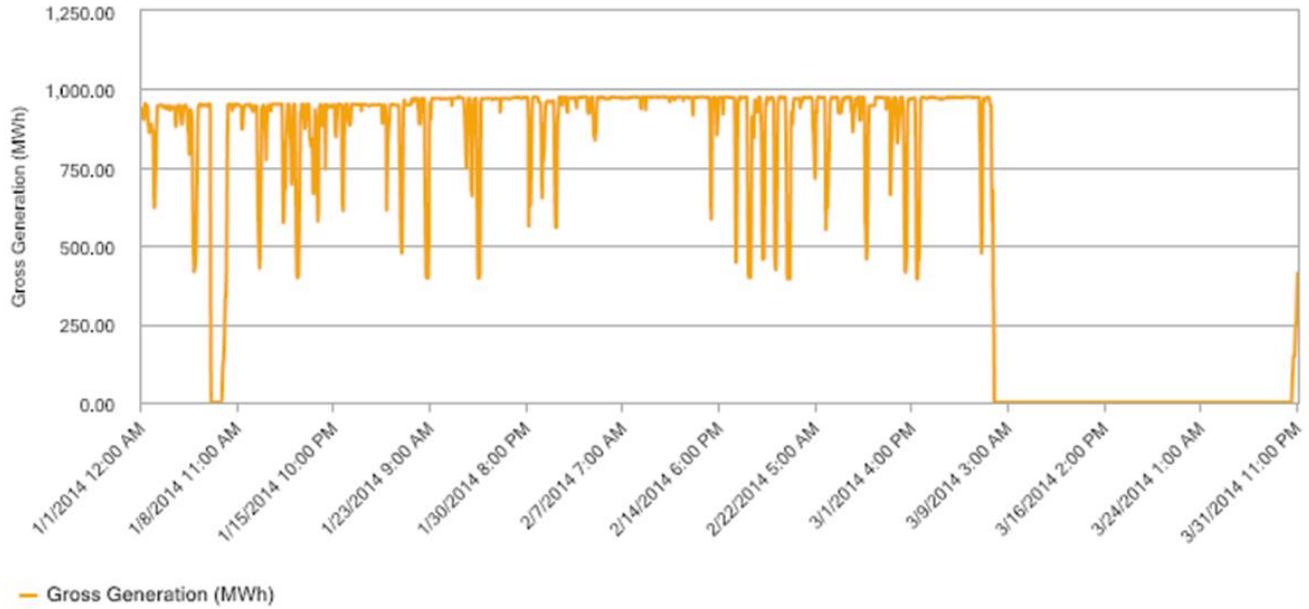
<sup>20</sup> Vistra Energy. [Vistra to Close Two Texas Power Plants](#). Oct. 13, 2017.

market, ERCOT's coal generators have been forced to try and adapt to this new operating paradigm, as can be seen in the following two graphics illustrating the sharp increase in cycling at Sandy Creek Unit 1 during comparable operating periods in 2014 and 2020.

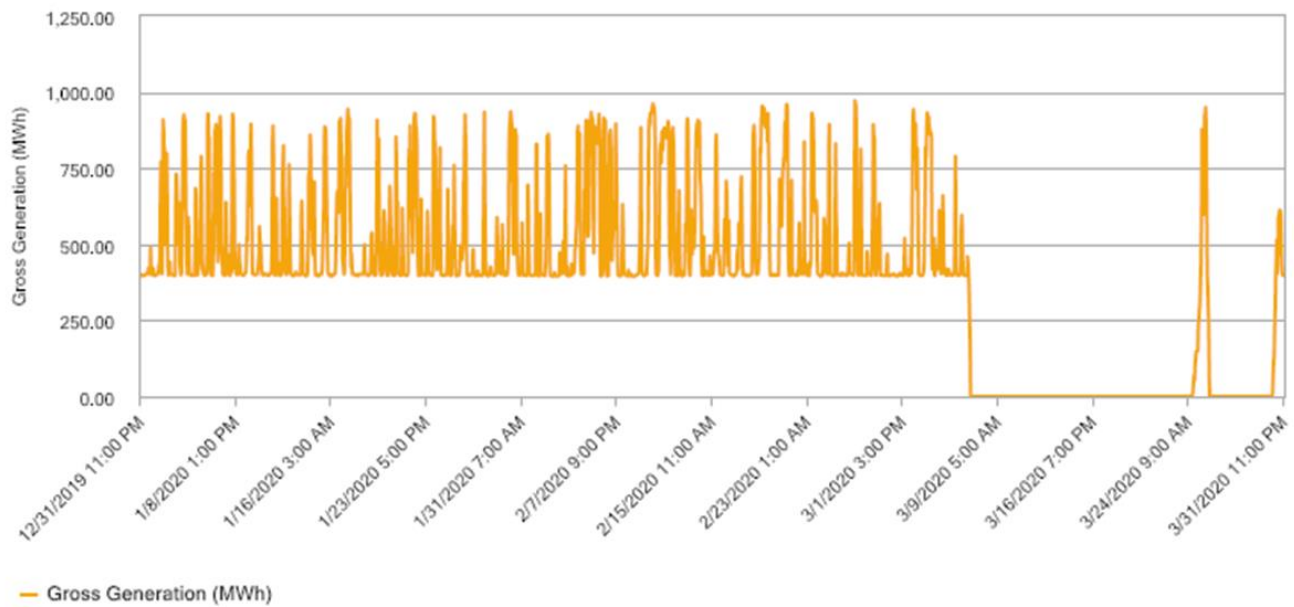


Figure 4: Cycling Activity at Sandy Creek Unit 1

Sandy Creek ST S01 - Gross Generation (MWh)



Sandy Creek ST S01 - Gross Generation (MWh)



Source: S&P Global Market Intelligence database.

## Rankings: Commercial Longevity

The following pages detail the 11 operating ERCOT coal-fired plants, highlighting the particular problems facing each plant. While these vignettes do not predict specific retirement dates, the plants are presented in rough order of likely commercial longevity, beginning with the first to go and ending with the plants likely to operate the longest.

### Oklaunion

*(Scheduled to retire Oct. 1, 2020)*

Oklaunion is a single-unit, 650MW coal plant majority owned by American Electric Power. Located near the Texas-Oklahoma border, the plant's output is split between ERCOT (72.66%) and the Southwest Power Pool (27.34%). The plant, which entered commercial service in 1986, has faced economic challenges for years, with AEP CEO Nick Akins acknowledging in 2017 that "Oklaunion has been a drag, particularly on the unregulated side [in ERCOT]."

**ERCOT approved  
the Oklaunion plant's  
shuttering for Oct. 1, 2020.**

That drag, with little likelihood of improvement, ultimately prompted the company to announce plans to retire the facility; earlier this year, ERCOT approved the company's plan to shutter the unit on Oct. 1, 2020.

While the official closure date is still a few months off, it is worth noting here that EIA data through April (the latest information available from the agency) show that the plant has not generated any power since October 2019. Whether that six-month hiatus continues remains to be seen, but it highlights another problem faced by all of the remaining coal plants in ERCOT: As plants generate less electricity, they are forced to distribute their fixed costs across a shrinking number of kilowatt-hours, effectively raising their operating costs and making them less competitive than ever.

### Coleto Creek

The Coleto Creek plant is a single-unit station with a generating capacity of 648MW that entered commercial service in 1980. It is one of the three Texas plants owned by Vistra Energy; the other two are Martin Lake and Oak Grove, which are larger, multi-unit generation stations.

Coleto Creek performed exceptionally well in the early 2010s, posting an average annual capacity factor of 87.3% from 2009-2014. Since then, the plant's performance has fallen, with the unit posting an average capacity of 61.7% through 2019, while 2020 has been significantly lower. EIA data through April show the unit posting a 17.6% capacity factor in January, no generation in February or March, and then a 52.8% capacity factor in April.

In addition to its struggles with competitive pressures in the Texas power market, Coletto Creek also may become one of the casualties of Vistra's sustainability initiatives. The company's recently released 2019 Sustainability Report notes that the company plans to retire 7,000MW of its operating coal-fired generation capacity in the coming 10 years—more than 60% of its current total of 11,415MW. At the same time, the company plans to add 6,000MW of renewable generation and battery storage to its portfolio. "Vistra is focused on becoming a clean energy company," the report states.<sup>21</sup>

## **Martin Lake**

The Martin Lake plant is a three-unit facility with a total generating capacity of 2,410MW—making it the second-largest coal plant in ERCOT (behind the four-unit W.A. Parish facility at 2,499MW). The facility has performed well over the past 10 years, although there has been a noticeable decline in its annual average capacity factor. In the three years from 2009-2011 the plant's capacity factor was above 80%; from 2012-2014 it slipped to 67.5%; and since 2015 the average has fallen to 55.8%.

**Martin Lake is a clear test of Vistra's commitment to its sustainability pronouncements.**

This is a clear indicator that competition from wind and gas has taken a toll.

In Vistra's latest investor presentation, executives pointed out that the company had hedged all its projected 2020 electricity generating in the state, protecting itself against price volatility. This clearly has benefits by keeping the company from losing money during those periods when ERCOT's prices are lower than Martin Lake's marginal costs, but it also affects the upside, preventing the company from benefitting when prices climb in the summer. A recent S&P analysis, for example, found that a typical combined cycle merchant gas plant in Texas likely earns about 30% of its annual revenue in the month of August, when system prices are generally highest.<sup>22</sup> The numbers may be slightly different for coal plants like Martin Lake, but the company's hedging makes it a moot point, as it allows no market upside for the facility.

Beyond these economic limitations, Martin Lake is a clear test of Vistra's commitment to its sustainability pronouncements. The plant is the single-largest emitter of sulfur dioxide in the country, releasing 93 million tons of SO<sub>2</sub> from its uncontrolled smokestacks in 2019 alone.

In addition, it is the company's largest emitter of carbon dioxide, releasing 13.9 million tons in 2019, making Martin Lake one of the 10 largest power plant CO<sub>2</sub>

<sup>21</sup> Vistra, [2019 Sustainability Report](#), p. 5. June 2020.

<sup>22</sup> S&P Global Market Intelligence. [Despite pandemic load impact, ERCOT attractive for renewable energy investment](#). June 4, 2020.

emitters in the country. This has happened while the company has pledged to cut its CO<sub>2</sub> emissions by 80% by 2030, a goal that would clearly be served by a Martin Lake shutdown.

## **Fayette**

The Fayette Power Project is a three-unit facility with a total net summer generating capacity of 1,615MW. Units 1 and 2, which came online in 1979 and 1980, are jointly owned by Austin Energy and the Lower Colorado River Authority (LCRA); Unit 3, which entered commercial service in 1988, is wholly owned by LCRA.

The plant has performed well over the past 10 years, but it faces a reckoning: Austin Energy, the municipal utility serving the state capital, wants out. The utility's current resource plan, which runs through 2030, includes the following directive: "Austin Energy will maintain its current target to cease operation of Austin Energy's portion of the Fayette Power Project (FPP) coal plant by year-end 2022. Austin Energy will continue to recommend to the City Council the establishment of any cash reserves necessary to provide for that schedule."<sup>23</sup>

The details of the split remain to be resolved, but the market for 1,180MW of 40-plus-year-old coal capacity is not robust, if there is any market at all.

## **San Miguel**

This single-unit, 391MW capacity plant is the only asset of the San Miguel Electric Cooperative, which in turn is wholly owned by the South Texas Electric Cooperative. South Texas is a generation and transmission cooperative that supplies power to eight distribution co-ops serving roughly 241,000 customers from south of San Antonio to Brownsville on the Texas-Mexico border. The plant, which burns coal from an adjacent lignite mine, came online in 1982.

**South Texas paid roughly  
\$58 per MWh for power  
from San Miguel in 2018,  
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average price.**

South Texas has a long-term contract with the plant to buy all its generation through 2037. Data from the two cooperatives' 990 forms filed with the IRS indicate that South Texas paid roughly \$58 per MWh for power from San Miguel in 2018, which was 63% above the ERCOT-wide average price of \$35.63 that year;<sup>24</sup> a difference that could not have sat well with member co-ops.

On the surface, this looks like a plant that will be generating power for years to come. But a growing number of examples show that may not be the case, with the

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<sup>23</sup> Austin Energy. [Austin Energy Resource, Generation and Climate Protection Plan to 2030](#). Accessed July 7, 2020.

<sup>24</sup> Potomac Economics. [2018 State of the Market Report for the ERCOT Electricity Markets](#). June 2019.

swift transition at Tri-State Generation and Transmission Association being perhaps the most relevant comparative example. Based in Colorado, Tri-State provides power to 43 distribution co-ops spread across four states (Colorado, Nebraska, New Mexico and Wyoming). It fought with members for years over the high costs of its coal-fired generation and sought to prevent its distribution members from installing more than de minimus amounts of renewable energy resources in their service territories. Two members, Kit Carson Electric Cooperative and the Delta Montrose Electric Association, ultimately bought their way out of Tri-State and turned to another provider for cheaper electricity and more renewables. Other members, including La Plata Electric Association and United Power, have also pushed for change.

In response, Tri-State did an about-face earlier this year, announcing plans to exit coal-fired generation in New Mexico and Colorado entirely by 2030, beginning with the closure of its 257MW Escalante Station in New Mexico by the end of this year. In addition, the co-op pulled its support for a planned 895MW expansion of the Holcomb coal plant in Kansas, leading to its cancellation.

### **Sandy Creek**

LS Power, a privately held power plant developer, owns 64% of Sandy Creek, a single-unit, 936MW supercritical plant, a design that is more efficient than older sub-critical units. Brazos Electric Cooperative owns a 25% stake in the plant, located near Waco, while LCRA owns the remaining 11% stake.

The plant has posted a relatively robust average capacity factor of 61.5% since coming online in May 2013. Still, its performance has varied widely and recently has tailed off: In both 2017 and 2018, the plant recorded a capacity factor above 80% in nine of the 12 months of each year. In 2019, the plant only topped 75% once, in January. In the 15 months since, the plant's average has dropped to 55.5%.

**In the fifteen months  
since January 2019, Sandy  
Creek's capacity factor  
has dropped to 55.5%.**

LS Power largely hides its ownership stake in the plant on its website and on its main 'About Us,' LS Power states the following: "We are at the forefront of the greening of the electric grid. Through LS Power's national fleet of utility scale solar, wind, hydro, natural gas-fired and battery storage generation projects, our customer-facing distributed energy resources and energy efficiency platforms, and by building the transmission that connects it all, we are not just talking about the decarbonization of the system—we are making it happen."

LS Power offers not a word about coal-fired electricity or its ownership stake in Sandy Creek, which has emitted 39.4 million tons of CO<sub>2</sub> since 2013.

## Oak Grove

The two-unit plant has a combined operating capacity of 1,665 MW; Unit 1 came online in April 2010 while Unit 2 entered commercial service in April 2011. The plant is 100% owned by Vistra Energy.

The plant has posted an average annual capacity factor of more than 80% since 2012 after both units began commercial operation. That indicates that the plant is competitive, but the facility ranks in the top 10 in the country for CO<sub>2</sub> emissions, putting it at odds with Vistra's stated sustainability goals (see Martin Lake above).

## JK Spruce

Owned by City Public Service (CPS), San Antonio's municipal utility, JK Spruce is a two-unit plant with a total capacity of 1,345MW. Unit 1 came online in 1992, while Unit 2 did not begin commercial operation until 2010.

Ownership of JK Spruce by CPS, which dubs itself "the nation's largest municipally owned utility," has become politically problematic in San Antonio. The plant was shown to be economically unviable as far back as 2015, and cost more to operate in 2019 than other forms of generation.<sup>25, 26</sup> Although one unit at JK Spruce is supposed to remain operational until 2060, its longevity is far from assured. The city's Climate Action and Adaptation Plan, enacted last year, establishes net-zero carbon policy goals that take effect in 2050.

**The JK Spruce plant was shown to be economically unviable as far back as 2015.**

The chief executive of CPS has stated that it will keep the plant running until "energy storage technology improves or economics on the Texas power grid make the coal plant too expensive to run,"<sup>27</sup> conditions that probably will come to pass sooner rather than later.

JK Spruce's capacity factor in 2019 was 57.6%.

## Limestone

The two-unit plant has a combined capacity of 1,689MW. Unit 1 came online at the end of 1985 and Unit 2 started commercial service at the end of 1986. The plant is 100% owned by NRG, and here again, corporate goals are an issue. The CEO of NRG

<sup>25</sup> The Rivard Report. Coal Plant Losing Money, But CPS Energy is Keeping it – For Now. September 2017.

<sup>26</sup> San Antonio News-Express. [Environmental group's study: CPS coal units costlier than cleaner alternatives](#). June 25, 2019.

<sup>27</sup> The Rivard Report. [San Antonio Adopts Climate Plan to Go Carbon-Neutral by 2050](#). Oct. 17, 2019.

told investors this year that it will reduce its carbon footprint by 50% by 2025 and be carbon “net-zero” by 2050.<sup>28</sup>

Limestone’s capacity factor exceeded 90% as recently as September 2017 but has since declined, averaging 59% in 2019, staying consistently below 50% for the first four months of this year (the period for which the most recent data is available), and dipping below 30% during the month of February.

**Limestone’s capacity factor has stayed consistently below 50% for the first four months of this year.**

### **W.A. Parish**

The four coal-fired units (Units 5-8) at the plant have a combined capacity of 2,499MW. Overall, the plant has eight units, four of which are gas-fired, and a total capacity of 3,662MW. Unit 5 came online in 1977, Unit 6 in 1978, Unit 7 in 1980 and Unit 8 in 1982. The entire plant, which includes the Petra Nova carbon capture facility at Unit 8, is 100% owned by NRG, which brings certain corporate policy risks (see Limestone plant, above).

Parish’s capacity factor, which had routinely topped 70% from month to month over the past several years, averaged only 33% during the first four months of this year.

### **Twin Oaks**

The two-unit plant has a total capacity of 315MW. Unit 1 came online in 1990 and Unit 2 came online in 1991. The plant is 100% owned by The Blackstone Group, a privately held investment company that bought the facility at a bankruptcy auction in 2014 for \$126 million.<sup>29</sup> Blackstone also owns the Walnut Creek mine that supplies the power plant. The plant has posted an average capacity factor above 90% since 2015.

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<sup>28</sup> Green Biz. [NRG’s CEO talks sustainability to investors](#). March 5, 2020.

<sup>29</sup> S&P Global Market Intelligence. [Optim Energy reaches deal with Blackstone to end long bankruptcy fight](#). Aug. 17, 2015.

## About IEEFA

The Institute for Energy Economics and Financial Analysis (IEEFA) examines issues related to energy markets, trends and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. [www.ieefa.org](http://www.ieefa.org)

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