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April 30, 2021

The Honorable Frank Pallone, Jr.
Chairman, Committee on Energy & Commerce
United States House of Representatives
Washington, DC 20515

Re: Response to Post-Hearing Questions

Dear Chairman Pallone:

As requested in your letter of April 16, 2021, I am providing the attached responses to the questions of Congresswoman DeGette, Congresswoman Kuster, and Congressman Burgess.

Please do not hesitate to let me know if you or other members of your committee need any additional information.

Respectfully,

/s/ Bill Magness

Bill Magness
President and Chief Executive Officer
bill.magness@ercot.com
512-248-6538

cc: The Honorable Diana DeGette
The Honorable Ann M. Kuster
The Honorable Michael C. Burgess, M.D.
Mr. Austin Flack

**Attachment—Additional Questions for the Record**

**Subcommittee on Oversight and Investigations**
**Hearing on**
**"Power Struggle: Examining the 2021 Texas Grid Failure"**
**March 24, 2021**

Mr. Bill Magness, President and Chief Executive Officer, Electric Reliability Council of Texas

**The Honorable Diana DeGette (D-CO)**

1. The Chairman of the Railroad Commission of Texas has stated that the Electric Reliability Council of Texas (ERCOT) "didn't understand that they needed a continuous gas flow to be able to put gas into power plants."

    a. Do you agree with this assessment? If not, please explain why not.

No. ERCOT has always understood that natural gas supply is essential for gas power plant production. In fact, in 2019, ERCOT worked with its stakeholders to create a Gas-Electric Working Group in an effort to facilitate further communications between natural gas pipeline operators and members of the electric power industry in Texas. ERCOT does not control or regulate the gas supply, nor does it have access to information about real-time gas supply. Also, while ERCOT is responsible for directing transmission utilities to curtail an aggregate quantity of firm load when necessary to ensure grid reliability, ERCOT does not decide which customers are curtailed. That decision is made by exclusively by the transmission utilities. To the extent certain gas infrastructure serves the electric power industry, it should be registered as critical load pursuant to rules of the Public Utility Commission of Texas (PUC). Owners of gas infrastructure bear the sole responsibility for seeking critical load designation. ERCOT does not regulate critical load designation in any respect.

    b. Following the extreme winter weather event of 2021, what steps, if any, has ERCOT taken to improve communication and coordination with the natural gas industry, particularly during extreme weather events?

Although critical load designation does not fall under ERCOT's regulatory purview, ERCOT did work with its transmission utilities and members of the Texas Energy Reliability Council (TERC) (including the PUC and the Railroad Commission of Texas) in early March to develop a universal form for critical load designation. This form is now posted on ERCOT's website.[1] ERCOT, along with other industry participants, awaits direction from the Texas Legislature about other possible gas and electric power industry reforms. Additionally, ERCOT's

[1] *See* http://www.ercot.com/content/wcm/key_documents_lists/174326/Final_-_pdf_-_App_for_gas_pipeline_load_v020320.pdf.

direct regulator, the PUC, has initiated a project to consider further electric and gas coordination.[2] Once ERCOT has had a chance to assess reforms adopted by these and other authorities, ERCOT will have a better understanding of what additional improvements in coordination between the gas and electric industries may be needed.

2. What actions do you believe ERCOT should take to address climate change-related risks to ERCOT's grid?

With the February winter event establishing a new cold-weather benchmark for the ERCOT region, ERCOT will need to evaluate risks of more severe weather as part of its system planning efforts. ERCOT intends to discuss with its stakeholders what assumptions it should make in evaluating these risks. For example, whether the February weather event should be regarded as the most severe cold-weather scenario that should be evaluated, or whether even more severe conditions should be studied, will need to be discussed. Other measures, such as generator weatherization requirements, are currently being considered by the Texas Legislature. Depending on the outcome of these efforts, ERCOT may have other roles in furthering grid resilience during extreme weather conditions.

**The Honorable Ann M. Kuster (D-NH)**

1. On April 6, 2021, ERCOT released a preliminary report entitled, "Preliminary Report on Causes of Generator Outages and Derates for Operating Days February 14-19, 2021 Extreme Cold Weather Event." This preliminary report appears to summarize the data that I asked you to provide this Subcommittee as part of its ongoing investigation into the February power outages in Texas.

    a. Please summarize what the preliminary data reveal about the extent to which cold weather-related conditions caused generator outages or derates.

ERCOT's April 6, 2021 preliminary report was intended to identify the general causes of generator outages during the February event based on generator owner responses to ERCOT requests for information. Several outage categories are directly linked to cold weather conditions, including "weather related," "fuel limitations," and "frequency related." These categories accounted for approximately 80% of the total of all outages other than existing outages. Outages in other categories may have also been indirectly linked to cold weather conditions.

    b. Will you promptly provide the Subcommittee with a copy of the final event analysis report, as well as any interim supplements to the preliminary report, once complete?

Yes, ERCOT will provide the Subcommittee a copy of all updates to this report. I am including with this report a copy of ERCOT's April 27 update to the preliminary report, which provides additional information about generator outages during the February weather event, including an estimate of the amount of lost output by each generator fuel type.

[2] *See* PUC Project 51839, Electric-Gas Coordination.

**The Honorable Michael C. Burgess, M.D. (R-TX)**

1. ERCOT has stated the Texas grid was 4 minutes and 37 seconds from collapsing. Can you explain for the record how this situation occurred?

The ERCOT system could have experienced a blackout in the early morning hours of February 15, 2021 if substantial quantities of customer demand had not been curtailed to match the rapidly diminishing supply of generation. This controlled curtailment of load was necessary because the generation supply had been severely impacted by the cold weather. While some generator outages and derates had been observed in the days leading up to the event, many outages occurred over a very short period of time in the early morning hours of February 15, 2021 as the Arctic storm system arrived in Texas, bringing record and near-record low temperatures along with snow, ice, and freezing rain. These conditions had a substantial impact on the ERCOT generation fleet. If the imbalance between supply and demand on the system had been allowed to persist, additional generators would have tripped offline to avoid damage due to the low frequency on the system that results from such an imbalance, resulting in an even more severe imbalance. While there are automated systems in place to protect against such a cascading failure of generation, it is not clear that the activation of this system under such stressed system conditions would have protected the system from further collapse. The 4 minutes and 37 seconds refers to the amount of time that ERCOT grid operators had to correct a frequency deviation caused by the generation failures that, if left unchecked, could have resulted in a grid-wide blackout.

2. How would such a collapse impact the residents and businesses of ERCOT?

If a grid-wide blackout had occurred, the ERCOT system would not have been able to provide electric power to any customer for an extended period of time—likely a period of several days to several weeks. During that time, no electricity would have been available to operate lights, furnaces, kitchen appliances, cell phones, computers, or any other electric-powered appliances or devices. Only customers with backup generators would have had power, and only so long as fuel was available to them. With record-low temperatures, a blackout early on February 15, 2021 would have certainly had far more catastrophic consequences for Texas consumers.

3. Critics of ERCOT have stated that power generators failed to weatherize at all following the blackouts in 2011. Is it true that no such weatherization occurred in Texas following the 2011 blackouts?

No, that is not true. Since the 2011 winter weather event, ERCOT and Texas Reliability Entity, Inc. (Texas RE)—the regional entity designated by the North American Electric Reliability Corporation (NERC) for overseeing enforcement of NERC Reliability Standards in the ERCOT region—have conducted generator site visits during each winter season and have made a concerted effort to share winter weatherization best practices with ERCOT generators during these visits and in annual weatherization workshops. As a result of these efforts, ERCOT and Texas RE had observed significant improvements in generator weatherization over the years following the 2011 winter weather event. As noted in ERCOT's March 18, 2021 response to the Committee's questions, the benefit of these improvements was seen during the 2018 extreme winter weather event, which was comparable in temperature and duration to the 2011 event, and which caused

substantial outages in other regions. While ERCOT lost 29,729 MW of generation in the 2011 event, ERCOT lost only 1,523 MW in the 2018 event. Although the February 2021 winter weather event demonstrated that generator weatherization efforts to date were generally not sufficient to withstand a much more severe winter storm event, that outcome should not be taken to suggest that generator weatherization never occurred, or that weatherization efforts provided no value during the event.

4. Was February's extreme weather comparable to the weather event in 2011?

No, the February 2021 event was much more severe than the 2011 event. As ERCOT noted in its March 18, 2021 response to the Committee's questions, low temperatures in the major load centers of Dallas, Houston, San Antonio, and Austin were 13 degrees, 21 degrees, 19 degrees, and 18 degrees, respectively, while low temperatures for those same cities during the 2021 event were -2 degrees, 13 degrees, 12 degrees, and 6 degrees, respectively. Also, the 2021 event involved snowfall of several inches or more across most of the state in 2021, which did not occur in 2011. The duration of the period below freezing during the 2021 event was also much longer than it was during the 2011 event.

5. What role does ERCOT play to ensure critical infrastructure does not lose power if load shedding is necessary to maintain grid reliability?

ERCOT does not regulate which loads are curtailed as a result of an ERCOT load-shed directive. Determining which circuits to disconnect is a decision for each transmission utility. Whether a given circuit may be disconnected depends in part on whether any critical loads are served by the circuit. Critical load designation is governed by PUC rules—primarily, PUC Rule 25.497 (16 Tex. Admin. Code § 25.497)—not by ERCOT rules. As noted above, ERCOT has recently worked with transmission utilities and state government agencies to develop a universal critical load designation form. This form is now posted on ERCOT's website and may be readily used by owners of critical gas infrastructure and other loads.

6. Independent market monitors have indicated that the Public Utility Commission of Texas (PUC) overcharged Texans by billions of dollars in high energy costs. Can you explain the PUC's decision to set the price of electricity to the legal maximum of $9,000/MWh?

The PUC's decision to administratively set prices at the maximum level of $9,000/MWh was based on its conclusion that energy prices in ERCOT should have been at that maximum level, and not at significantly lower levels, because firm load was being curtailed to preserve the system frequency under conditions of generation shortage.[3] The PUC's February 16 order reasoned that "[e]nergy prices should reflect scarcity of the supply," and "[i]f customer load is being shed, scarcity is at its maximum, and the market price for the energy needed to serve that load should also be at its highest."[4]

[3] *See* Public Utility Commission of Texas, Second Order Directing ERCOT to Take Action and Granting Exception to Commission Rules, Docket 51617 (Feb. 16, 2021), available at https://www.puc.texas.gov/51617WinterERCOTOrder.pdf.
[4] *Id.*

7. What was ERCOT's role in that decision?

ERCOT consulted with the Commission prior to its decision, and ERCOT agreed that prices should be set at the cap to reflect the actual scarcity on the system.

8. Did the PUC re-examine this decision at regular intervals as power generators come back online and market conditions returned to normal?

ERCOT kept the PUC Commissioners apprised of the availability of the generation supply throughout the week of February 14-19, 2021. As more generation began to come back online on February 17, ERCOT worked with the PUC Chairman to develop steps to ensure that once customer outages ended, they would not return as the winter storm concluded. As a result of those efforts, ERCOT notified market participants that it would leave the Level 3 Energy Emergency Alert (EEA) and the associated scarcity pricing in place even after firm load curtailment was recalled, given ERCOT's concern that the supply of generation would soon again be insufficient to serve forecasted load and also given the need to provide maximum incentive for generators to be available and for large industrial loads to remain offline. The PUC Chairman indicated that she believed this decision was consistent with the PUC's February 15 and 16 orders. At its March 5, 2021 meeting, the PUC discussed ERCOT's decision to continue pricing energy after firm load curtailment was recalled late on February 17, 2021.[5] The PUC declined in that meeting to order ERCOT to change prices.

9. Did the volatility of the natural gas market impact electric prices within ERCOT during the week of February 15, 2021?

Yes, natural gas prices did impact electricity prices during the week of February 15, 2021. Under normal conditions, wholesale electricity prices in ERCOT are determined by the cost of dispatching the last unit needed to most economically serve the system load. Very often, the marginal unit is powered by natural gas, which means that the price of gas typically plays a direct role in the wholesale price of electricity. There were cases of this on February 15, when wholesale electricity prices were high but not necessarily at $9,000/MWh. While a certain amount of fuel for a power plant can be contractually arranged for in advance, some amount of fuel is typically purchased in the shorter-term.

10. What is ERCOT's "uplift charge" mechanism and what is its purpose?

ERCOT reads this question to refer to the "default uplift" mechanism under the ERCOT Protocols. When a market participant fails to pay ERCOT for energy or other services administered by ERCOT, that participant is said to be in "default" with respect to its payment obligations. Because ERCOT must remain revenue-neutral—i.e., it cannot pay out more than it collects—ERCOT rules require ERCOT to allocate any such payment deficiency to each non-defaulting market participant—i.e., to "uplift" that amount—based on that participant's share of market activity.[6] The amount recouped through the default uplift mechanism is paid to generation

[5] The PUC's discussion is available at http://texasadmin.com/tx/puct/open_meeting/20210305/. The relevant discussion begins at the 20:00 mark.
[6] ERCOT Protocols §§ 9.19(1)(e); 9.19.1.

owners and others that were not fully compensated in accordance with ERCOT rules.[7] The default uplift charge serves the critical function of ensuring these entities are paid for the services they provide to the grid.

11. Many electric providers in Texas, both privately and municipally owned, have been severely hurt by unexpectedly high uplift charges. Is ERCOT working with electric providers to ensure they can continue to operate while these charges are sorted out?

ERCOT is doing what it can, within its rules, to ensure that market participants can continue to perform their functions while the financial impacts of the February winter weather event continue to be evaluated and addressed. ERCOT is aware that the Texas Legislature is considering legislation to allow municipally owned utilities and other market participants to securitize debts related to the February winter weather event. This legislation could provide a mechanism to lessen the immediate financial burden for certain market participants that were negatively impacted during the event. ERCOT does not plan to begin invoicing default uplift charges until after completion of the Texas legislative session.

[7] *Id.* § 9.19.2.2.

# Update to April 6, 2021 Preliminary Report on Causes of Generator Outages and Derates During the February 2021 Extreme Cold Weather Event

ERCOT Public
April 27, 2021

# Overview

**This report provides aggregated information about the causes of generator outages and derates during the February winter storm event based on information provided in response to ERCOT Requests for Information.**

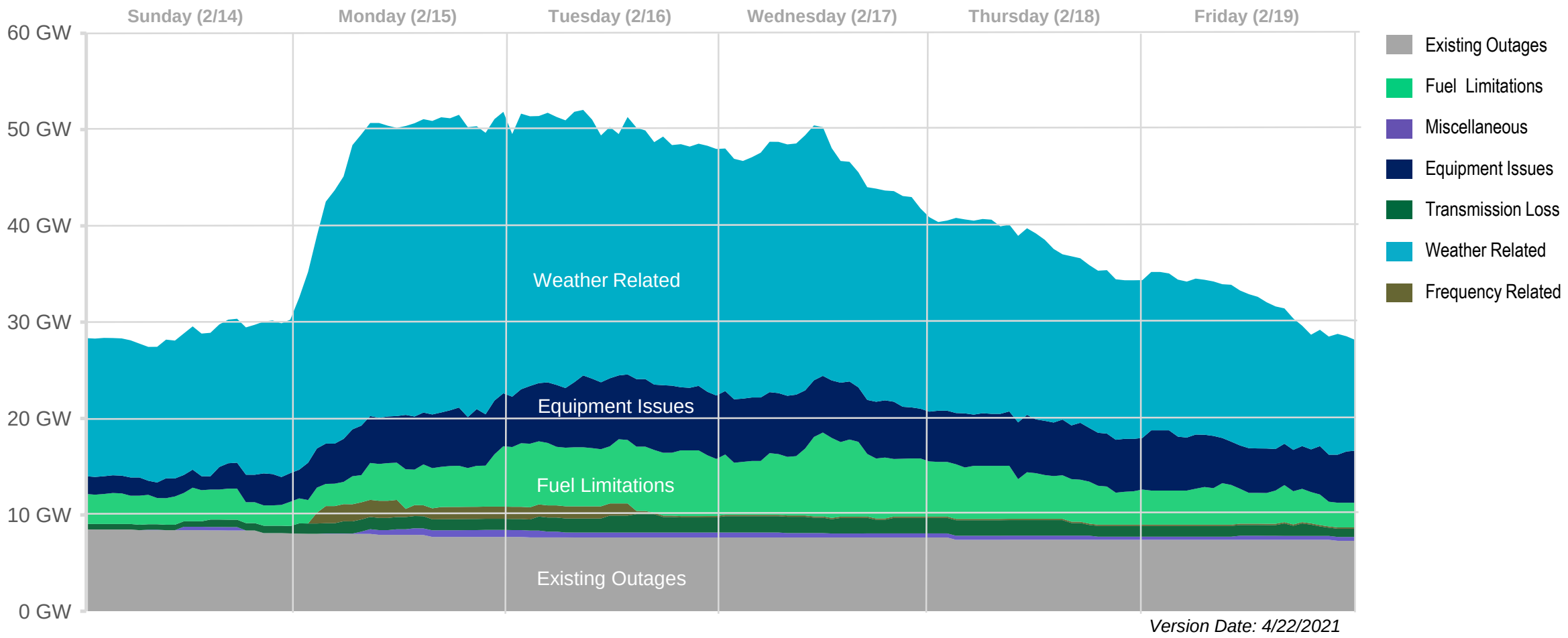
- On February 24, 2021, ERCOT sent Requests for Information (RFIs) to all Qualified Scheduling Entities (QSEs) that represent Generation Resources or Energy Storage Resources.
- The RFIs included questions about the causes of any generator outages and derates that occurred during the period of February 14-19, 2021, which were the days when the Energy Emergency Alert (EEA) was in effect.
- Using the RFI response information, ERCOT assigned each outage and derate to one of seven cause categories (*see slides 9-10 for a description of these categories*).
- The data in this report includes information about outages and derates entered by each QSE or Resource Entity into ERCOT's Outage Scheduler for the period February 14-19, 2021 as of 4 p.m. on March 4, 2021 (*Note: previously posted outage and derate data was based on entries as of February 20, 2021*).
- Following publication of the April 6, 2021 preliminary report, ERCOT requested that stakeholders provide written questions about the initial report. In response to the questions and comments received, ERCOT provides this updated version of the preliminary report with additional categorizations of the generation outage data. The supplemental analysis begins on slide 11.

# Important Notes

- The information in this document is preliminary and subject to change.
- Slides 4, 6, and 8 have been revised in this updated report to accurately reflect the seasonal capacities of each generator for the time of the event and to correct other minor categorization issues.
- For the purposes of this document, an “outage” is the complete unavailability of a generator’s capacity, and a “derate” is the partial unavailability of that capacity.
- All generator outage and derate values reflected in the graphs are based on generator nameplate capacity—i.e., the maximum possible MW output specified by the generator manufacturer. Because wind and solar output is typically much lower than the specified nameplate capacity, the outage and derate MW values used for those units to develop this report are generally much higher than the actual amount of power that would have been available in the absence of the outage or derate.
- ERCOT cannot disclose the unit-specific outage causes because they are Protected Information.

# Net Generator Outages and Derates by Cause (MW)

## February 14 – 19, 2021




Net generator outages at the beginning of each hour on February 14-19, 2021, by cause category.

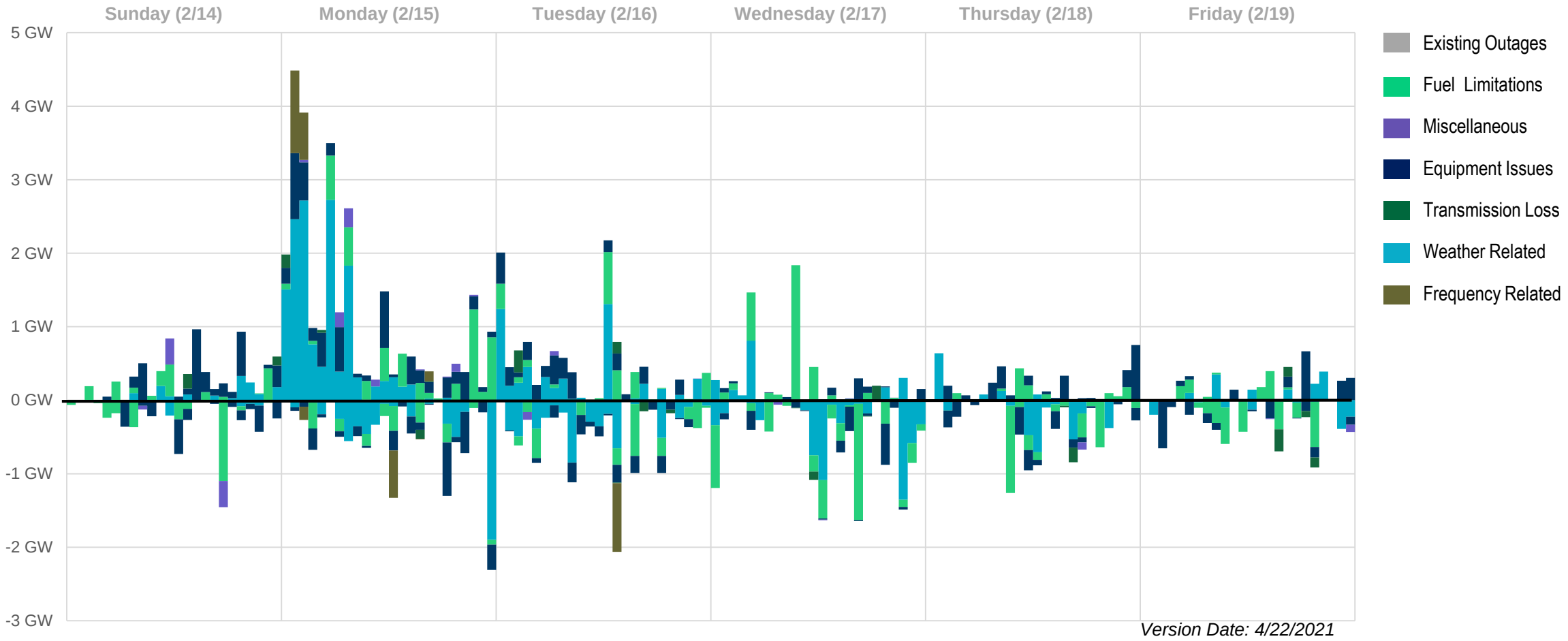
# Continued Volatility of Generation Supply During the Event

- The amount of outaged capacity shown on the previous slide (slide 4) increased sharply as the storm arrived on Sunday and stayed fairly constant from late morning on Monday to mid-day on Wednesday.

- However, as shown on the next slide (slide 6), the net level of outages masks the volatility in generation availability that continued throughout the week, with generators continuing to go out of service and come into service throughout the duration of the event.

- This volatility made it difficult to accurately forecast an end to emergency conditions.

# Incremental Generator Outage and Derates by Hour
starting 00:00 on 2.14.21




Outages and derates continued through the week at a high rate.

# Explanation: Incremental Generator Outage and Derates by Hour

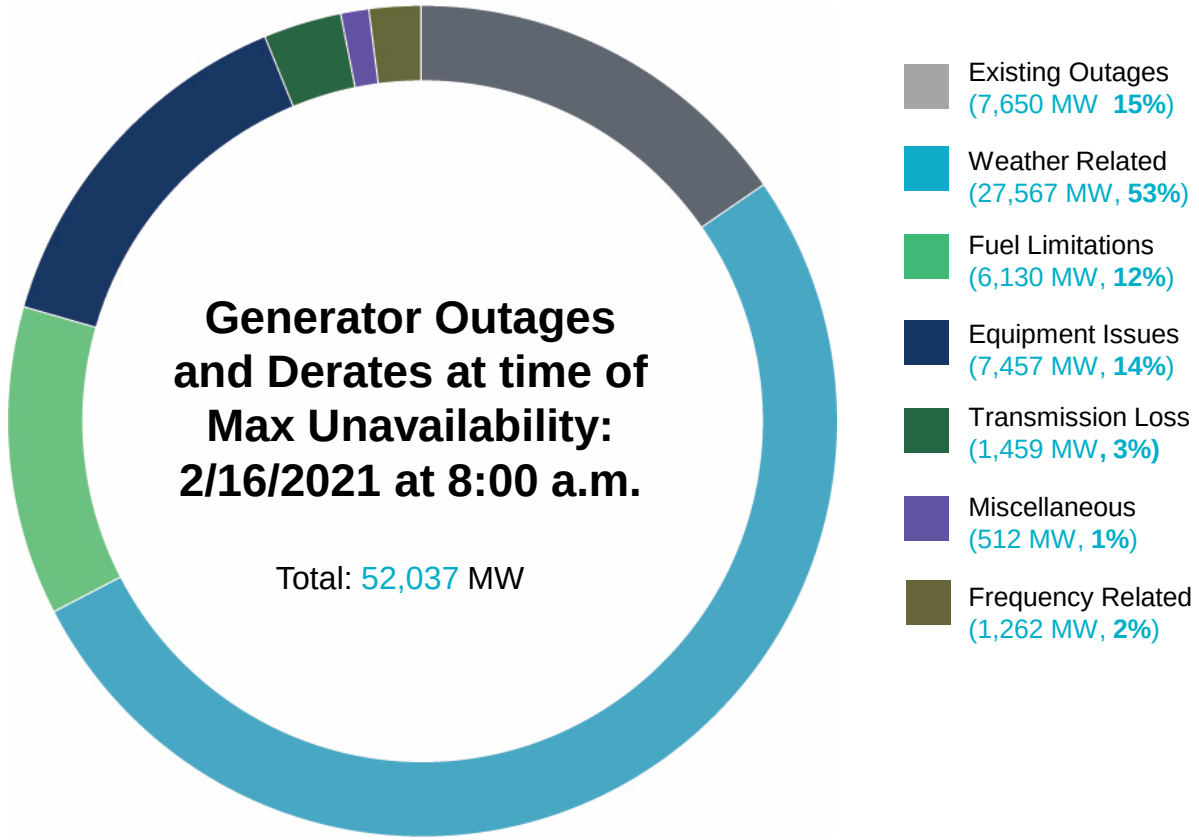
- The graph on the previous slide shows the generator outages and derates that started or ended in each hour on February 14-19, 2021, by cause category. The quantity of outages starting during a given hour are shown as positive values, and the quantity of outages ending during a given hour are shown as negative values.

- For example, if a 100 MW generator started an outage at 2 p.m. on February 14 due to a fuel limitation, and that outage ended at 5 p.m. on February 17, it would show as a positive 100 MW in the fuel limitation category for 2 p.m. on February 14 and a negative 100 MW in the fuel limitation category at 5 p.m. on February 17.

- This graph does not include the start of any outage or derate that occurred before February 14, but it does include the incremental reduction in outaged MW for any of those outages or derates that ended during the February 14-19 window.

# Generator Outage and Derates: Maximum Unavailability

- The highest amount of unavailable capacity during the period of February 14-19, 2021 occurred on February 16 at ~8:00 AM and was 52,037 MW.
- This chart shows the MW of the generator outages or derates that were occurring at that point in time by cause category.
- Note that the total outaged and derated capacity at this time is different than what was previously reported (52,277 MW) due to additional information received in response to the RFIs.



# Outage Cause Categories

**Existing Outages**:

Generator outages or derates that started before the issuance of the Operating Condition Notice on February 8, 2021; includes ongoing planned and forced outages as well as seasonally mothballed units. Some existing outages ended before or during the event, allowing the unit to return to service.

**Fuel Limitations**:

Generator outages or derates due to lack of fuel, contaminated fuel, fuel supply instability, low gas pressure, or less efficient alternative fuel supply.

**Weather Related**:

Generator outages or derates explicitly attributed to cold weather conditions in the RFI responses. This includes but is not limited to frozen equipment—including frozen sensing lines, frozen water lines, and frozen valves—ice accumulation on wind turbine blades, ice/snow cover on solar panels, exceedances of low temperature limits for wind turbines, and flooded equipment due to ice/snow melt.

# Outage Cause Categories *(continued)*

**Equipment Issues**:
Generator outages or derates due to facility equipment failures or malfunctions not explicitly attributed to cold weather in the RFI response. This includes trips and derates related to control system failures, excessive turbine vibrations, or other equipment problems.

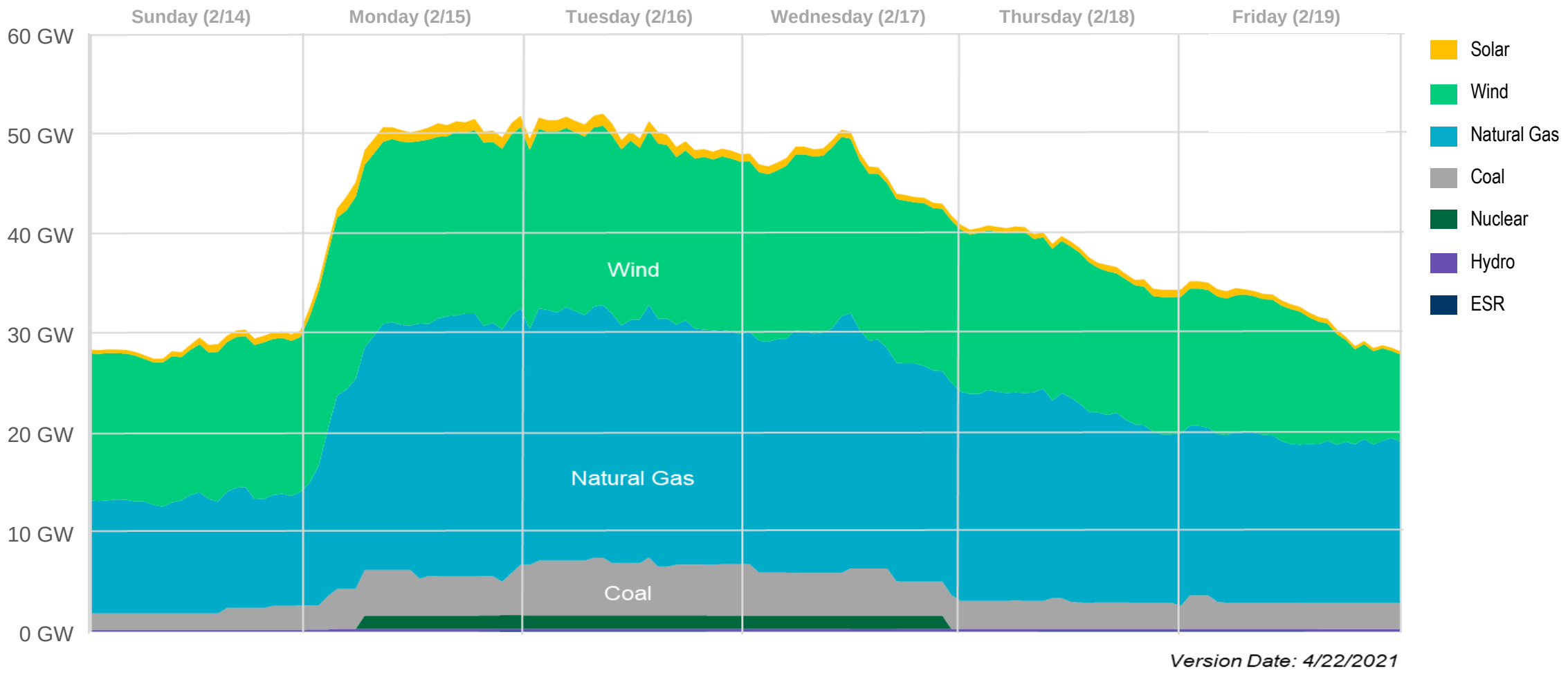
**Transmission Loss**:
Generator outage or derates due to forced outages on directly connected transmission facilities.

**Frequency Related**:
Generator outage or derates attributed to frequency deviations from 60Hz; includes automatic tripping due to under-frequency protection relays and any automatic or manual tripping attributed to plant control system issues related to frequency deviation.

**Miscellaneous**:
Other generator outages or derates not linked to one of the above causes, including outages for which a cause is yet unknown.

# Supplemental Analysis

# Net Generator Outages and Derates by Fuel Type (MW)




Outage and derate MW for Wind in this graph are based on capacity.

# Actual Wind and Solar Production Lost Due to Outages and Derates

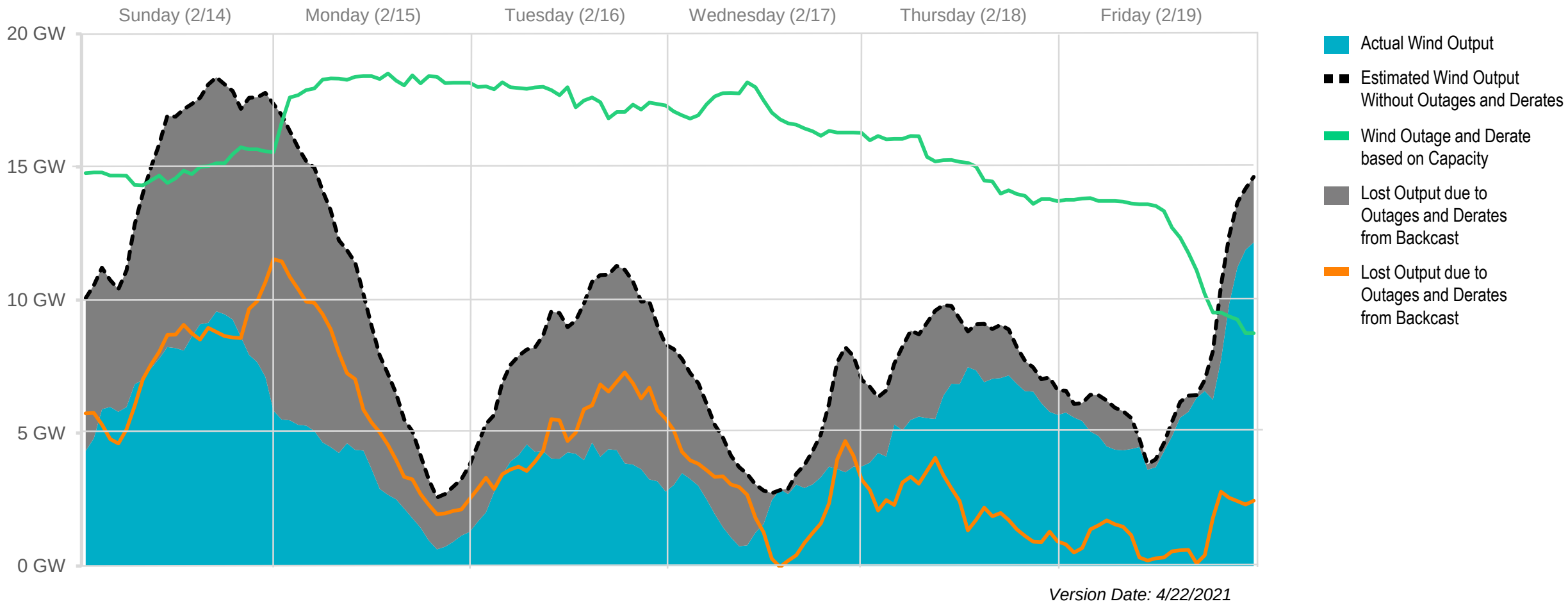
- The graphs in the April 6, 2021 version of this report (slides 4, 6, and 8) are based on the amount of capacity that was lost due to outages and derates, without regard to how much each generator would have otherwise produced during the period of the outage or derate.

- For wind and solar generators, using capacity values may not provide a complete picture of the actual energy production that was unavailable due to the outages; for example the outage of a solar generating unit at night would have no effect on the amount of generation that is available to serve consumers' demand.

- The graphs on the following two slides (slides 14 and 15) provide an estimate of the energy that would have been produced by wind and solar generation "but for" the reported outages and derates.
  - *For the wind generation estimate, ERCOT's wind forecast vendors produced a backcast of the systemwide MW that would have been produced by wind generators without outages or derates. The estimated lost output due to outages and derates is the difference between that systemwide backcasted value and the actual systemwide wind output.*
  - *For the solar generation estimate, ERCOT scaled the actual solar energy production up by the portion that reported an outage or derate of the total solar capacity.*

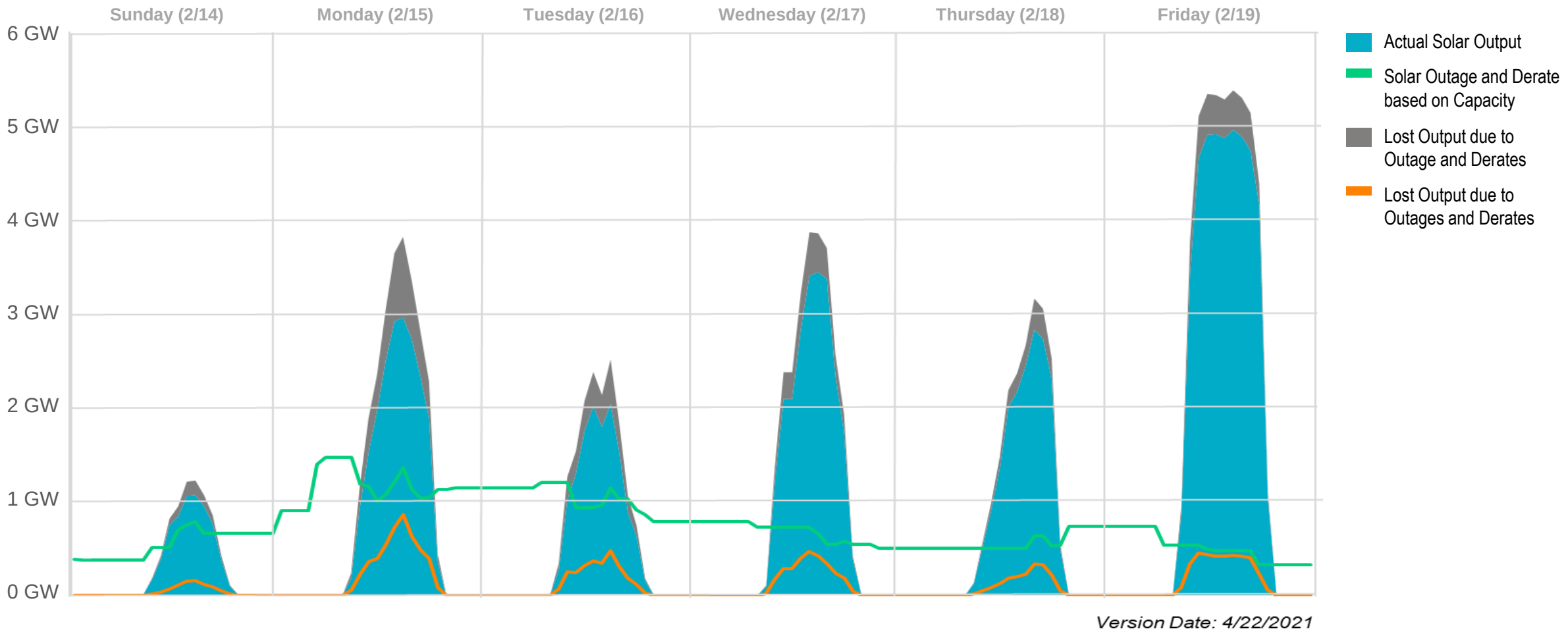
- These estimates were then used to reproduce the Net Generator Outages and Derates by Fuel Type graph on slide 16 based on the actual wind and solar production lost due to the outages or derates of solar and wind generation units.

# Estimated Impacts of Outages and Derates on Wind Output



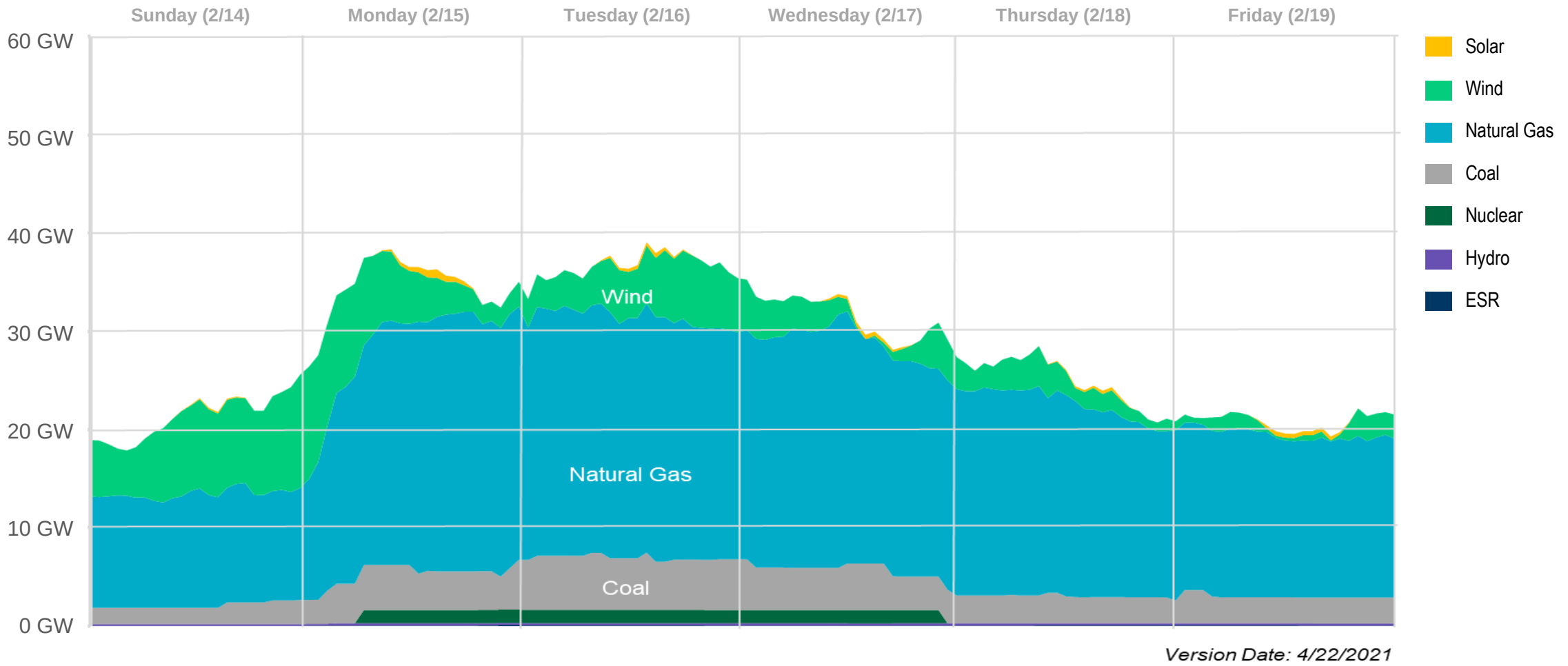

Magnitude of orange line and gray area are both equal to the estimated impact of wind outages and derates.

# Estimated Impacts of Outages and Derates on Solar Output




Magnitude of orange line and gray area are both equal to the estimated impact of wind outages and derates.

# Net Generator Outages and Derates by Fuel Type (MW)



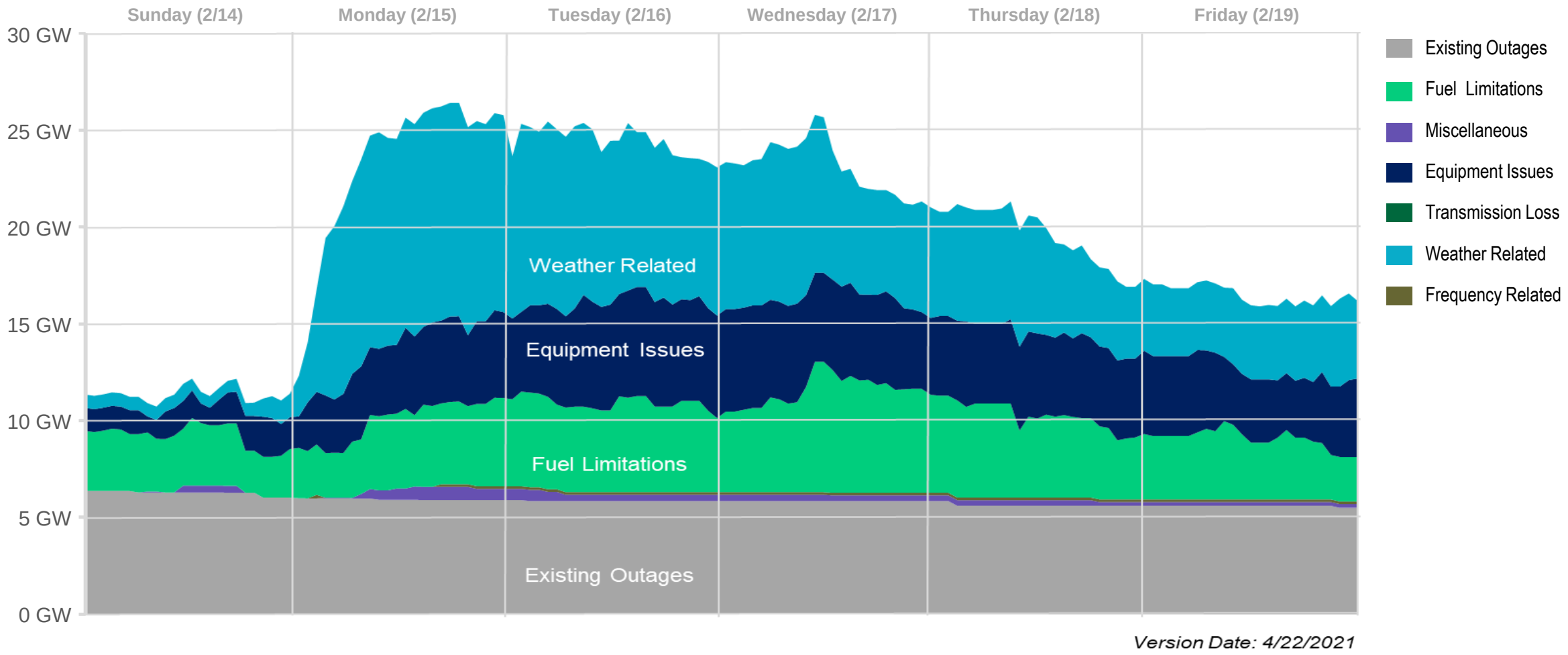

Wind and solar MW values based on estimated lost output due to outages and derates from slides 15 and 16.

# Outage and Derate Causes by Fuel Type

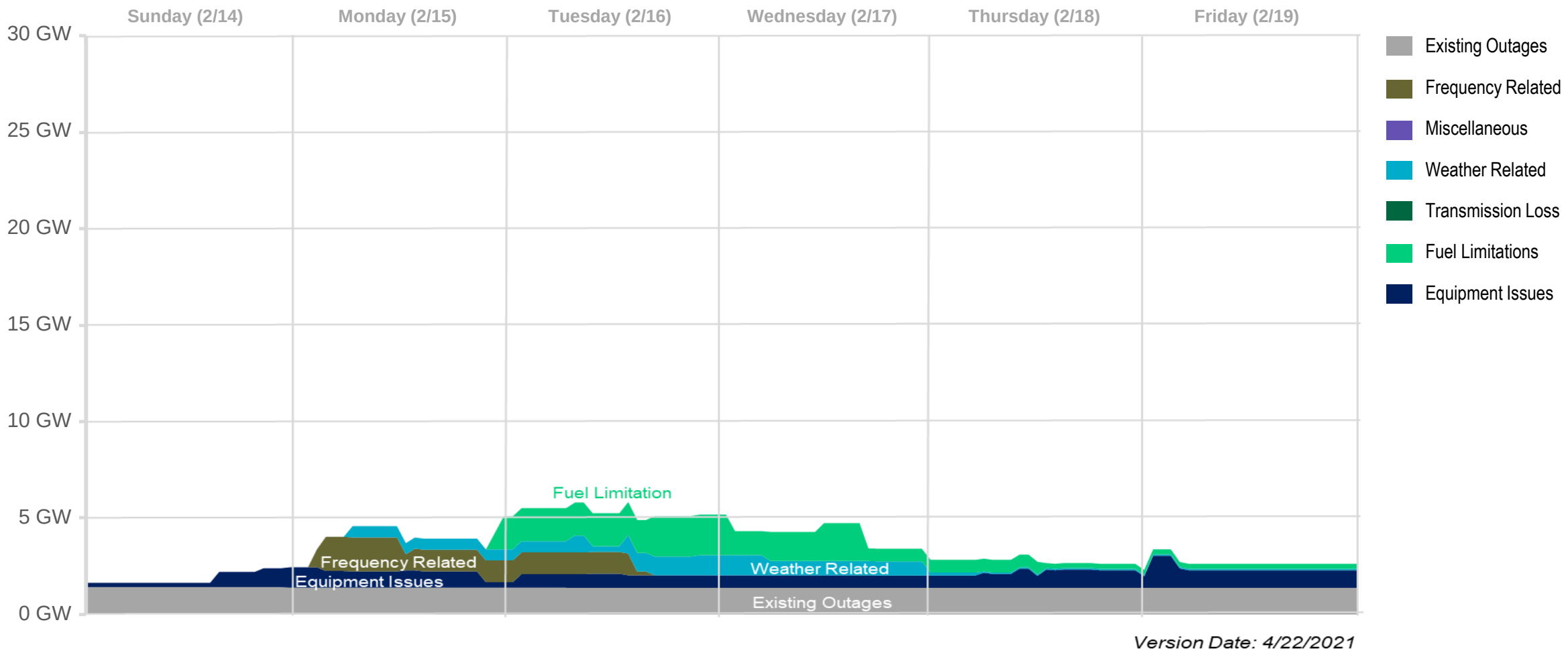
**The graphs on the following slides show the cause categories of the net outages or derates for each fuel type.**

- Graphs are included for gas, coal, and wind generator outages and derates.
- For wind generators, the outages and derate values on slide 20 are based on capacity, and the values on slide 21 are based on estimated lost wind output. On slide 21, the allocation of the lost wind output to each cause code is based on the proportion of total outaged wind capacity assigned to each cause for each hour; this is an approximation, as the backcasted lost output is not available on a unit-by-unit basis.
- Graphs are not included for nuclear, hydro, solar and energy storage because the number of outages is small and it would be possible to identify individual generating unit outage causes.

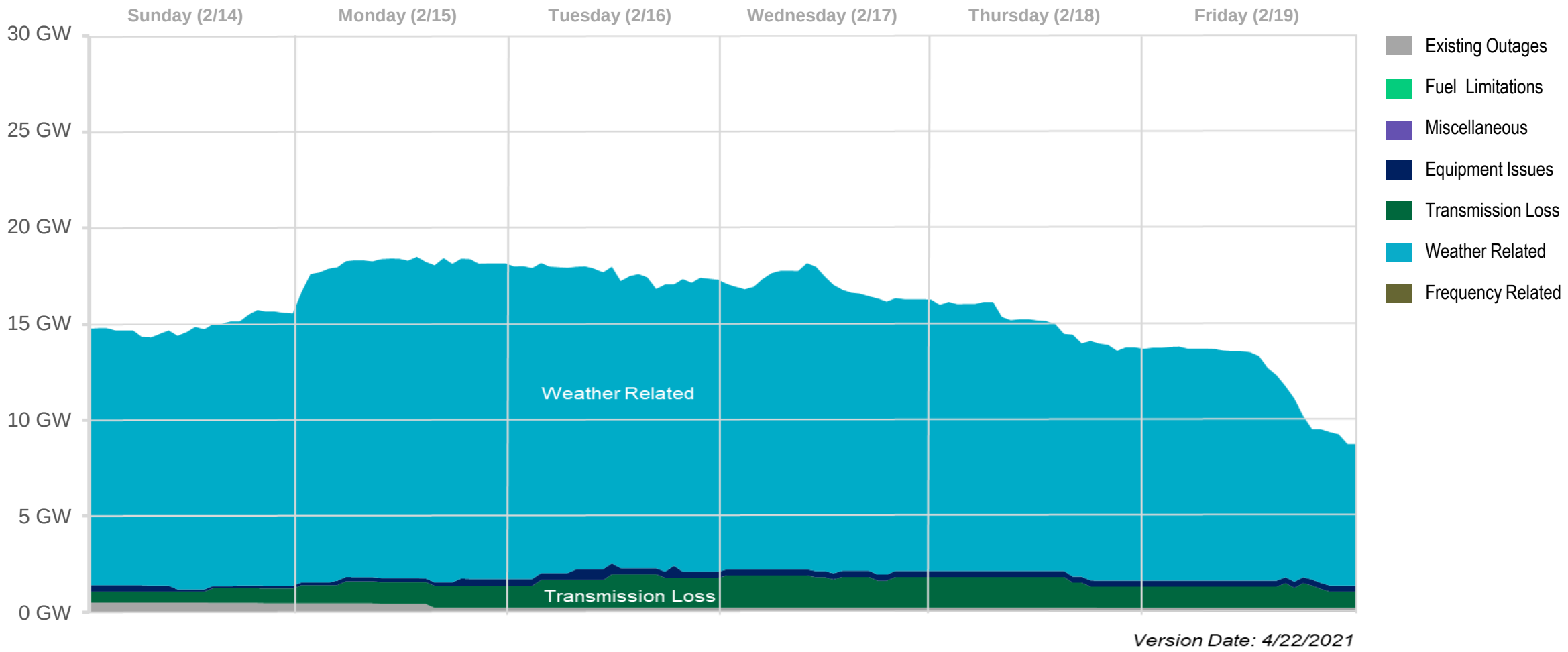
# Net Generator Outages or Derates for Natural Gas Generators by Cause



# Net Generator Outages or Derates for Coal Generators by Cause

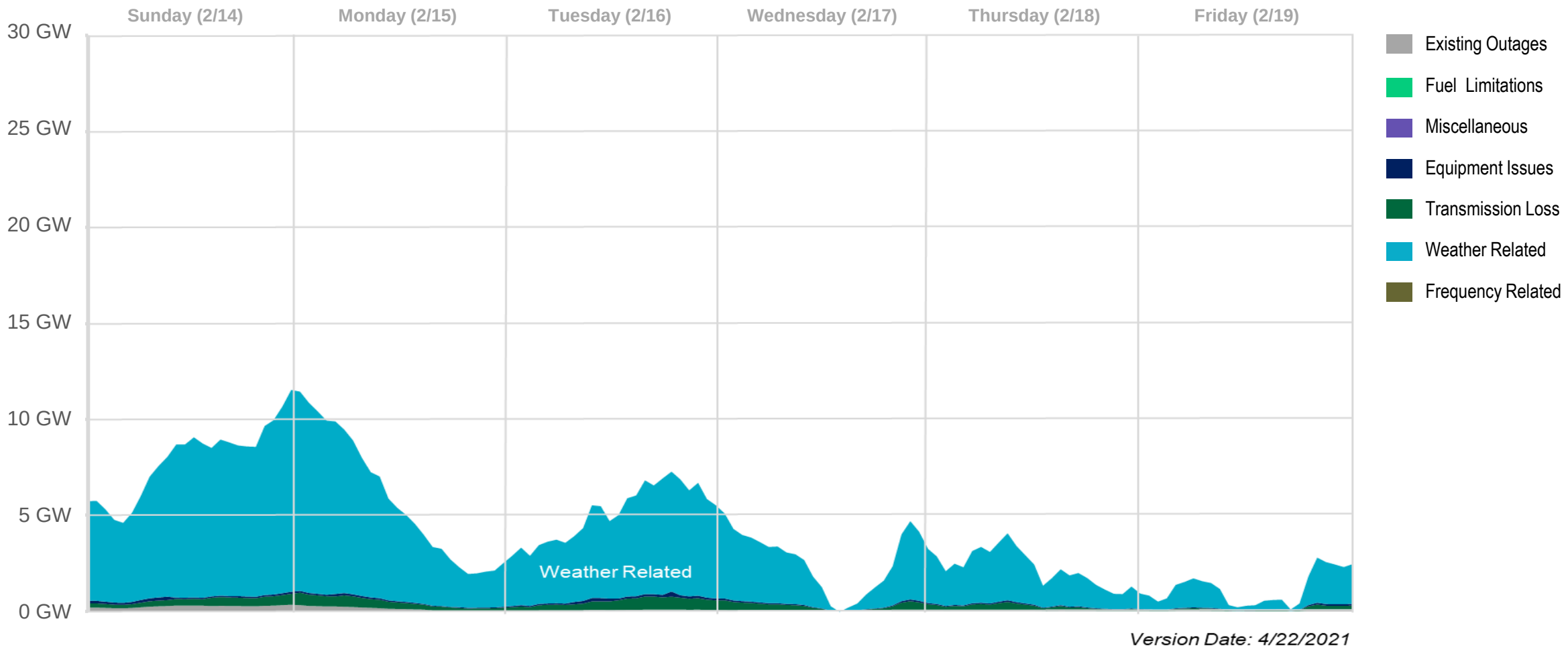


# Net Generator Outages or Derates for Wind Generators by Cause




Outage and derate MW values are based on capacity.

# Net Generator Outages or Derates for Wind Generators by Cause




Outage and derate MW values are estimated based on the proportion of total outaged wind capacity assigned to each cause for each hour.

# Outage and Derate Causes by Sub-causes

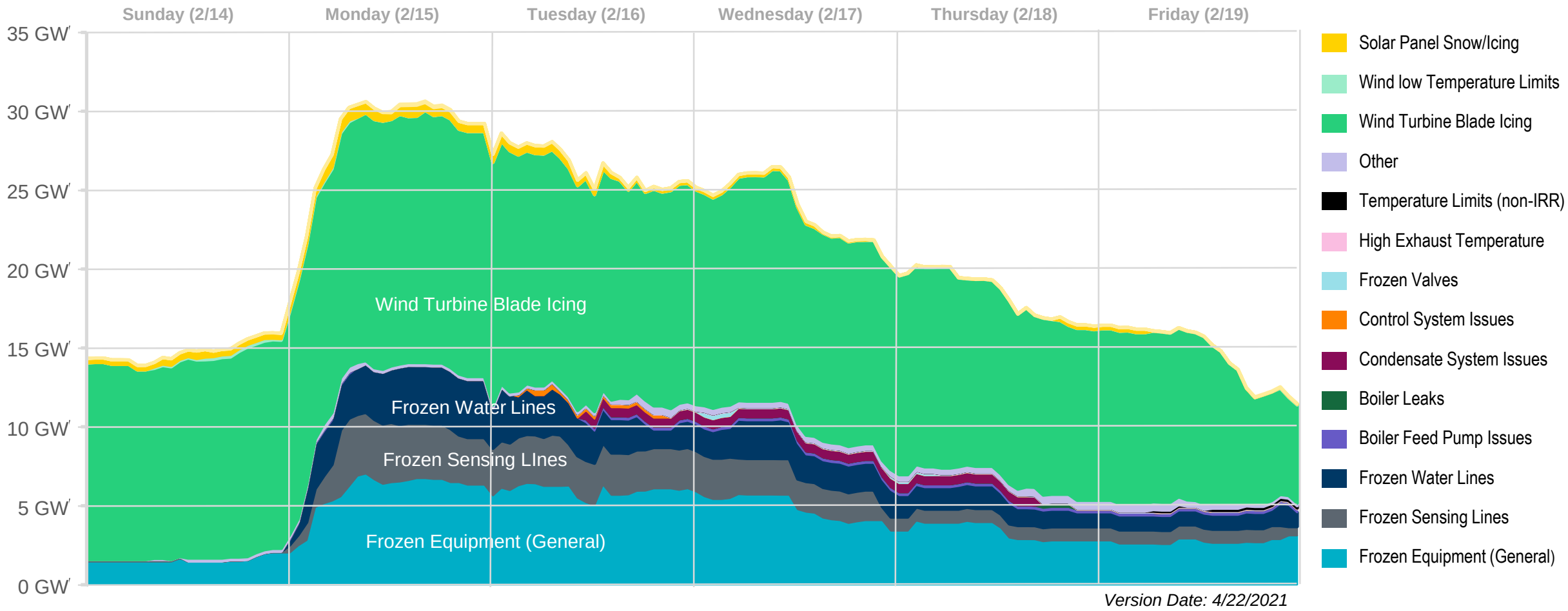
**ERCOT has further divided the Weather Related and Fuel Limitations cause categories into sub-categories of causes. These subcategories are as follows:**

- **Weather Related**
  - Boiler Feed Pump Issues
  - Boiler Leaks
  - Condensate System Issues
  - Control System Issues
  - Frozen Equipment (General)
  - Frozen Sensing Lines
  - Frozen Valves
  - Frozen Water Lines
  - High Exhaust Temperatures
  - Temperature Limits (non-IRR)
  - Solar Low Temperature Limits
  - Wind Low Temperature Limits
  - Solar Panel Snow/Icing
  - Wind Turbine Blade Icing
  - Other
- **Fuel Limitations**
  - Fuel Contamination
  - Fuel Equipment Issues
  - Fuel Impacted by Weather
  - Fuel Other
  - Fuel Pressure Issues
  - Fuel Switching
  - Lack of Fuel

**The following three graphs show the outages and derates by sub-cause for the Weather Related and Fuel Limitation outages and derates**

- *Slide 23 provides the sub-causes for the Weather Related outages using the capacity for wind outages. Slide 24 uses the estimated lost output due to outages and derates for wind outages based on the proportion of total outaged wind capacity assigned to each cause for each hour.*
- *Slide 25 provides the sub-causes for the Fuel Limitations outages.*

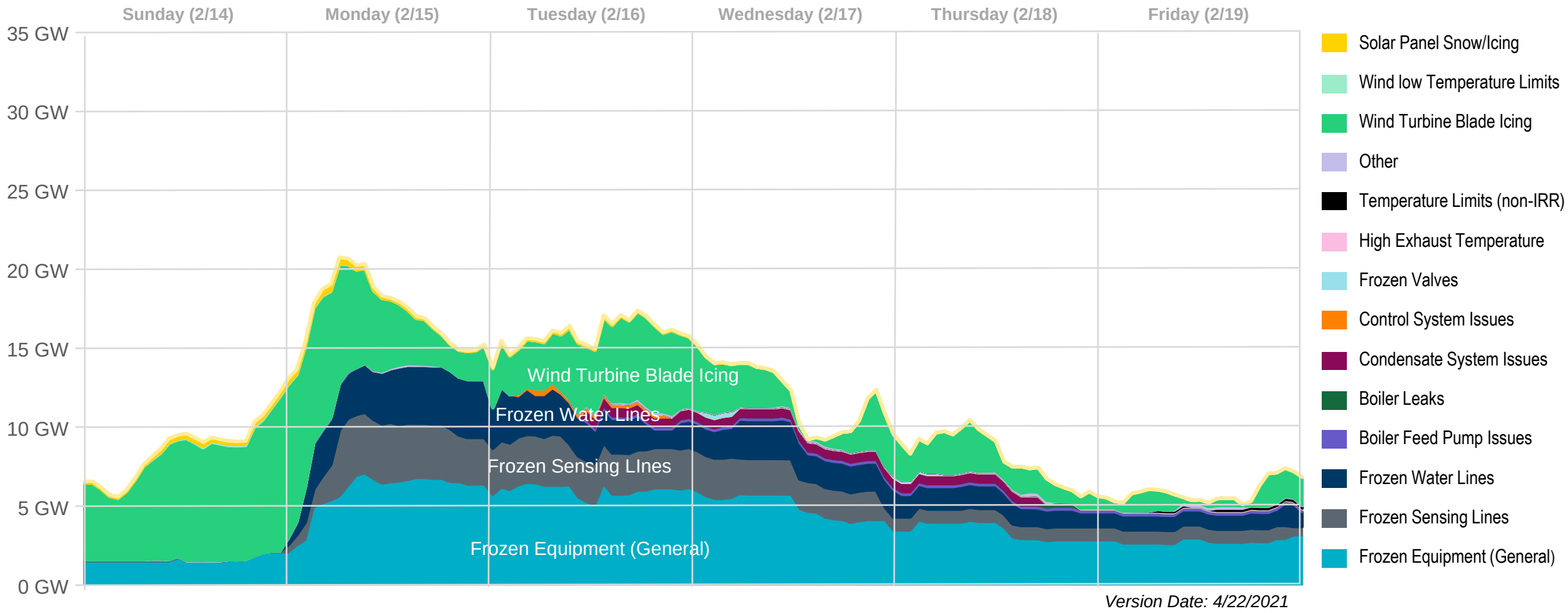
# Weather Related Generator Outages and Derates by Sub Cause




*Version Date: 4/22/2021*

Outage and derate MW for wind and solar are based on capacity.

# Weather Related Generator Outages and Derates by Sub Cause

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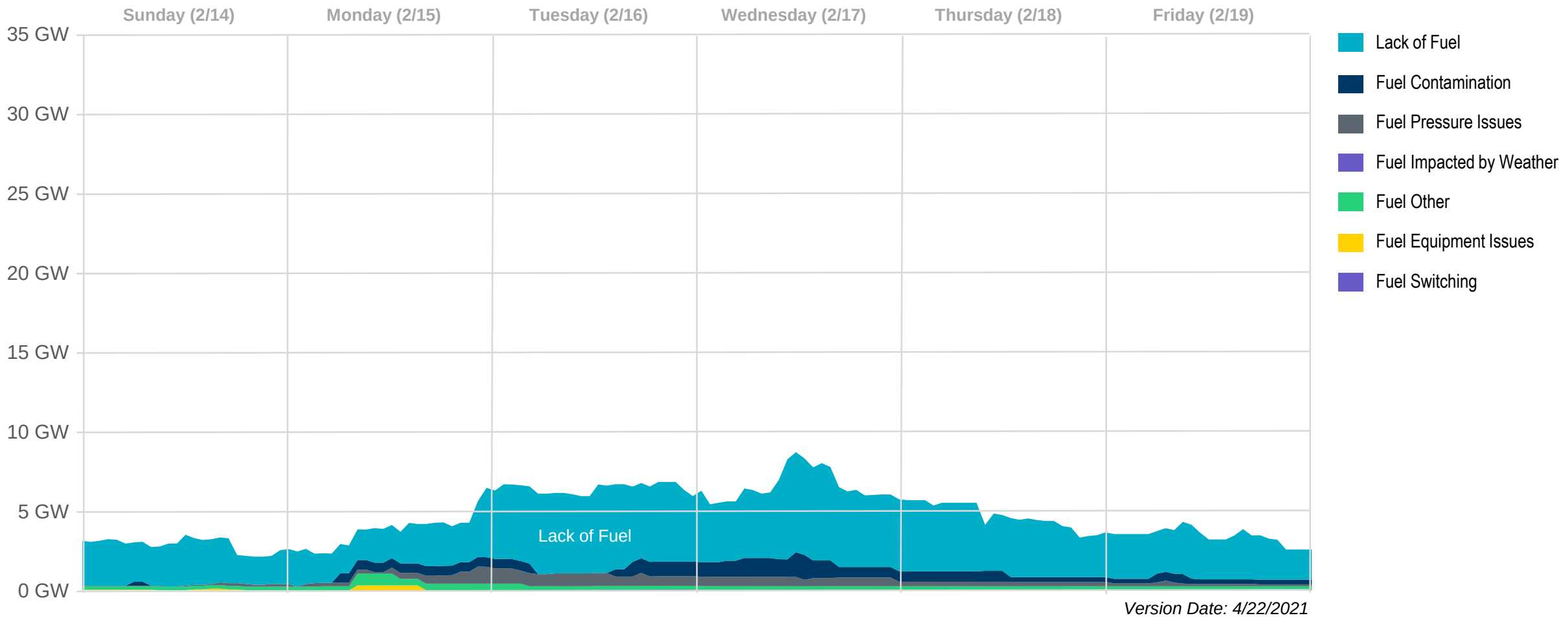
Outage and derate MW for wind are estimated based on the proportion of total outaged wind capacity assigned to each cause for each hour.

# Fuel Limitations Generator Outages or Derates by Sub Cause

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