Analysis of Wind Curtailment in Southern Power Pool, 2018–2019

Impacts of Displacing Coal with Wind

Prepared for Union of Concerned Scientists

September 14, 2021

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1. OVERVIEW

The Union of Concerned Scientists (UCS) hired Synapse Energy Economics (Synapse) to conduct an analysis of wind supply in Southwest Power Pool (SPP), motivated by the understanding that wind is being curtailed during hours with potentially displaceable coal generation. The analysis examines issues of wind oversupply, wind curtailment, and the relationship between wind curtailment and coal generation. The aim of this report is to better understand when wind curtailment is taking place, how much curtailment has occurred historically, and how curtailing coal generation instead of wind can provide more value to the region in terms of reduced greenhouse gas emissions from coal plants and reduced costs to ratepayers.

In Chapter 2, we provide background on the SPP data sources that were available for this analysis. In Chapter 3, we describe our methodology and assumptions. In Chapter 4 and Chapter 5, we present our results and discussion.

Our analysis finds that, in the years 2018 and 2019, curtailed wind represented a small fraction of total generation in SPP, and a wind oversupply does not exist in SPP. We estimate that, if all curtailed wind had instead been used to displace coal generation during those years, ratepayers in SPP could have avoided paying $41 million per year in energy costs. In addition, 1.2 million short tons of carbon dioxide (CO_2) emissions could have been avoided each year.

2. BACKGROUND AND DATA SOURCES

Our analysis was conducted for the 2018 and 2019 calendar years. These years were selected for study as the two most recent calendar years unaffected by the impacts of the COVID-19 pandemic. We analyzed generation mix and wind curtailment data sourced from publicly available SPP datasets, described in detail in the following sections.[1]

2.1. SPP Generation Mix Data

Synapse sourced resource generation data from SPP's historical generation mix dataset.[2] Generation in SPP is primarily met by coal, gas, wind, nuclear, hydro, and solar.[3] In 2019, coal provided about 35 percent of annual generation, wind provided 26 percent, gas provided 27 percent, nuclear provided 6 percent, hydroelectric provided 6 percent, and solar less than 1 percent.[4]

Wind provided 65 terawatt-hours (TWh) (23 percent) of generation in 2018, equal to 23 percent of SPP's total in-region generation. In 2019, this rose to 74 TWh (27 percent of generation). Over the course of an average day in each season, wind generation is greatest in the evening hours, while coal generation is greatest during daytime hours (see Figure 1 through Figure 3). Over the course of a year, wind generation is greatest in the shoulder months (April and October) while coal generation is greatest during winter and summer months.[5]

Coal's monthly share of the generation mix varied from 28 percent to 43 percent over the course of 2019—highest in the winter and summer months. On a monthly basis, wind varied from 18 percent to 37 percent of total generation in 2019 and was highest in the shoulder months. Figure 4 illustrates how the monthly generation mix changes over the course of 2019.

[1] The wind curtailment and generation mix datasets are provided at five-minute intervals for 2018 and 2019. Synapse's analysis was at the hourly level, so we aggregated 5-minute interval data into hourly data.

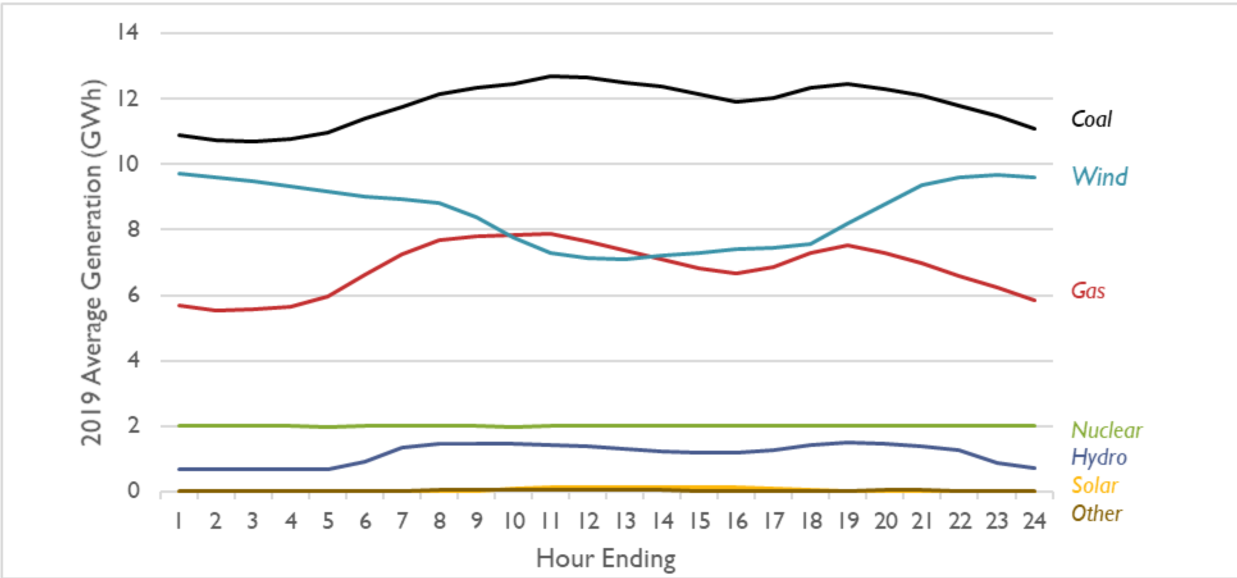
[2] Southwest Power Pool Marketplace. "Generation Mix Historical." *www.marketplace.spp.org*. Accessed June 2021. Available at: https://marketplace.spp.org/pages/generation-mix-historical. Synapse removed outlier observations further than 2 standard deviations from the SPP load data to account for observed abnormalities within the data.

[3] Diesel Fuel Oil, Waste Disposal, Waste Heat, and other sources are also part of the generation mix, but for are a very small share of the total energy generation. In this report, we aggregate these resources together as "Other".

[4] Wind generation does not include wind curtailments. Likewise, total generation also excludes wind curtailments.

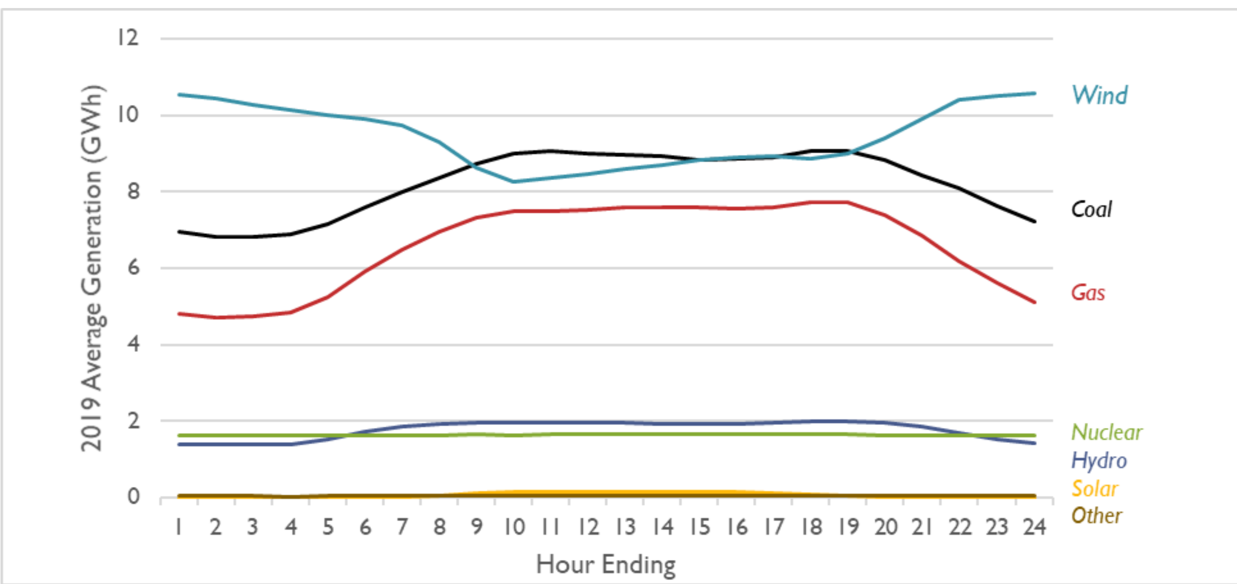
[5] Winter is identified as December 1st through March 31st and Summer is identified as June 1st through September 30th in line with SPP's resource adequacy guidelines. Shoulder months include all other months during the year (April 1st through May 31st and October 1st through November 30th).

Figure 1. 2019 SPP hourly average generation by resource and hour – winter season average day



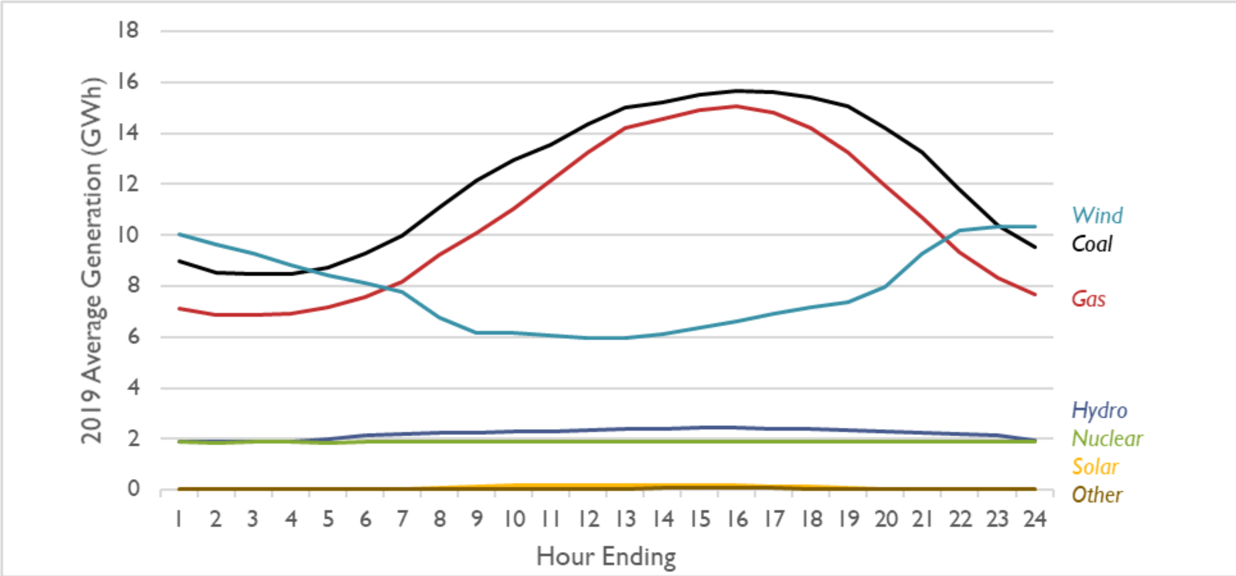
Source: SPP Historical Generation Mix Data available at: *https://marketplace.spp.org/pages/generation-mix-historical.*

Figure 2. 2019 SPP hourly average generation by resource and hour – shoulder season average day



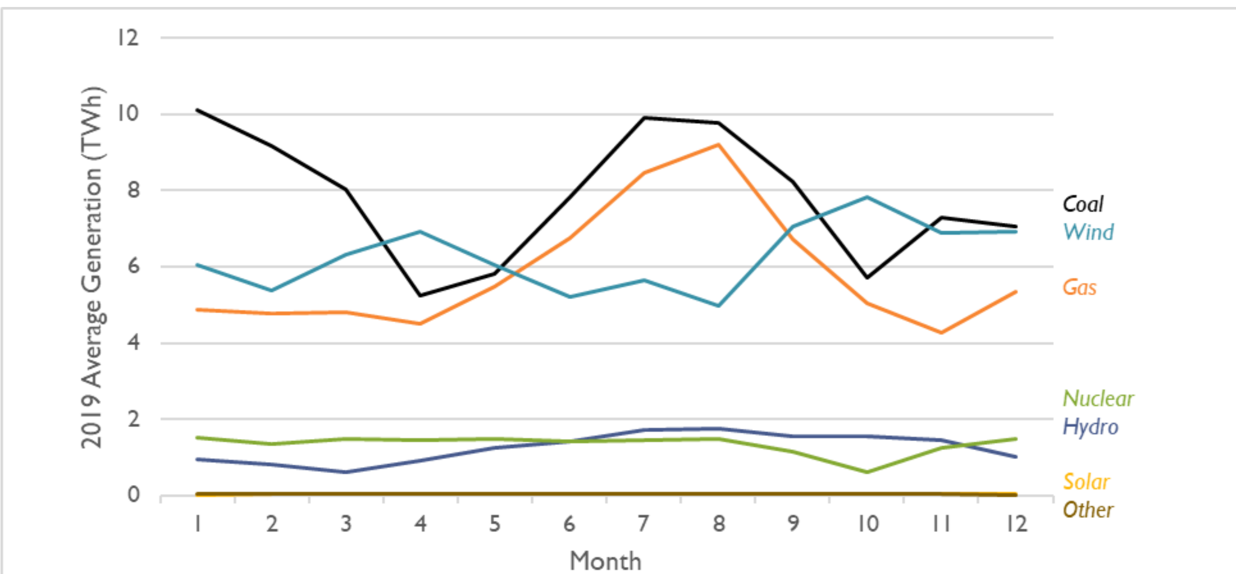
Source: SPP Historical Generation Mix Data available at: *https://marketplace.spp.org/pages/generation-mix-historical.*

Figure 3. 2019 SPP hourly average generation by resource and hour – summer season average day



Source: SPP Historical Generation Mix Data available at: *[https://marketplace.spp.org/pages/generation-mix-historical.](https://marketplace.spp.org/pages/generation-mix-historical)*

Figure 4. 2019 SPP total generation by resource and month



Source: SPP Historical Generation Mix Data available at: *[https://marketplace.spp.org/pages/generation-mix-historical.](https://marketplace.spp.org/pages/generation-mix-historical)*

2.2. Wind Curtailment Data

Wind curtailment data for 2018 and 2019 was obtained from the Variable Energy Resource curtailment dataset posted by SPP.[6] For each five-minute increment of the year, this dataset contains information on two different kinds of wind curtailments. SPP defines these two curtailment types as:

- Wind Redispatch Curtailments: These curtailments performed automatically by the SPP real-time market based on pricing signals.
- Wind Manual Curtailments: A manual curtailment takes place when the SPP Reliability Coordinator must manually intervene to ensure reliability of the system.

In general, redispatch (market-driven) curtailments are in response to inefficient pricing signals due to congestion on the transmission system (i.e., congestion pricing) and self-committing resources. Congestion pricing indicates that a transmission constraint will limit imports or exports across certain zones or regions. Generally, this occurs when there is a transmission constraint between areas of mismatched supply and demand. Such a mismatch might be caused, for instance, by a load pocket without enough local generation and limited transmission capacity in and out of the region. Conversely, a mismatch might also occur in a region with a surplus of generation but minimal load and not enough transmission capacity to move all the generation to the load. These constraints are most apparent during peak hours and can drive large discrepancies in locational energy prices, or locational marginal prices (LMPs), across regions. These types of constraints can be mitigated or resolved by transmission upgrades, new transmission projects, strategically sited battery storage, other non-wires alternatives, or a combination of all. Addressing transmission constraints in high wind regions can allow increased utilization of zero marginal cost wind that would otherwise be curtailed. This in turn can lower wholesale energy prices.

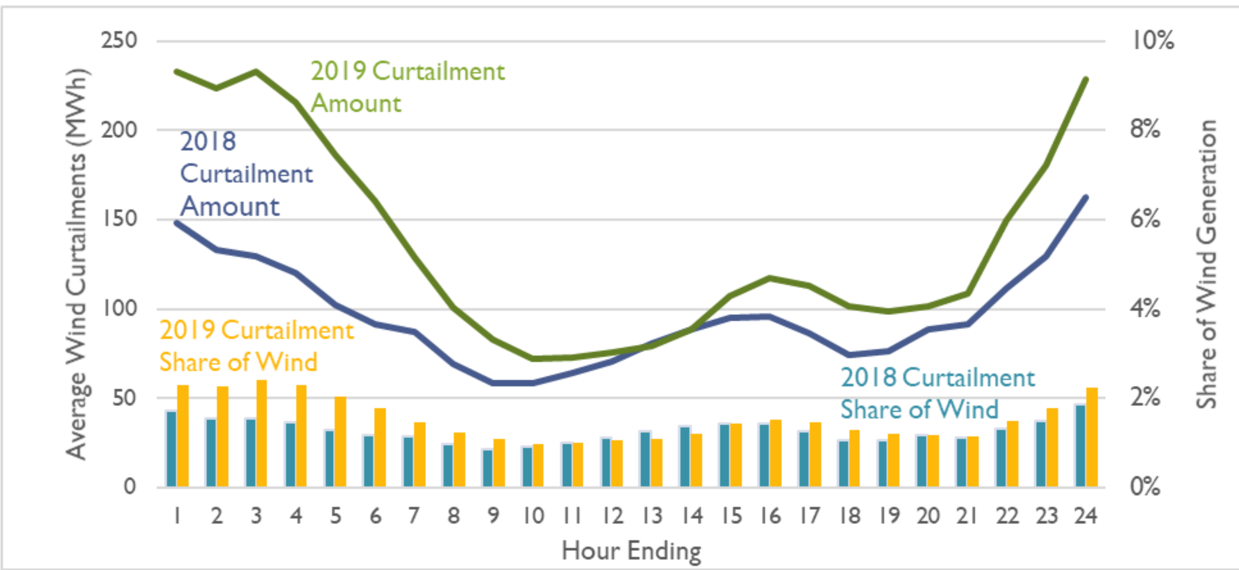
As mentioned above, self-committing resources are another barrier to effective price signals. Self-commitment is when a market participant tells the market operator to commit a unit at its minimum operating level even if the market LMP falls below the unit's marginal production cost. Coal units make up the majority of self-committed resources in SPP, primarily because coal units are relatively inflexible resources that cannot be turned on and off or ramped up and down quickly. If a coal unit is turned on and committed into the market, it has to operate at or above its minimum operating level even if there are cheaper resources available. By locking in a minimum level of fossil resources that cannot easily

[6] Southwest Power Pool Marketplace. "VER Curtailments." *www.marketplace.spp.org*. *Available at:* https://marketplace.spp.org/pages/ver-curtailments. Data was separately analyzed for 2018 and 2019 to identify any year-over-year trends in the data. The 2018 dataset contains 225 blank observations (0.2 percent of the data) while the 2019 dataset contains 358 blank observations (0.3 percent of the data). These observations were treated as intervals with zero curtailment for the purposes of the analysis.

ramp up and down, the maximum contribution from wind is lower than it would be with more flexible resources on the system.[7]

Though redispatch curtailments make up about 90 percent of all curtailments in 2018 and 2019, Synapse focused its analysis on the combined impact of both curtailment types, as both may be avoidable. In 2018 and 2019, curtailed wind represented a small fraction of wind generation, and an even smaller fraction of total generation in SPP. On average over the two years, curtailed wind represented 1.5 percent of wind generation and 0.4 percent of total generation. In general, curtailed wind is greatest overnight between the hours of 10 PM and 6 AM during the shoulder months. From 2018 to 2019, curtailed wind energy increased by 62 percent from 0.8 TWh to 1.2 TWh, with increases occurring primarily at night and in the early mornings (see Figure 5).[8]

Figure 5. Hourly average wind curtailment in SPP, 2018 and 2019



[7] This topic is discussed at length in SPP's 2019 report, "Self-committing in SPP markets: Overview, impacts, and recommendations," available at: https://spp.org/documents/61118/spp%20mmu%20self-commit%20whitepaper.pdf.

[8] Average wind curtailment per hour is calculated by summing the total wind curtailment within each hour (1-24) and dividing each of the 24 hour bins by the number of days in a year (365).

3. ANALYSIS

For each year, we examined whether there were any instances of a wind oversupply, examined the relationship between curtailed wind and coal generation, identified major wind curtailment events, and calculated the impacts of displacing coal with curtailed wind. The following sections describe the approach and results for each calculation.

3.1. Wind Oversupply

In regions like California, renewable resources (like solar and wind) are curtailed in hours when there is a oversupply (i.e., surplus) of energy, but only in some of those hours is there an actual oversupply of renewable resources (i.e. solar generation could have met 100 percent of California's load if not for various system constraints).[9,10] In this analysis, we examine whether wind was ever curtailed in SPP because wind supply exceeded total load. Therefore, we define an oversupply as any hour in which total wind energy (including curtailed wind) exceeds total system generation (load plus exports).[11] In each hour of 2018 and 2019, we summed the wind generation (in GWh) and wind curtailment (in GWh), then compared the sum to the total SPP generation in each hour. We also examined, for both years, the impact of adding curtailed wind in the hour with the greatest share of wind. We conducted this analysis to understand if wind was ever being curtailed due to an excess supply relative to total generation.

There were no hours in 2018 or 2019 in which wind generation (including curtailed wind) exceeded total system generation. On average during the two years, wind generation plus curtailment represented 37 percent of total system generation. The maximum hourly share of wind generation relative to total generation was observed to be about 63 percent in both years. If wind had not been curtailed in these hours, the share of wind would have increased to 70 percent in 2018 and 67 percent in 2019 (see Figure 8 and Figure 9).

In 2018 and 2019, wind generation made up a large portion of SPP's total generation, but in no instances could it have supplied the entirety of SPP's load or caused an oversupply issue.

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[9] See http://www.caiso.com/informed/Pages/ManagingOversupply.aspx.

[10] See https://blog.ucsusa.org/mark-specht/renewable-energy-curtailment-101/.

[11] SPP's system generation mix data includes exports. For this calculation, we treated curtailed wind as being able to be exported with no transmission constraints. Further, we exclude solar in this calculation given its small contribution to total system generation.

Figure 6. Generation mix during single hour with maximum wind generation share, 2018

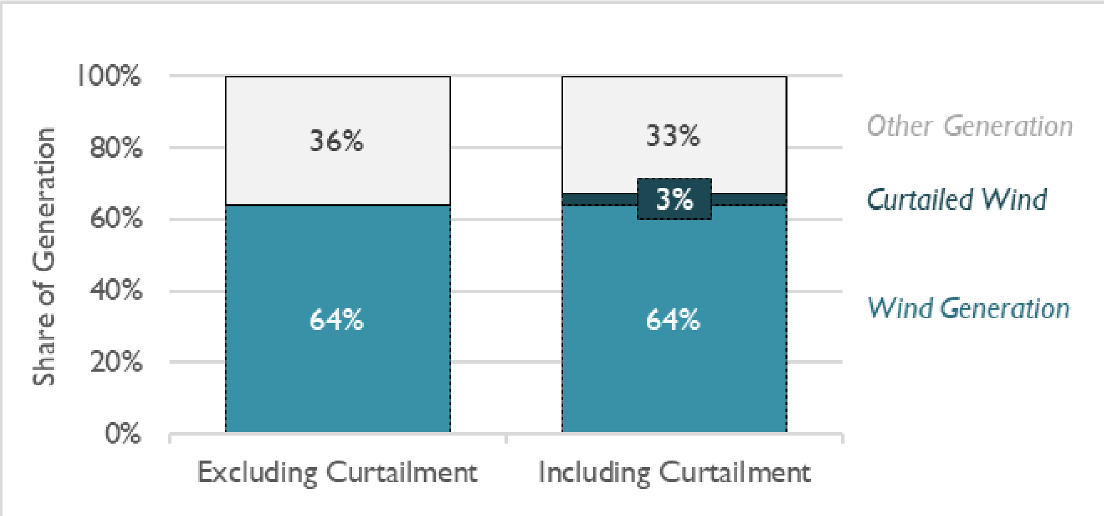
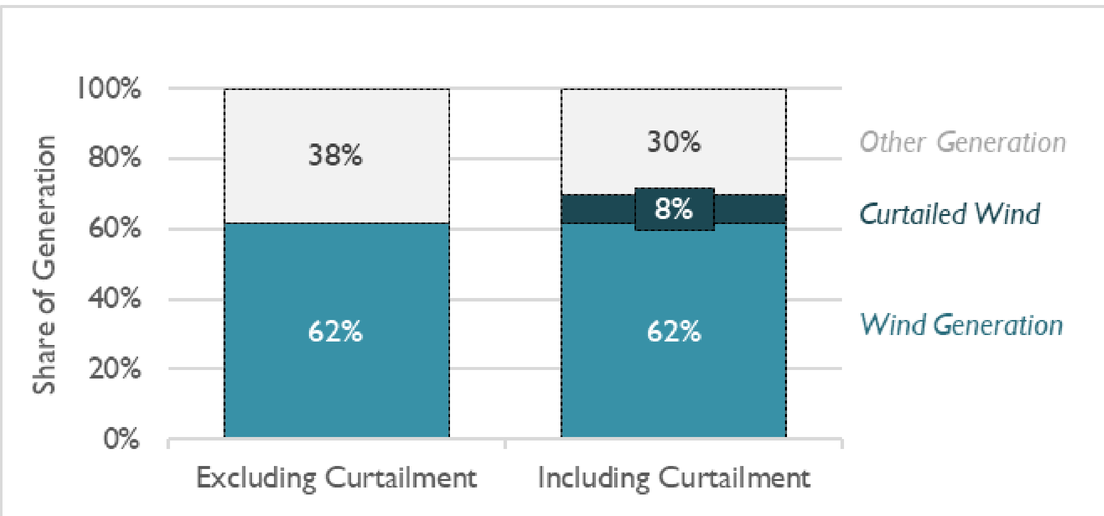


Figure 7. Generation mix during single hour with maximum wind generation share, 2019

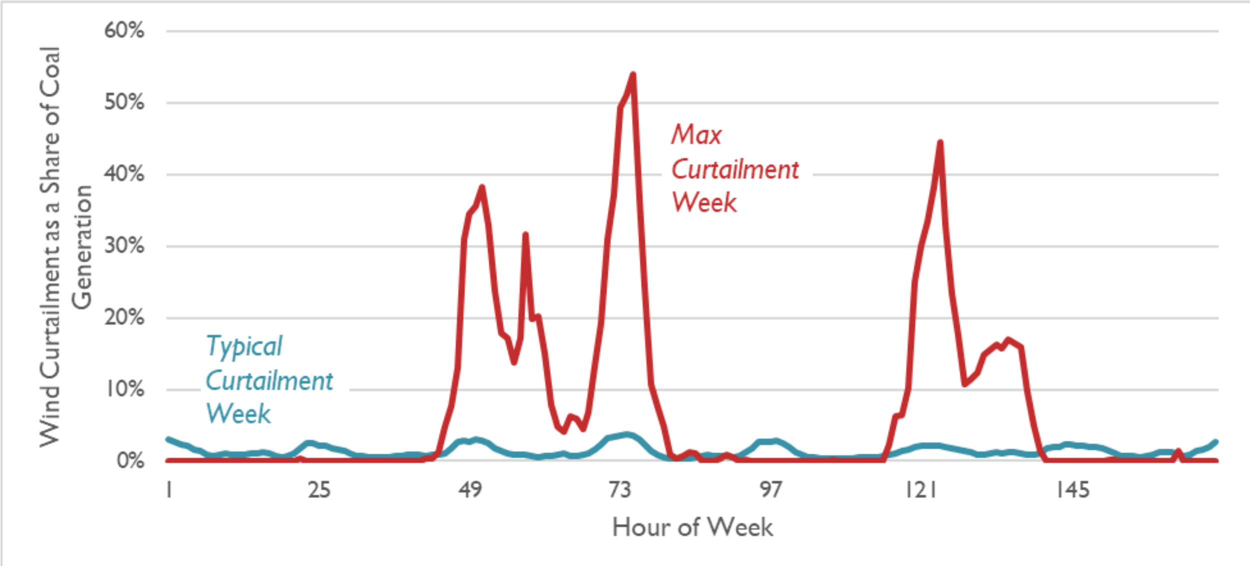


3.2. Wind Curtailment Relative to Coal Generation

Next, we compared the amount of wind curtailment relative to coal generation on an hourly and annual basis. In each hour of 2018 and 2019, we compared the sum of wind curtailment (in MWh) with the sum of coal generation (in GWh). We conducted this analysis to understand how much coal energy could have been avoided by utilizing curtailed wind.

There were no hours in 2018 or 2019 in which wind curtailment exceeded total coal generation in that same hour. On average during the two years, wind curtailment was observed to be between 1 percent and 2 percent of coal generation in hours during which wind curtailment occurred. The maximum share of wind curtailment to coal generation in any hour was observed to be 27 percent in 2018 and 57 percent in 2019. Figure 10 illustrates how the share of wind curtailment relative to coal generation can vary between an average week of curtailment and the maximum week of curtailment.[12]

Figure 8. Wind curtailment as a share of coal generation for average and maximum curtailment weeks, 2019



3.3. Major Wind Curtailment Events

As a third metric, we examined the relationship between sequential hours of wind curtailment and the amount of energy curtailed per hour to identify "major curtailment events." We identified major curtailment events because long, high-intensity curtailment events are most likely associated with large windstorms or other weather events, which are forecasted days in advance and therefore may be avoidable with early planning.

We defined "major" events as those that exceed 24 hours in length and whose hourly average magnitude is in the 95th percentile, or two standard deviations above the mean.[13] All other events were considered "minor". Based on our definition of major curtailment events, there were 31 major events in 2018 and 26 in 2019 (see Figure 13 and Figure 14). Major events tended to occur in winter months of 2018 and in the shoulder months of 2019 (see Table 3). Although major events make up under 1 percent of total events in both 2018 and 2019, they account for approximately 4 percent of total curtailed energy due to their high level of curtailment per hour (see Figure 11). On average, curtailed energy during a major event was about 16.7 GWh, while curtailment during a minor event was about 0.1 GWh—a difference of two magnitudes.

[12] The average wind curtailment profile for a week in 2019 is calculated by dividing the average wind curtailment by average coal generation in each hour of each day in the week. The average includes periods with no wind curtailment.

[13] The 95th percentile for hourly average magnitude was 222.6 MWh/hour and 162.3 MWh/hour in 2019 and 2018 respectively.

Figure 9. Wind curtailment event distribution and classification, 2018

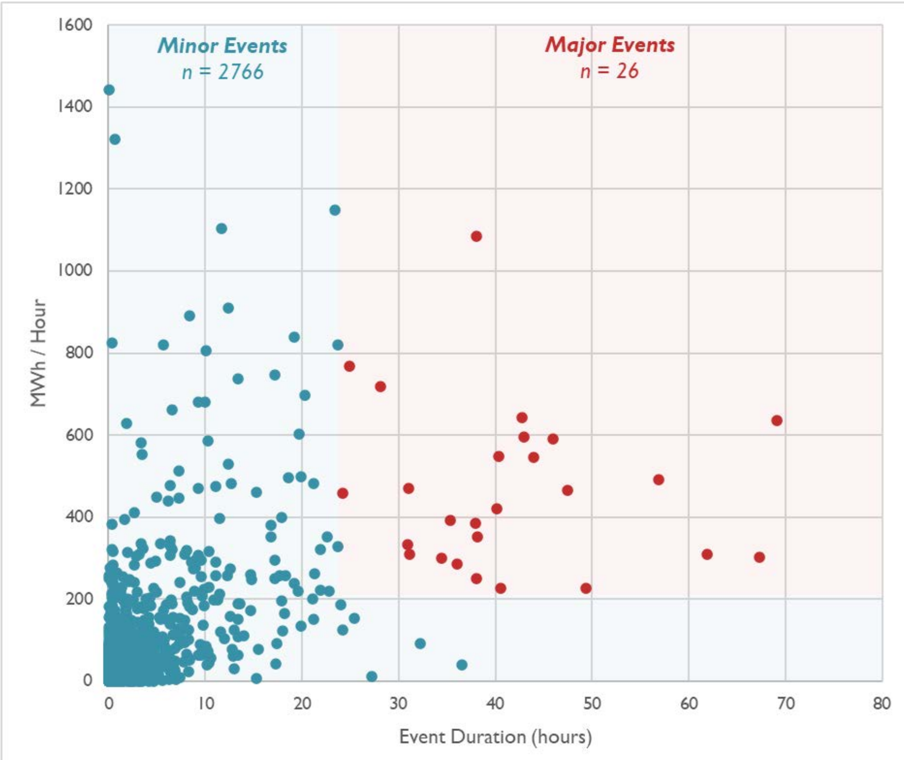


Figure 10. Wind curtailment event distribution and classification, 2019

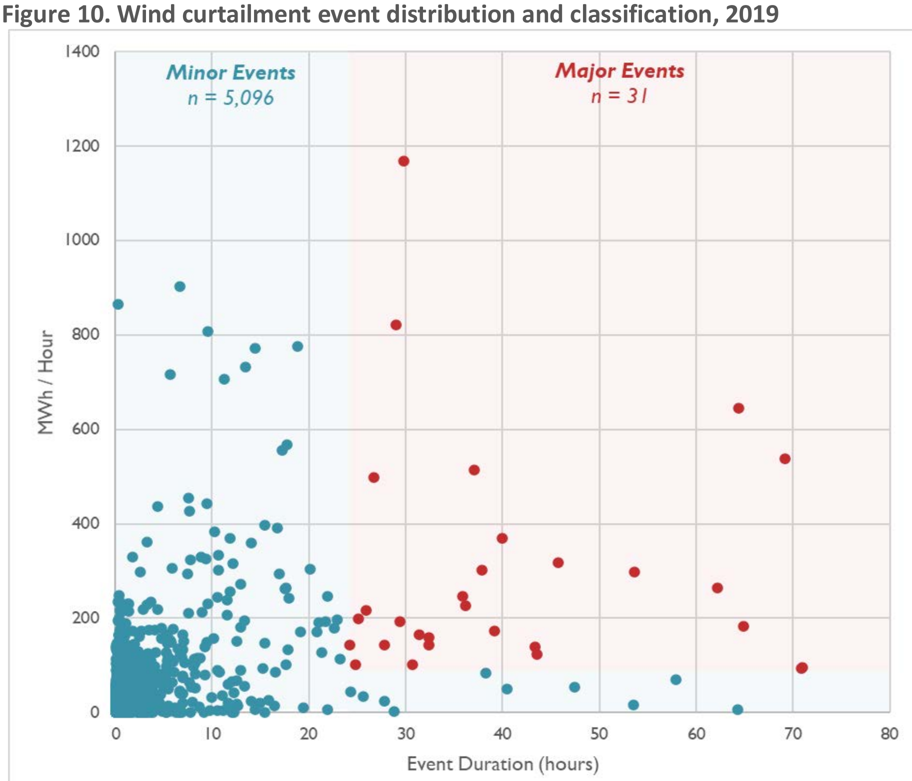
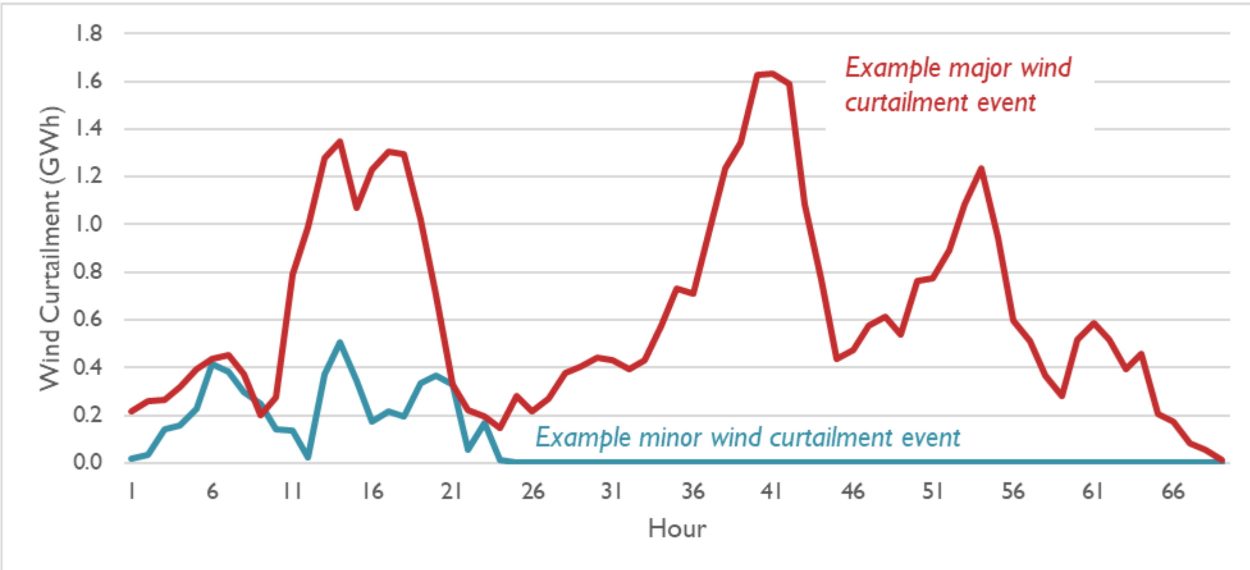


Table 1. Major curtailment events by month, 2018 and 2019

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2018	8	3	4	8	0	2	0	0	1	2	2	1	31
2019	3	1	4	5	3	1	0	0	2	5	2	0	26

Figure 11. Example minor and major wind curtailment events



Overall, major events had a large impact on total curtailment. A total of 459 GWh was curtailed in major events in 2018, while 495 GWh was curtailed in major events in 2019 (see Table 5). The total curtailed energy from major events made up 54 percent and 42 percent of total curtailed wind energy in 2018 and 2019, respectively.

During major events, wind curtailment represented an average of 4 percent coal generation over the two years (see Table 2). To illustrate this relationship, Figure 12 shows a week in 2018 that contained a major curtailment event. In this figure, the white regions represent how much coal could have been curtailed instead of wind over the course of the week.

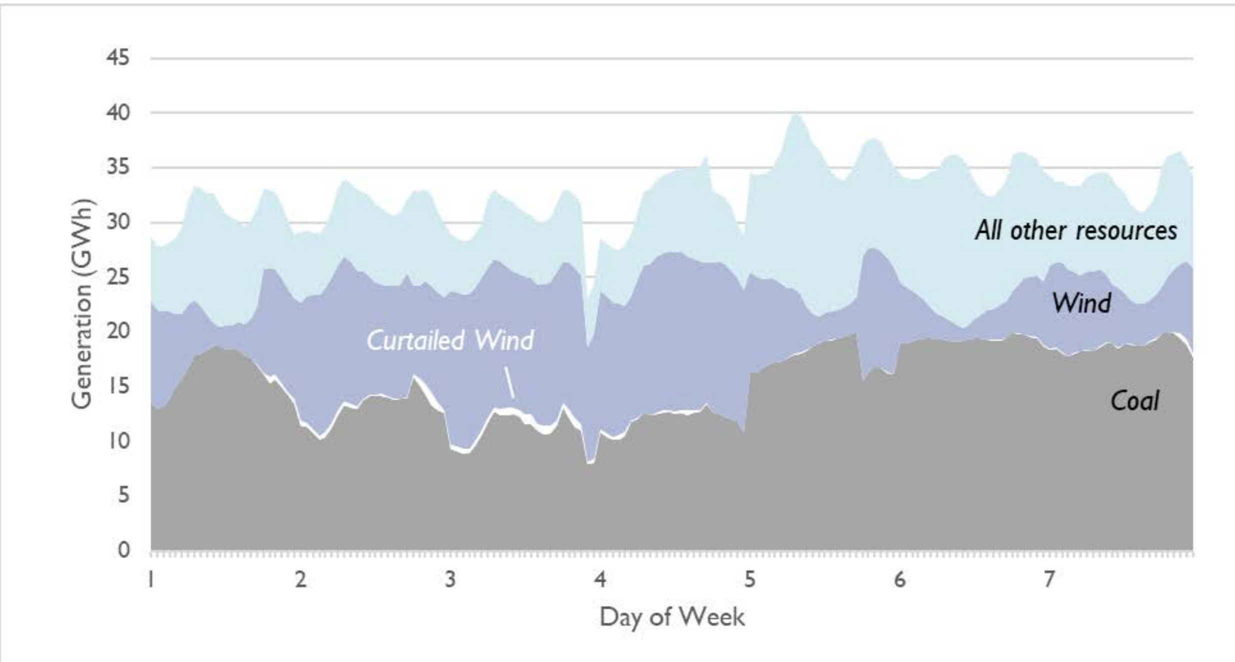
Comparatively, during minor events, wind curtailment comprised about 1 percent of SPP-wide coal generation, primarily because coal generation tends to be higher during minor events. Those major curtailment events might be easiest to avoid, minor events contain a higher share of coal generation.

Additional information about each of the major curtailment events is included in Appendix A.

Table 2. Wind curtailment by event type

Year	Curtailment Type	Total Wind Curtail. (TWh)	Total Wind Generation (TWh)	Total Coal Generation (TWh)	Wind Curtail. as a share of Wind	Wind Curtail. as a share of Coal
2018	Major	0.5	15	16	3%	3%
	Minor	0.4	50	101	1%	0%
	All	0.8	65	117	1%	1%
2019	Major	0.5	13	8	4%	6%
	Minor	0.7	61	86	1%	1%
	All	1.2	74	94	2%	1%
Total	Major	0.5	14	12	3%	4%
	Minor	0.5	55	93	1%	1%
	All	1.0	69	105	1%	1%

Figure 12. Illustration of curtailed wind relative to coal generation within major event in 2018



3.4. Impacts of Displaced Coal

Displacing coal generation with curtailed wind generation would provide substantial benefits to both SPP ratepayers (via avoided costs of operating coal plants) and society writ large (via avoided greenhouse gas emissions).[14] Were coal curtailed instead of wind during all wind curtailment events in 2018 and 2019, energy costs paid by ratepayers would have been reduced by $82 million and 2.4 million short tons of CO_2 emissions would have been avoided. Displacing coal generation during major events only would have saved ratepayers $41 million and avoided 1.2 million short tons of CO_2 (see Table 6).

To estimate these financial and climate impacts, we calculated the amount of coal energy (in MWh) that could be displaced by curtailed wind, assuming no operational or transmission constraints. We performed this calculation for all curtailment events as well as for only the major curtailment events. Our methodologies for calculating avoidable costs and CO_2 emissions are described below.

Avoidable Costs

Avoidable costs for coal plants in SPP were assumed to include fuel costs and variable operations and maintenance (VOM) costs, but not fixed operations and maintenance (FOM) costs as those are not avoidable with changes in a plant's generation. Synapse estimated SPP-specific fuel costs using data from EIA Form 923.[15] EIA costs were converted into a dollar per megawatt-hour (2020 $ per MWh) estimate for each plant by calculating the product of the heat rate, the average heat content, and the fuel cost in dollars per million British thermal units (2020 $ per MMBtu). VOM costs were estimated using data from Federal Energy Regulatory Commission's (FERC) Form 1 reporting. Synapse removed non-SPP and non-coal resources and estimated plant specific VOM costs by calculating the difference between total production costs and fuel costs. Synapse then produced an SPP-wide estimate of fuel and VOM costs by calculating a generation-weighted average of plant-specific fuel and VOM costs.[16] Synapse conducted this process separately for each of the study years, producing different estimates for 2018 and 2019.

For each hour in which curtailment occurred, we subtracted the hourly day-ahead market average LMP from the total operational costs described above, to yield the hourly savings from replacing coal with

[14] Avoiding coal generation also reduces many other air pollutants, but those were not included in this analysis.

[15] EIA Form 923. 2019. Available at: https://www.eia.gov/electricity/data/eia923/.

[16] Average fuel and VOM costs were estimated separately due to differences in data coverage between the FERC Form 1 and EIA 923 datasets. Although FERC Form 1 reports fuel costs, the EIA dataset had better coverage of SPP coal plants. As a result, we relied on EIA data for fuel costs while using FERC data for VOM.

wind.[17] Because we use the average market LMP instead of nodal LMPs, our analysis likely underestimates the likely savings from avoiding curtailment.[18]

Avoidable Carbon Dioxide Emissions

To calculate avoided CO_2 emissions, we used data published by the U.S. Energy Information Administration (EIA) describing the amount of CO_2 emissions produced by generators throughout the country.[19, 20] Synapse filtered the country-wide dataset to include only coal-fired power plants operating within SPP. Next, we calculated a generation-weighted average emissions rate by dividing total emissions from SPP coal plants by total generation. This process was conducted separately for each of the study years, producing different estimates for 2018 and 2019. Synapse calculated the potential emissions and avoided cost impacts of eliminating wind curtailment by multiplying the emissions rates described above by total wind curtailment for the year and for major curtailment events.

Synapse estimated that a total of 2.4 million short tons of CO_2 emissions in 2018 and 2019 could have been avoided by replacing coal generation with curtailed wind generation. Respectively, this is equivalent to 94 percent of the 2019 emissions at the Nearman Creek, a coal plant located in SPP.[21] Major events accounted for 1.1 million short tons of avoidable CO_2 emissions over the two years.

Table 3. Coal displacement impacts

Year	Curtailment Type	Avoided Cost (2020 $ millions)	Avoided Emissions (short tons CO_2)
2018	Major	$18.6	532,700
	Minor	$13.7	447,200
	All	$32.3	979,900
2019	Major	$22.5	586,100
	Minor	$26.4	820,600
	All	$48.9	1,406,700
2018-2019 Average	Major	$20.5	559,400
	Minor	$20.1	633,900
	All	$40.6	1,193,300

[17] SPP day-ahead LMPs were taken from*:* https://marketplace.spp.org/pages/da-lmp-by-bus. Accessed July 2021.

[18] We use market average day-ahead LMPs because the curtailment dataset does not indicate location on the SPP grid, so we are not able to utilize hub or nodal LMPs.

[19] U.S. Energy Information Administration. 2018. *Emissions 2018.* Available at: https://www.eia.gov/electricity/data/emissions/archive/xls/emissions2018.xlsx.

[20] U.S. Energy Information Administration. 2019. *Emissions 2019,* Available at: https://www.eia.gov/electricity/data/emissions/xls/emissions2019.xlsx.

[21] *Ibid.*

4. DISCUSSION AND CONCLUSIONS

In the years 2018 and 2019, curtailed wind represented a small fraction of total generation in SPP, and there were no hours in which wind generation exceeded total generation (load plus exports). In other words, a wind oversupply does not exist in SPP.

In SPP, wind generation is curtailed due to a combination of redispatch (market-driven) and manual (reliability-driven) reasons, although redispatch curtailments comprised about 90 percent of curtailed wind. Redispatch curtailments may be avoidable by resolving congestion issues and reducing the ability of resources to self-commit in the market. Though the relative contribution of congestion pricing and self-committing resources to redispatch curtailments was not evaluated in this analysis, we assume that both issues can be addressed or resolved in order to avoid some level of wind curtailment. Congestion issues can be resolved by transmission upgrades, strategically sited storage, or other non-wires alternatives. Reducing the ability of resources to self-commit in the SPP real-time market would create more efficient pricing signals and avoid unnecessary curtailment of non-emitting resources like wind.

Major curtailment events provide substantive opportunities for substituting curtailed wind generation for coal generation. If wind had not been curtailed during the 57 major events as defined in this report, ratepayers in SPP could have avoided $41 million in energy costs and 1.2 million short tons of CO_2 emissions by displacing coal generation. Were it possible to avoid all curtailment of wind by displacing coal, SPP ratepayers could have saved $41 million per year and the SPP marketplace could have avoided emitting 1.2 million tons of CO_2 per year.

Appendix A. MAJOR CURTAILMENT EVENT DETAILS

Table 4. Summary of major events in2018

Year	Start Date	Duration (Hours)	Total Curtailment (MWh)	Total Wind (MWh)	Total Coal (MWh)	Wind Curtail. / Wind	Wind Curtail. / Coal
2018	6-Jan	31.4	5	302	475	1.7%	1.1%
2018	8-Jan	35.8	11	336	521	3.2%	2.0%
2018	9-Jan	45.8	17	606	539	2.9%	3.2%
2018	13-Jan	64.9	12	552	1,114	2.2%	1.1%
2018	18-Jan	40.0	15	456	589	3.4%	2.6%
2018	19-Jan	82.6	8	942	990	0.9%	0.8%
2018	24-Jan	69.2	37	738	911	5.1%	4.1%
2018	29-Jan	127.1	62	1,187	1,824	5.2%	3.4%
2018	5-Feb	24.2	3	193	408	1.8%	0.8%
2018	8-Feb	25.9	6	251	344	2.6%	1.9%
2018	17-Feb	37.8	11	452	366	2.5%	3.1%
2018	2-Mar	53.6	16	687	430	2.3%	3.7%
2018	13-Mar	36.2	9	330	438	2.6%	1.9%
2018	15-Mar	70.8	8	703	726	1.1%	1.1%
2018	18-Mar	43.3	6	418	443	1.5%	1.5%
2018	2-Apr	43.6	18	442	460	4.0%	3.9%
2018	4-Apr	32.3	12	274	355	4.5%	3.5%
2018	5-Apr	70.9	10	639	760	1.5%	1.3%
2018	10-Apr	62.2	19	723	534	2.7%	3.6%
2018	16-Apr	32.4	5	252	350	2.0%	1.5%
2018	17-Apr	39.2	9	357	371	2.5%	2.4%
2018	19-Apr	27.8	5	281	241	1.7%	2.0%
2018	28-Apr	64.3	42	817	442	5.2%	9.6%
2018	3-Jun	24.8	4	162	344	2.5%	1.2%
2018	10-Jun	25.1	5	316	278	1.6%	1.8%
2018	19-Sep	30.7	3	369	396	0.9%	0.8%
2018	2-Oct	29.4	6	359	281	1.6%	2.0%
2018	29-Oct	29.0	24	265	268	9.0%	8.9%
2018	22-Nov	29.8	35	350	284	10.0%	12.3%
2018	30-Nov	26.7	14	313	274	4.5%	5.1%
2018	19-Dec	37.1	19	467	448	4.1%	4.3%

Table 5. Summary of major events in 2019

Year	Start Date	Duration (Hours)	Total Curtailment (MWh)	Total Wind (MWh)	Total Coal (MWh)	Wind Curtail. / Wind	Wind Curtail. / Coal
2019	6-Jan	28.1	20	394	232	5.1%	8.7%
2019	17-Jan	40.2	17	453	520	3.7%	3.3%
2019	20-Jan	43.0	26	566	523	4.5%	4.9%
2019	24-Feb	38.2	13	421	477	3.2%	2.8%
2019	5-Mar	36.0	10	362	512	2.8%	2.0%
2019	13-Mar	37.9	15	500	319	2.9%	4.6%
2019	26-Mar	38.1	41	492	240	8.4%	17.2%
2019	29-Mar	24.9	19	347	140	5.5%	13.7%
2019	10-Apr	31.2	10	445	202	2.2%	4.8%
2019	17-Apr	34.4	10	437	206	2.4%	5.0%
2019	20-Apr	45.9	27	559	240	4.8%	11.3%
2019	26-Apr	31.0	15	349	183	4.2%	8.0%
2019	28-Apr	30.9	10	363	155	2.8%	6.7%
2019	15-May	69.1	44	887	510	4.9%	8.6%
2019	20-May	40.3	22	435	280	5.1%	7.9%
2019	26-May	67.3	20	768	496	2.7%	4.1%
2019	13-Jun	24.2	11	261	189	4.3%	5.9%
2019	8-Sep	38.1	10	479	400	2.0%	2.4%
2019	29-Sep	61.9	19	907	489	2.1%	3.9%
2019	8-Oct	44.0	24	634	222	3.8%	10.8%
2019	10-Oct	56.8	28	700	319	4.0%	8.8%
2019	14-Oct	40.6	9	447	246	2.1%	3.7%
2019	17-Oct	35.3	14	526	193	2.6%	7.2%
2019	26-Oct	49.3	11	493	352	2.3%	3.2%
2019	15-Nov	42.8	27	517	321	5.3%	8.6%
2019	19-Nov	47.4	22	659	319	3.3%	6.9%