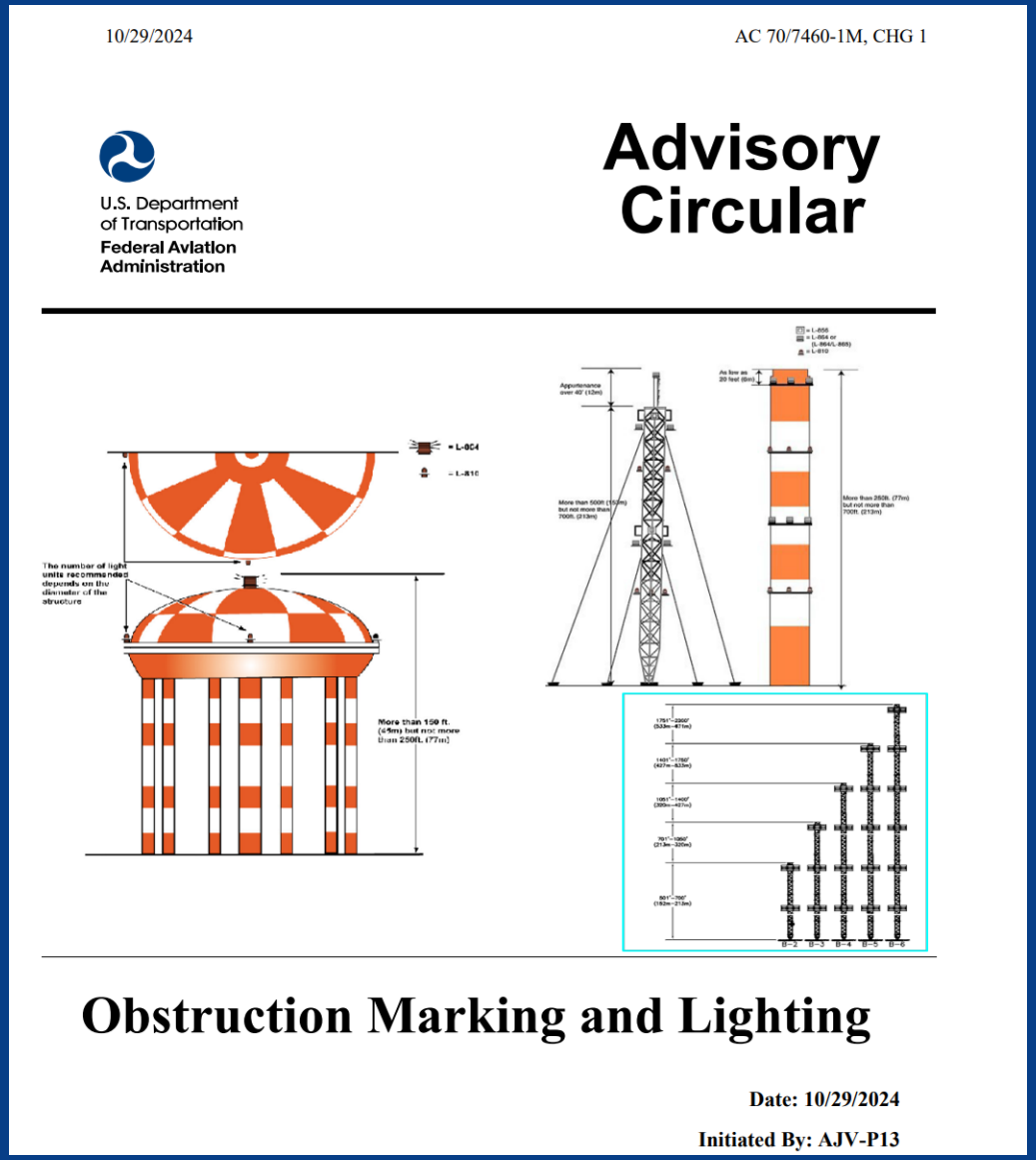
Aircraft Detection Lighting System Performance

SouthDakota

PUBLIC UTILITIES COMMISSION

Federal Aviation Administration Requirements



10/29/2024 AC 70/7460-1M, CHG 1

U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Obstruction Marking and Lighting

Date: 10/29/2024

Initiated By: AJV-P13

FAA Requirements for ADLS (AC 70/7460-1M, CHG 1)

- **Aircraft detection**
  - Horizontal coverage: 3 nautical miles (3.45 miles) from wind farm perimeter
  - Vertical coverage: 200 feet above ground level to 1,000 feet above highest part of obstruction or group of obstructions
  - ADLS must be able to detect aircraft with a cross-sectional area of one square meter or more
- **Lighting requirements**
  - Obstruction lights must activate prior to aircraft entering the coverage area identified above
  - If ADLS capable of continuous aircraft monitoring: lights stay on until aircraft exits the coverage area
    - If the aircraft signal is dropped, ADLS is required to initiate 30-minute timer to keep lights on before re-setting
  - If ADLS not capable of continuous aircraft monitoring: lighting duration based on formula
    - Lights on time (seconds) = (widest dimension for wind farm in nautical miles + 6) x 90 seconds

Coverage Area

* System above shown in active mode with aircraft in coverage area

FAA Requirements for ADLS (AC 70/7460-1M, CHG 1)

- **ADLS failures**
  - Failure affects all turbines: lights must be on until ADLS fully restored
  - Failure affects an individual turbine: impacted turbine must have light on until fixed, rest of turbines can be controlled by ADLS
- **ADLS test**
  - Once every 24 hours: communication and operation
- **Record retention**
  - Maintain log of ADLS activity for a period of no less than previous 15 days

Qualitative Survey Results

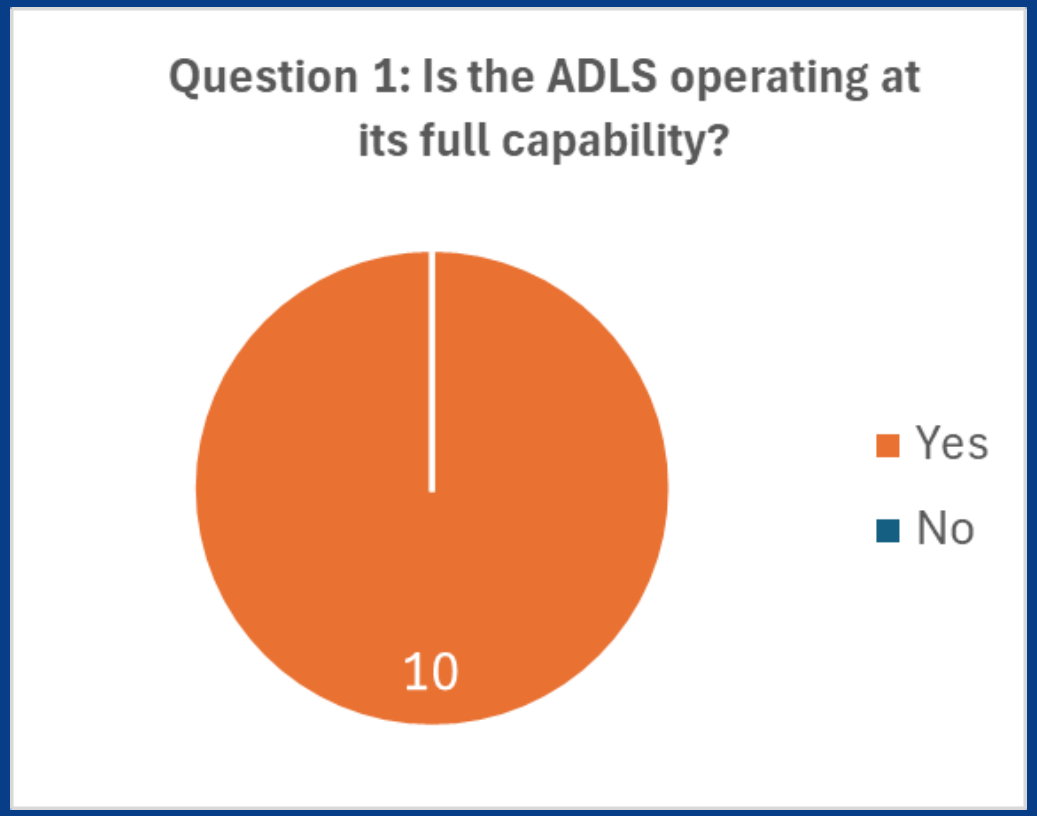
ADLS Operation Survey

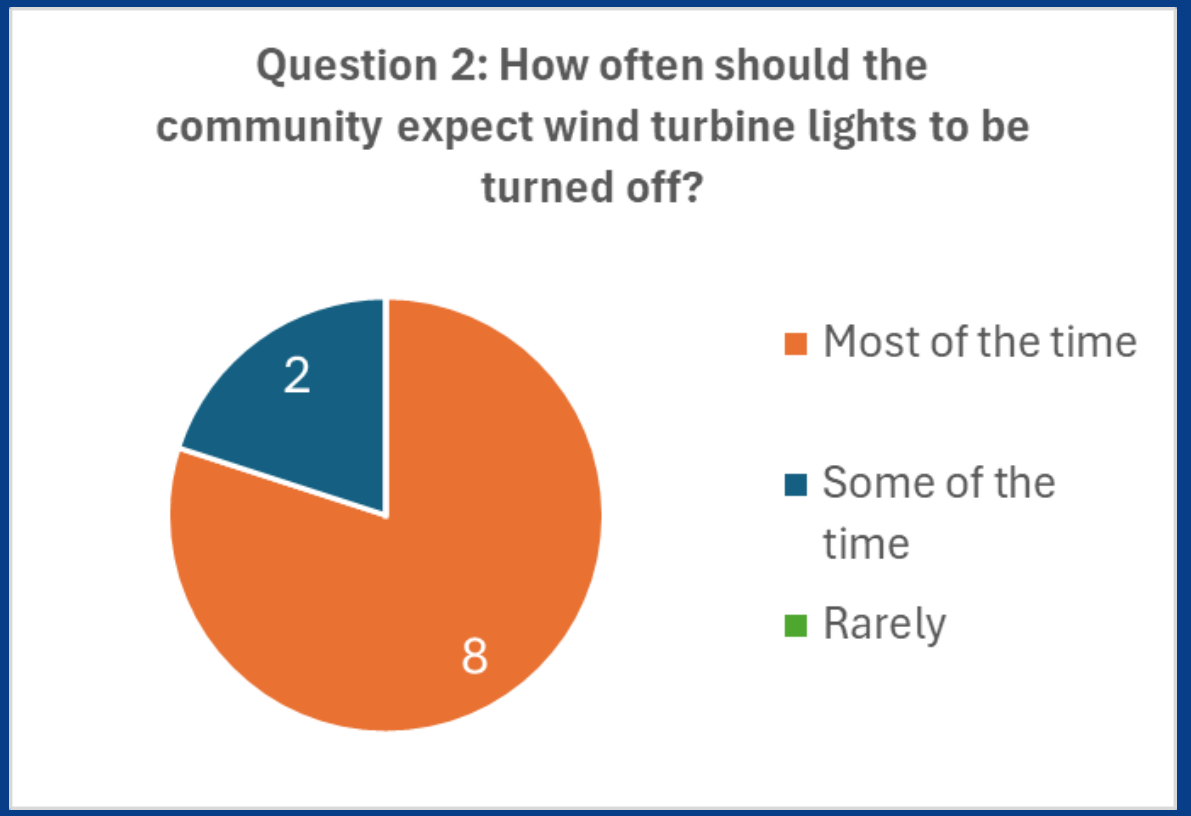
Instructions: Please select the best answer from the drop-down list in the green box and provide a more detailed explanation of the response selected in the orange explanation box.

Wind Farm Name:

No.	Question	Answer	Explanation
1	Based on your experience with the ADLS, do you find the ADLS is controlling the wind turbine lights to its full capability? Please explain the answer provided.		
2	Should the surrounding community expect the ADLS to keep the wind turbine lights turned off i) most of time, ii) some of the time, or iii) rarely? Please explain the answer you provide.		
3	Are there any ADLS tests that are required by the FAA? If yes, please provide the following in the explanation box:		
	a. a summary what takes place during testing,		a.
	b. the frequency of the tests, and		b.
	c. the time of day those tests typically occur.		c.
4	When the ADLS experiences a malfunction, how long does it typically take to troubleshoot, repair, and return the ADLS to full operation? Please explain the reason for your selection.		
5	Does the ADLS require regular troubleshooting and repair? If yes, please answer the following:		
	a. Are there any specific system components or networking issues that historically caused the issues? If so, what are they?		a.
	b. Has ADLS vendor support been readily available? Please explain your answer.		b.
	c. Have parts been readily available? Please explain your answer.		c.
6	Does the ADLS experience false positive detections that result in turning the lights on? If yes, please answer the following:		
	a. What is the main cause of the false positive detections? Please identify all causes experienced to date and identify other causes in the explanation box.		a.
	b. How frequently do the false positive detections occur?		b.
7	Please provide one year of ADLS operating data for January 2025 through December 2025. This data can be provided by either using reporting tools with the ADLS control system or by completing the "ADLS Operating Log" spreadsheet. If the ADLS system is used to generate a report, please ensure it includes the data requested in the "ADLS Operating Log."		

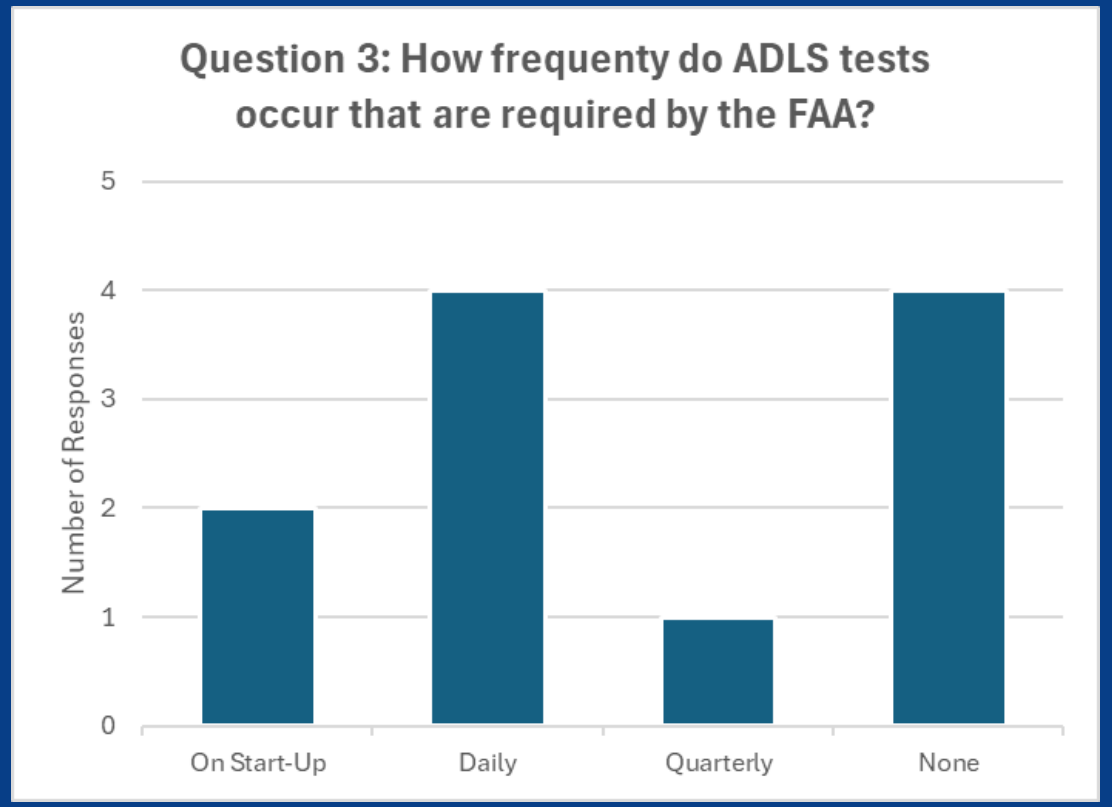
General Performance Expectations





A total of 10 wind farms were surveyed

FAA Testing That May Require “Lights-on”



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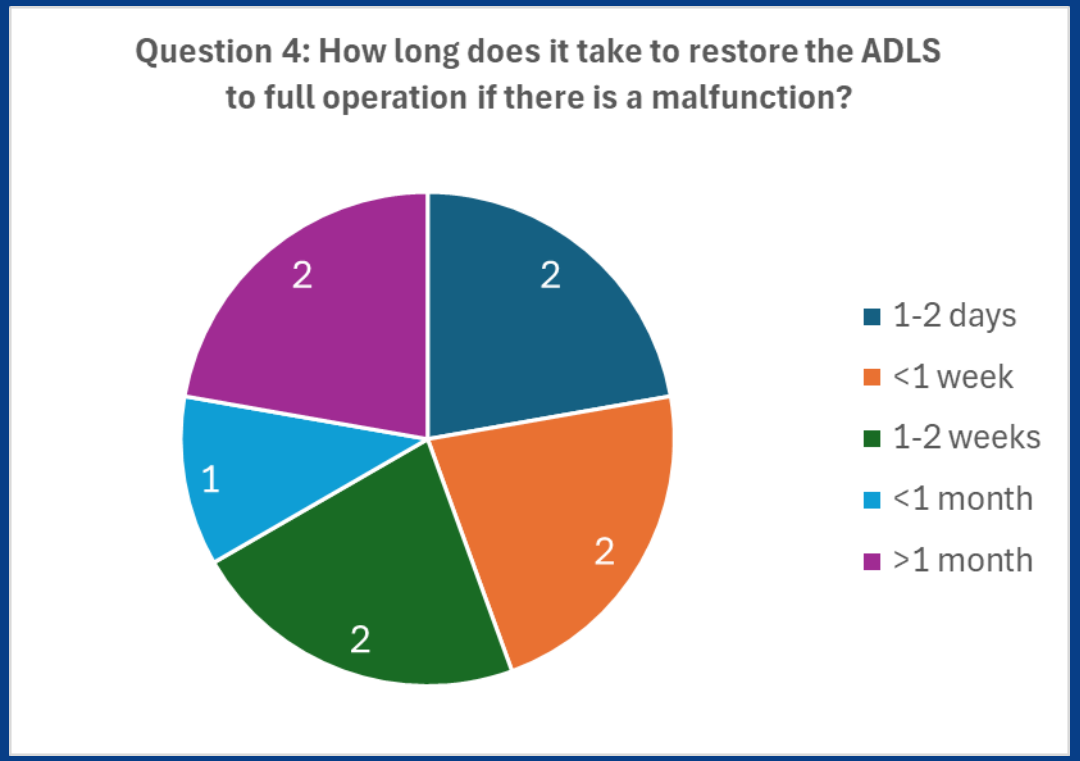
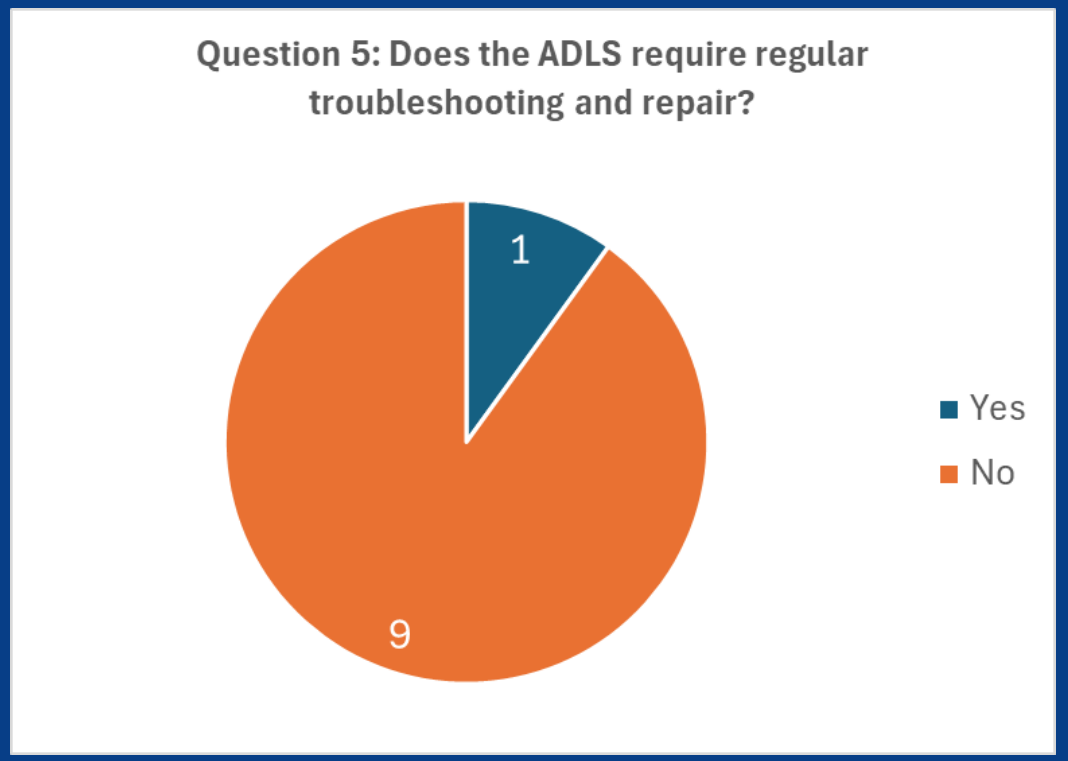
Trouble Shooting And Repair





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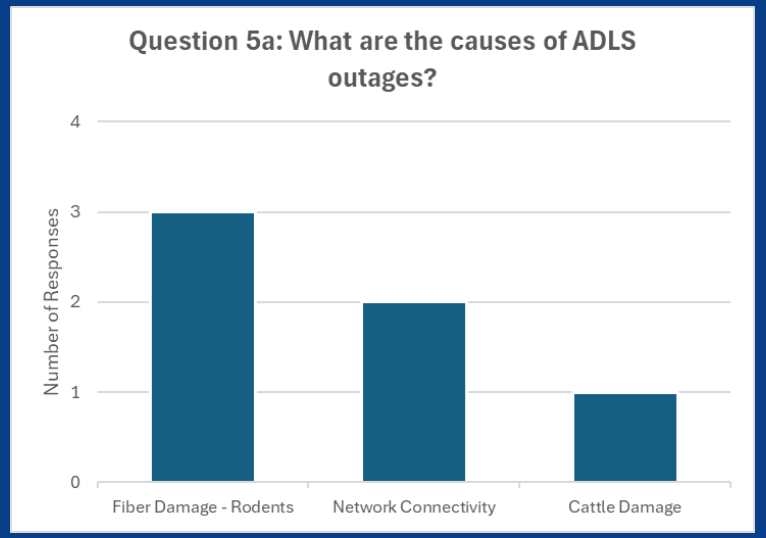

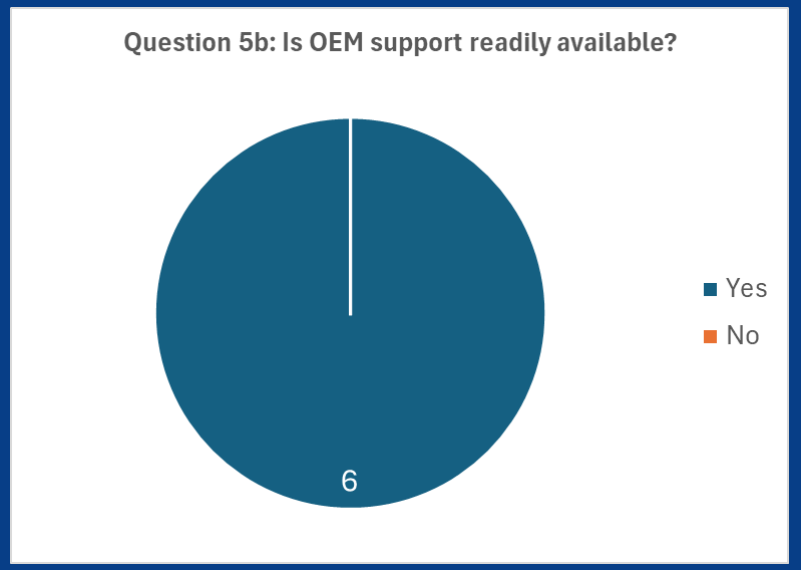

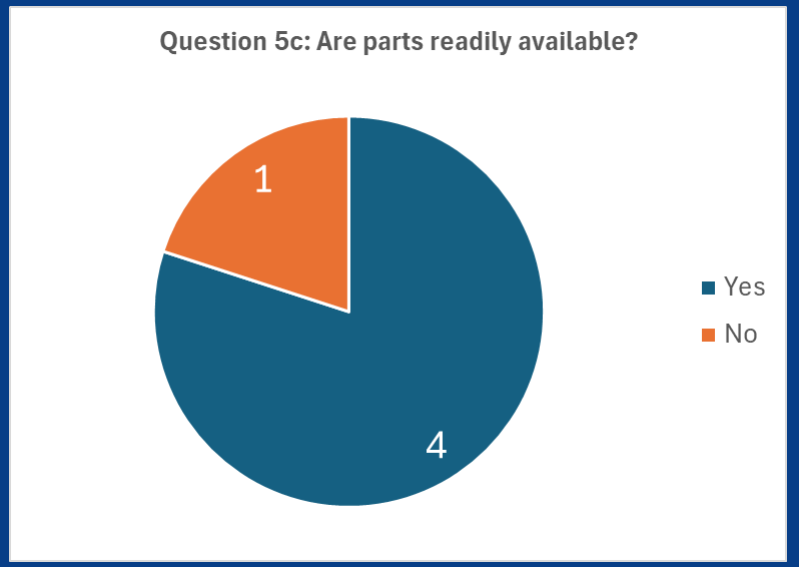

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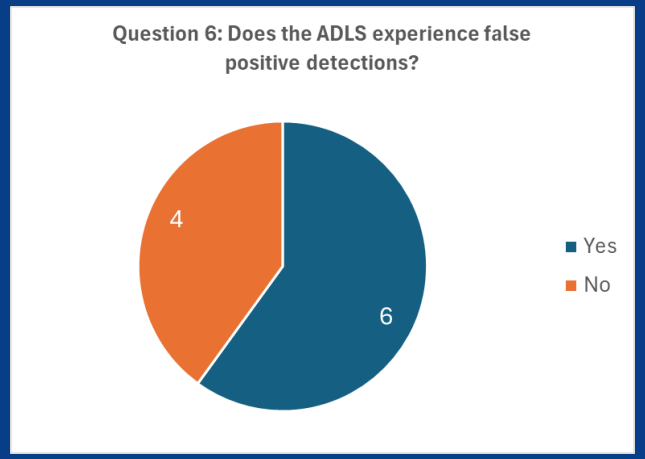
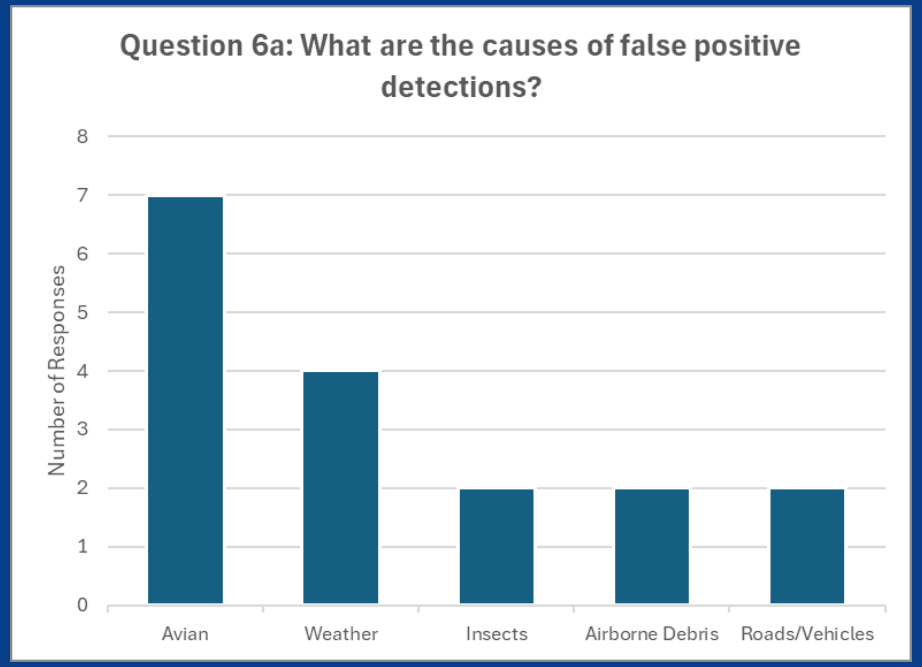
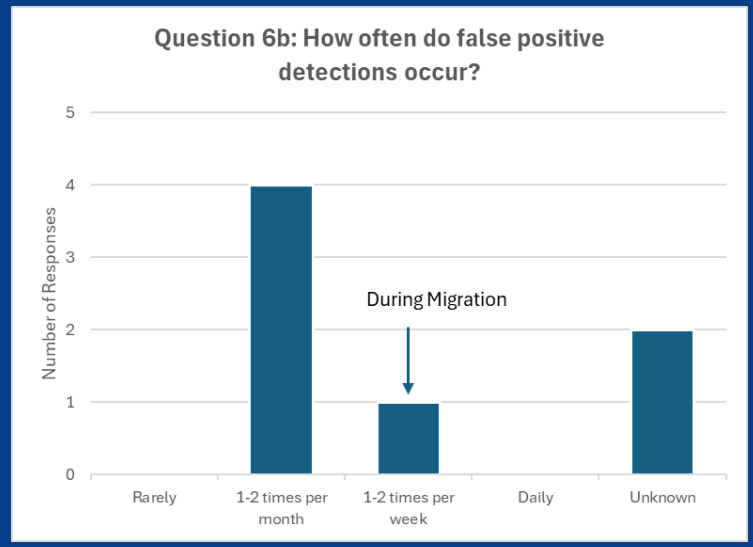
False Positive Detections







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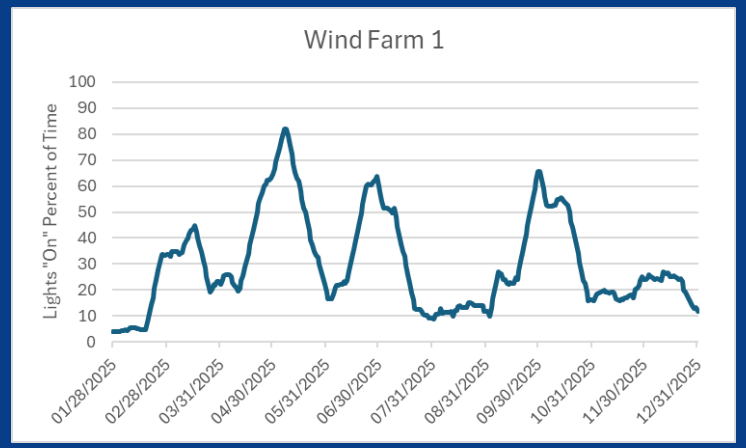
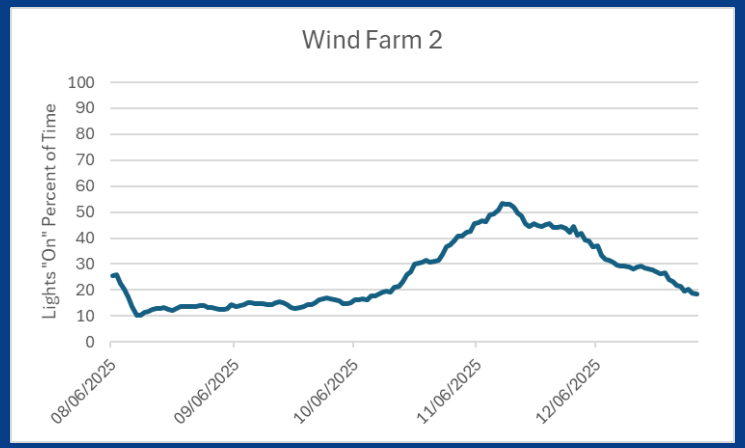
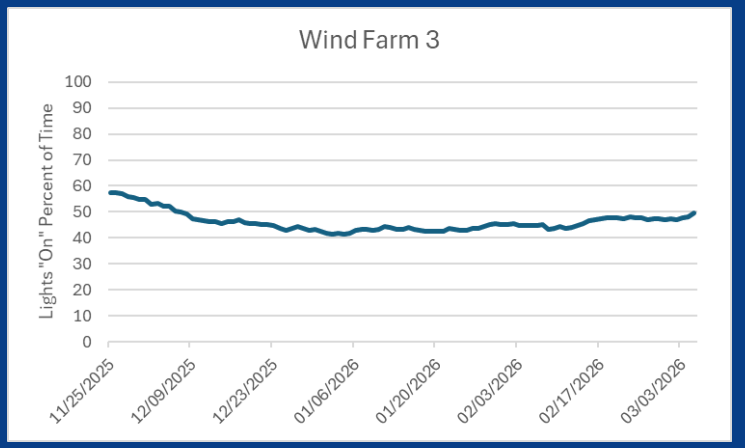
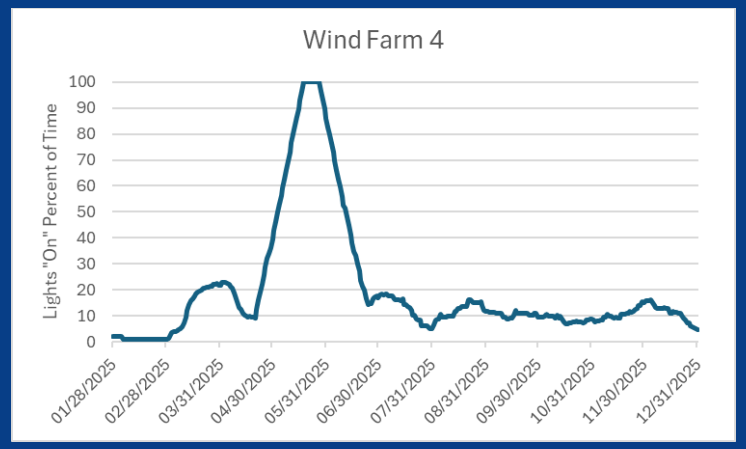
ADLS Performance by Wind Farm

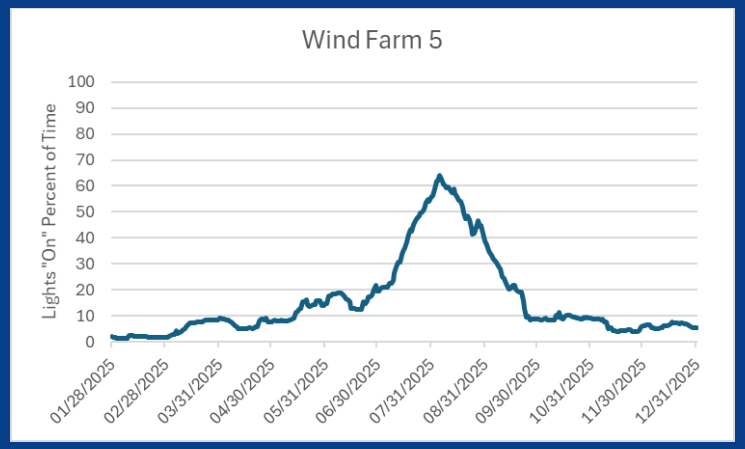
Percent of Night Lights "On" (28-Day Rolling Average)

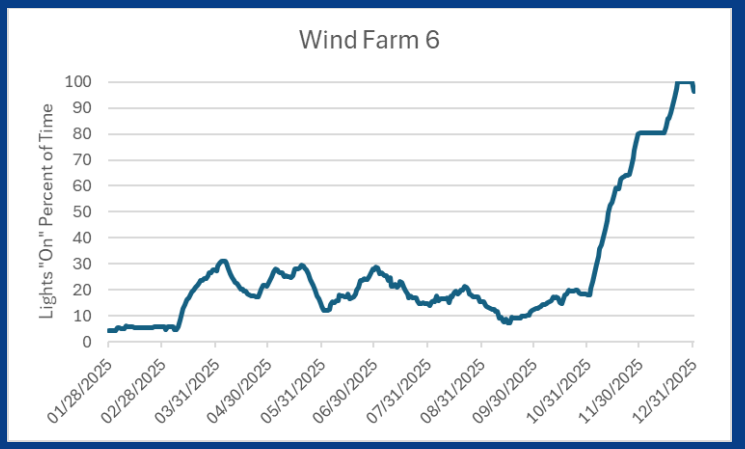




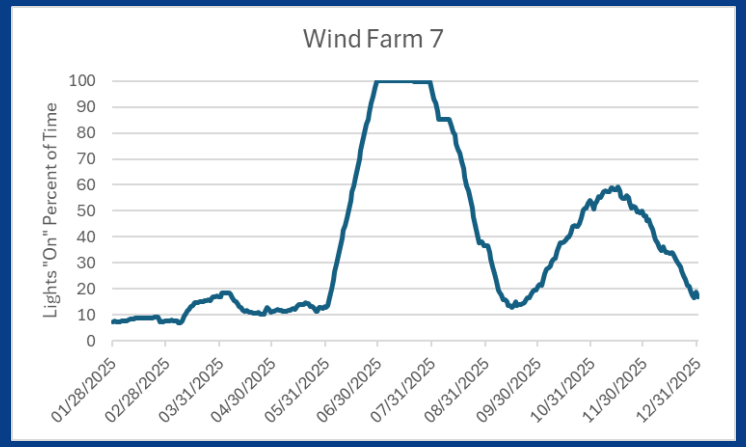


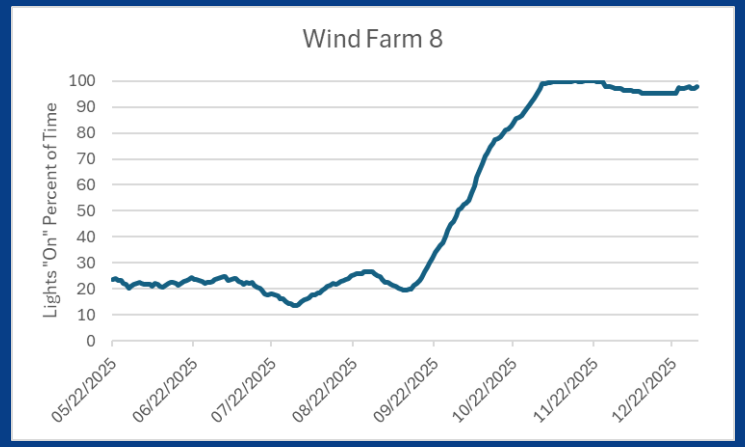


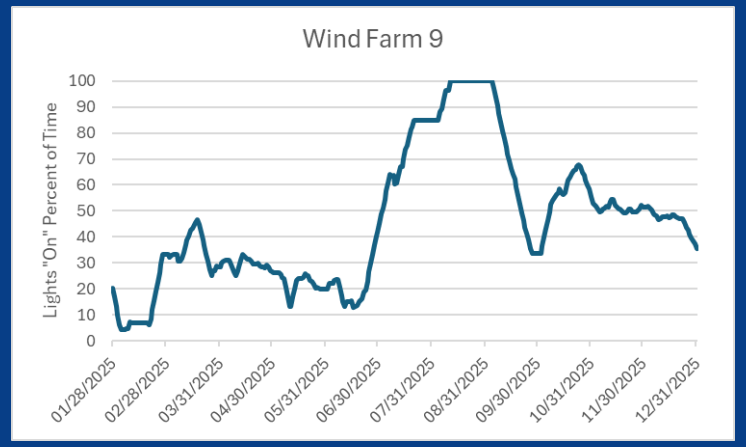


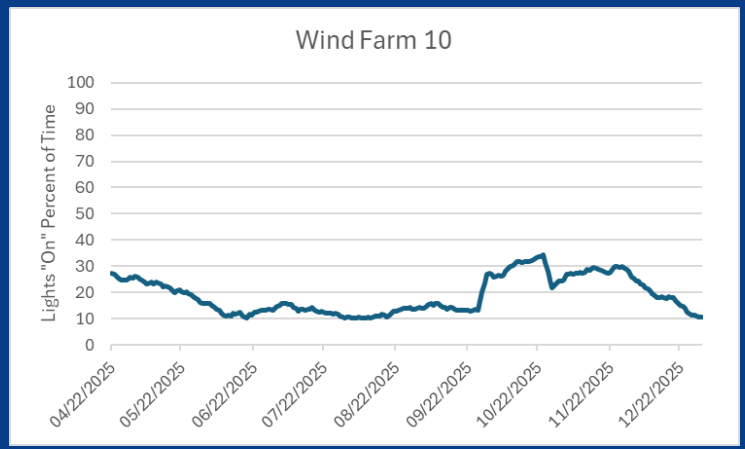


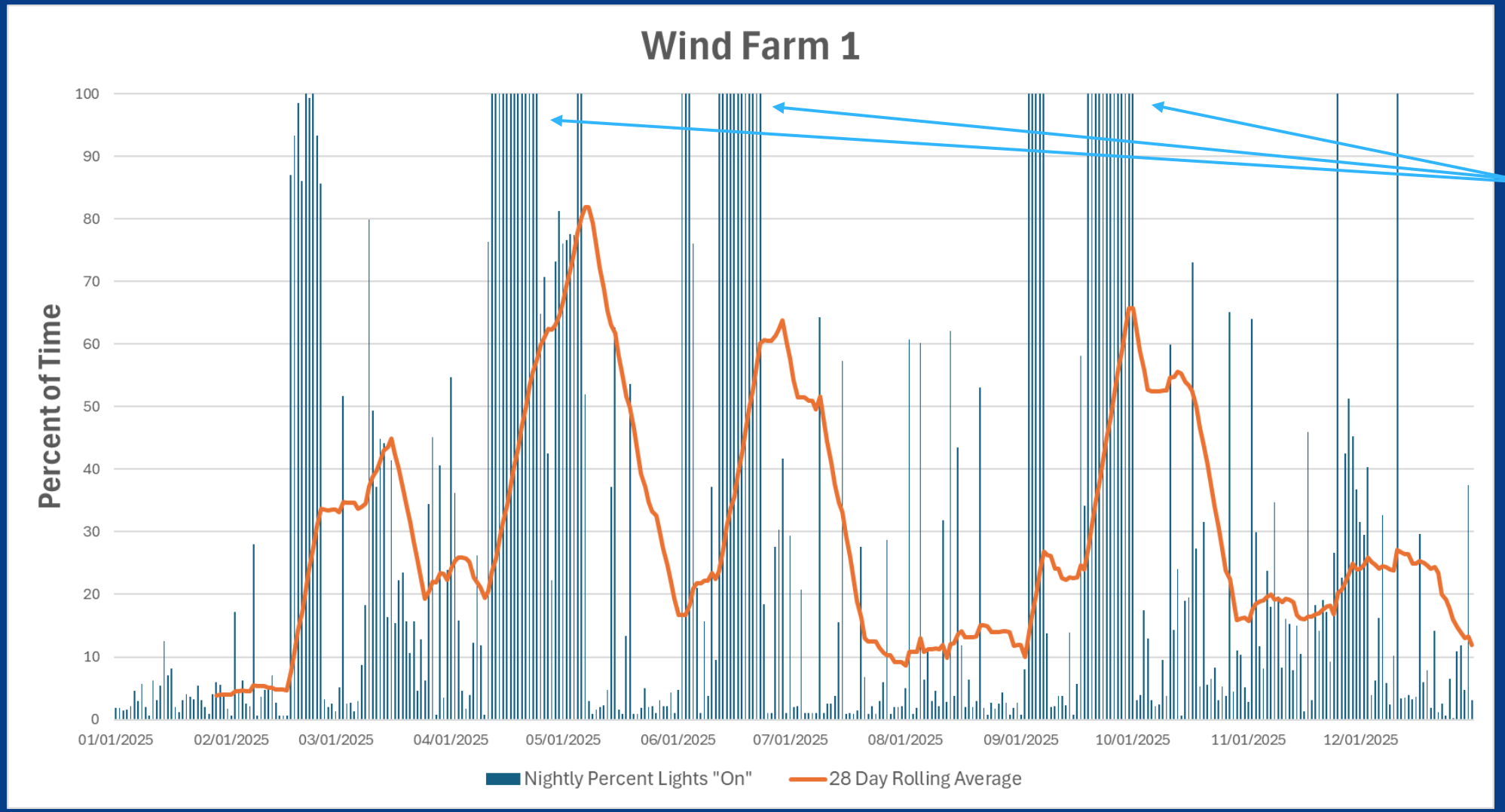
Percent of Night Lights "On" (28-Day Rolling Average)





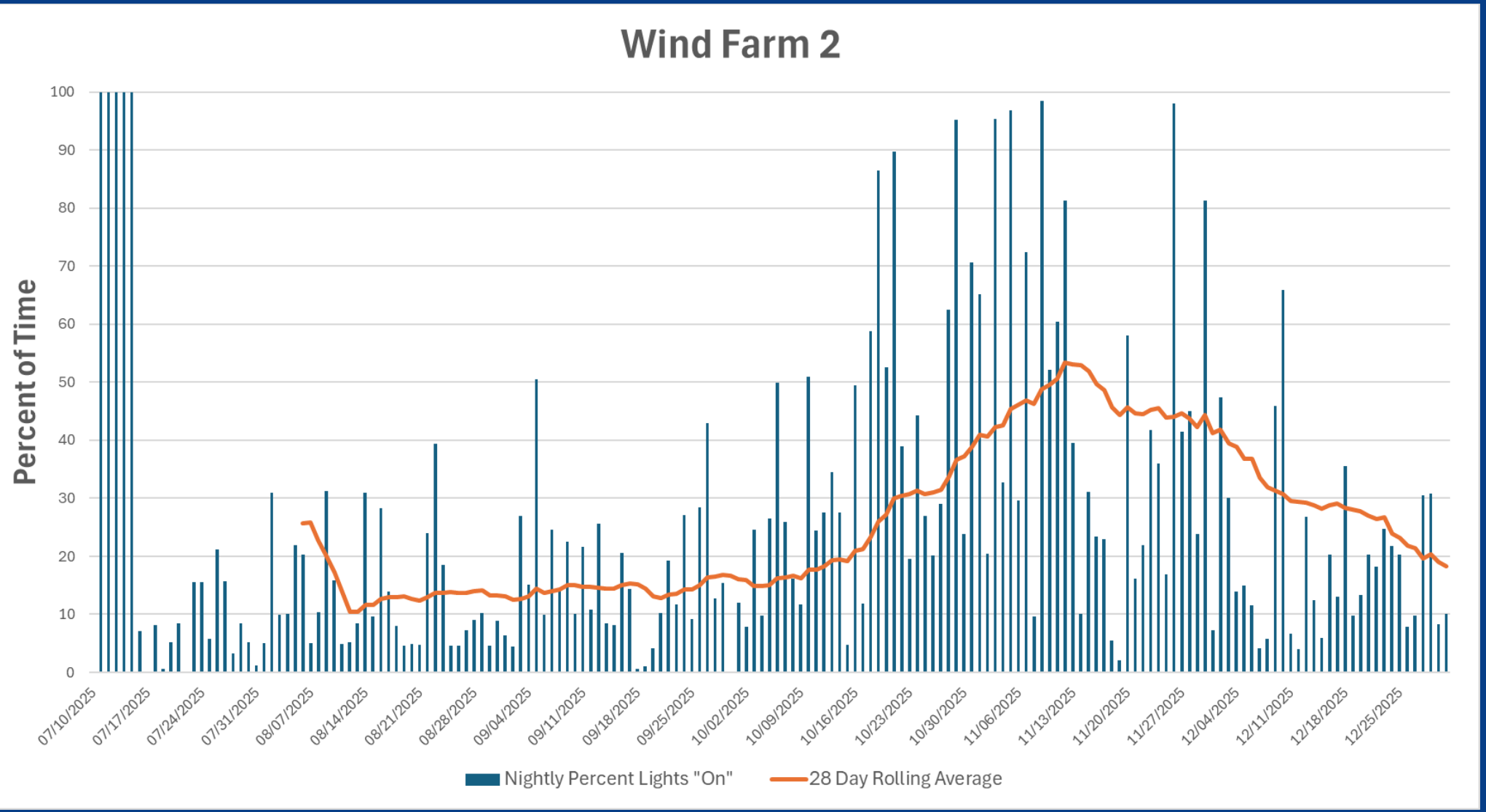






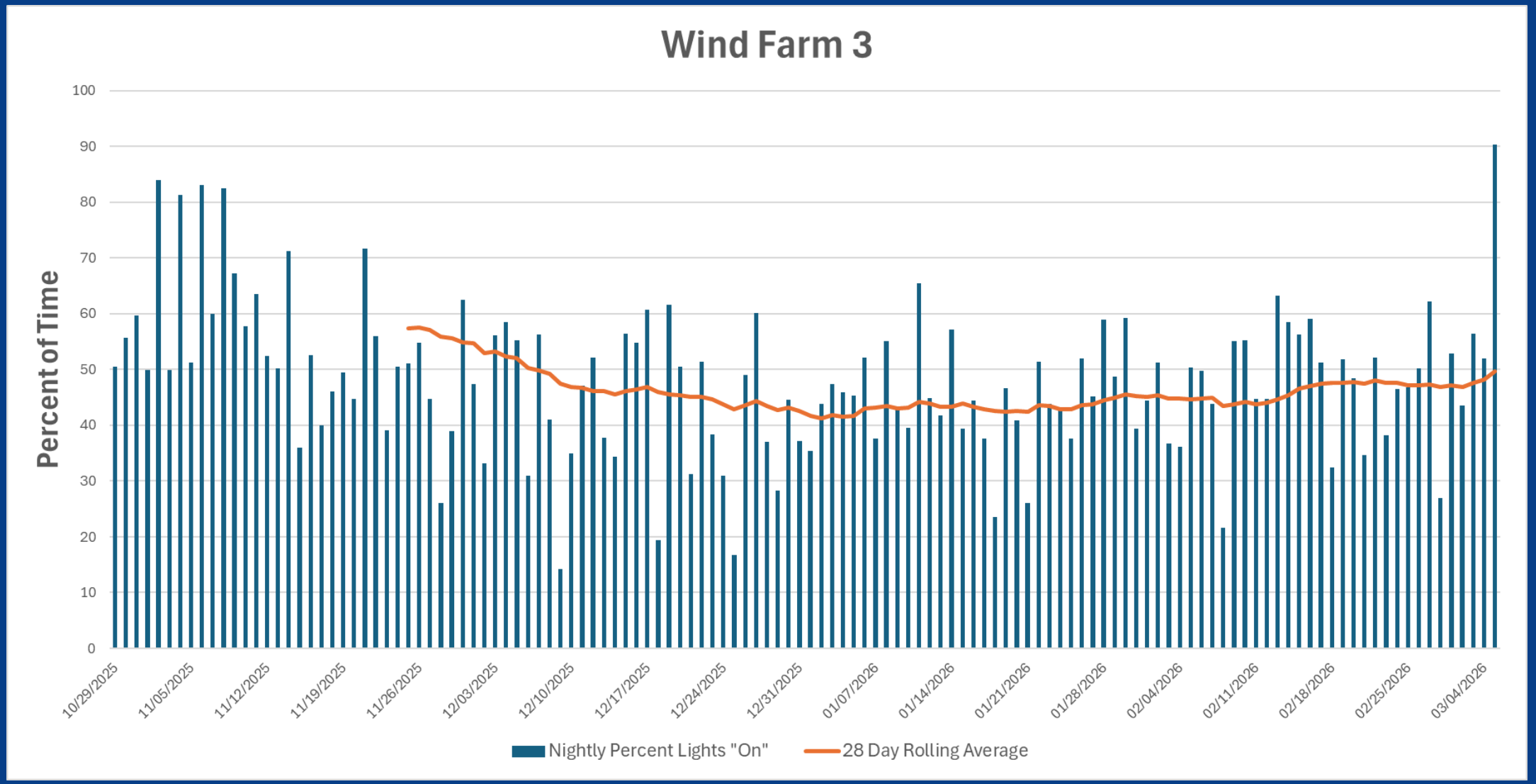
ADLS outages led to periods of time when lights were on 100% of time.

Rolling average indicates lights on 5% to 25% of time when prolonged ADLS outages are excluded.

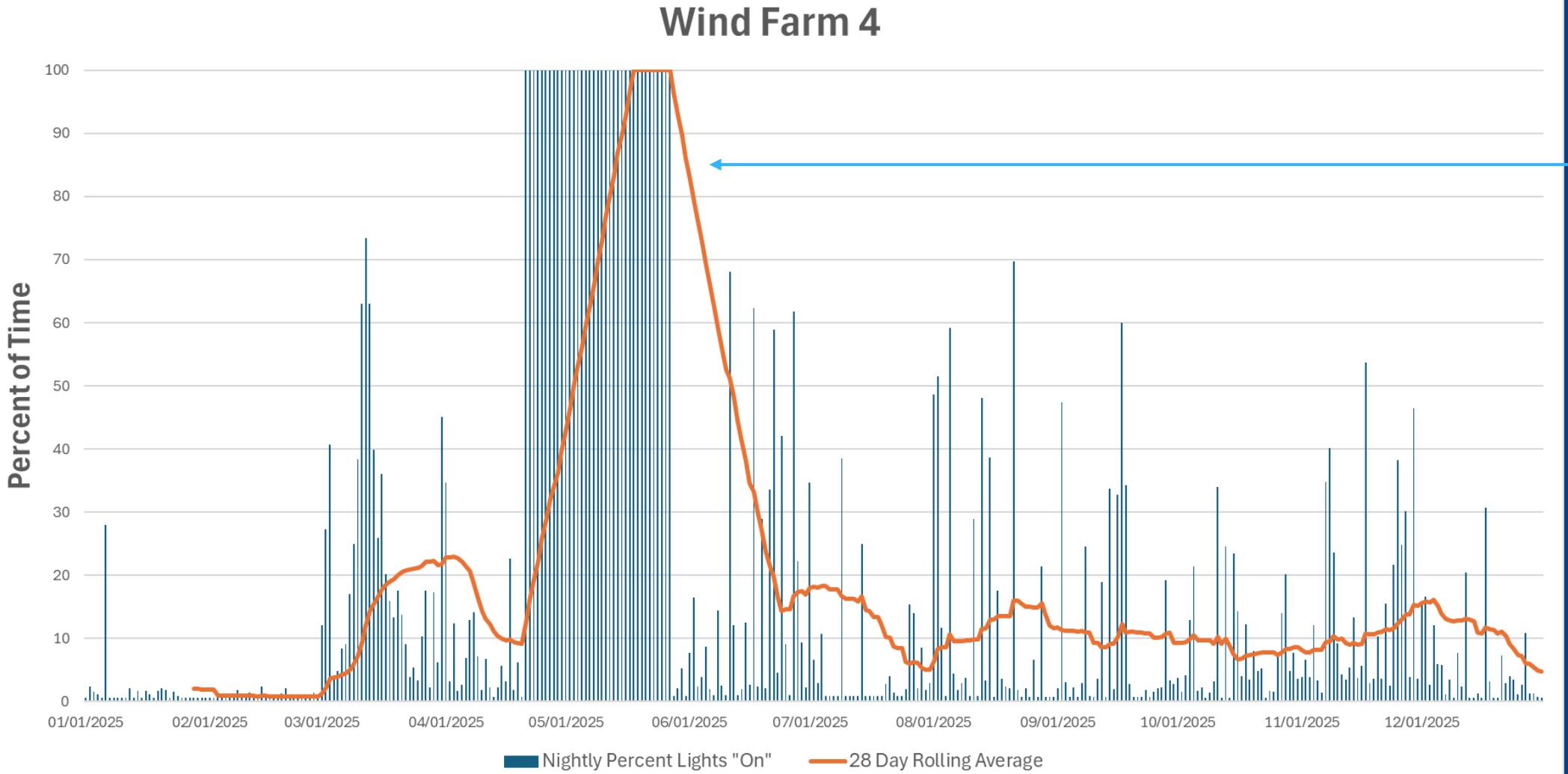


Wind farm did not identify periods with ADLS outages.

Rolling average indicates lights on 10% to 50% of time.

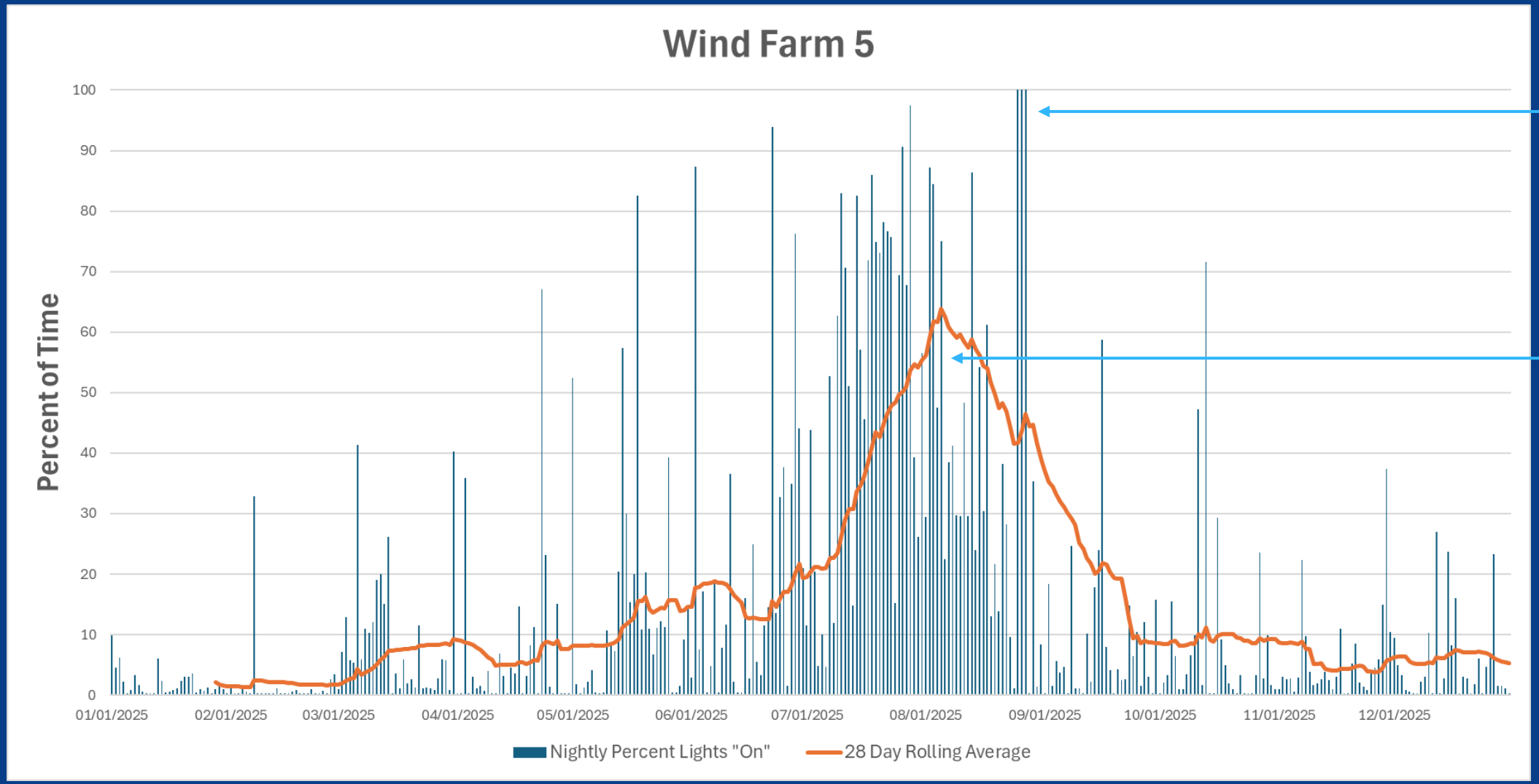


Rolling average indicates lights on 40% to 60% of time.



ADLS outage in late April and early May due to transmission and substation construction.

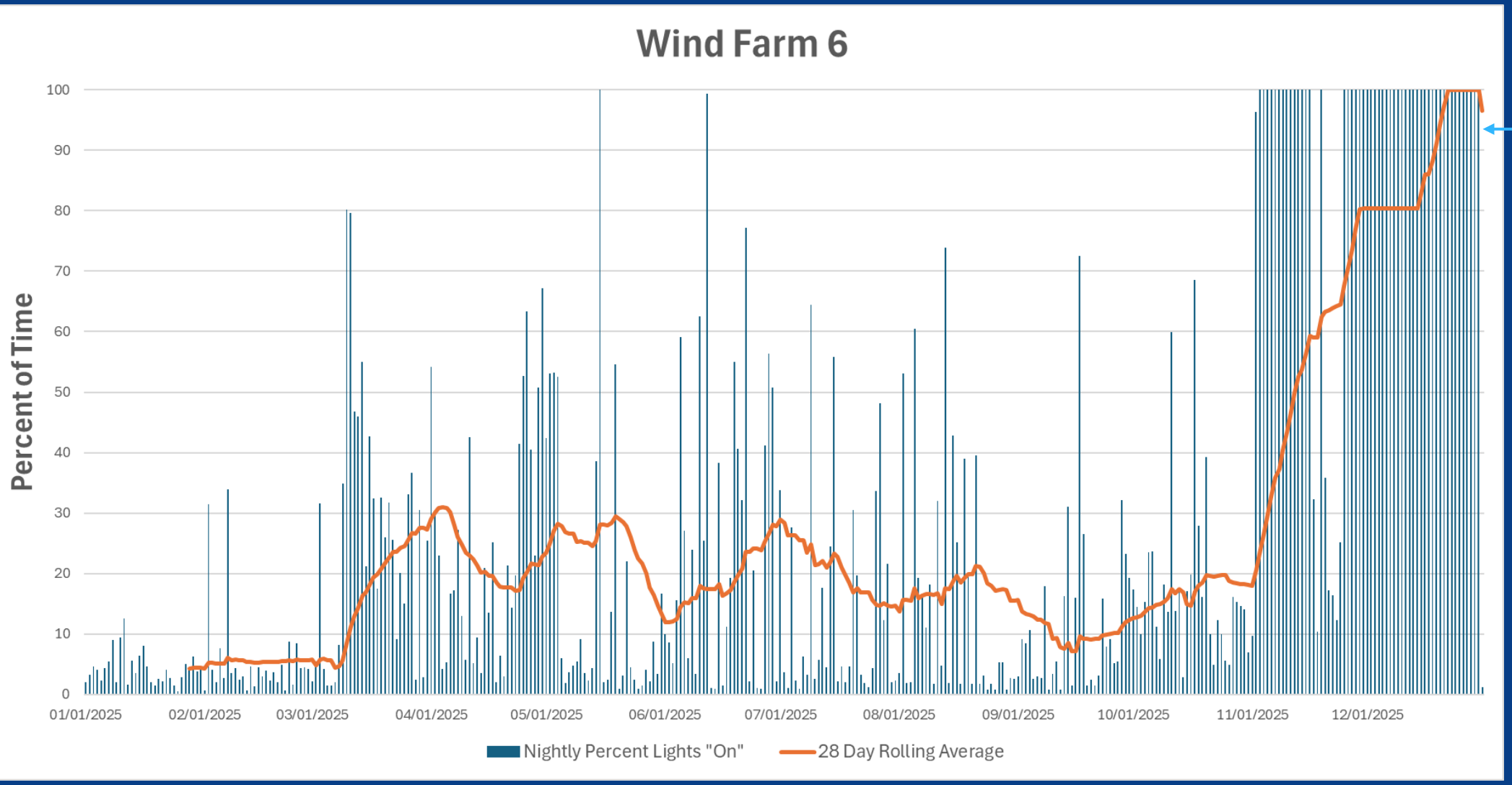
Rolling average indicates lights on 0% to 20% of time when prolonged ADLS outage excluded.



Brief ADLS outage in late August.

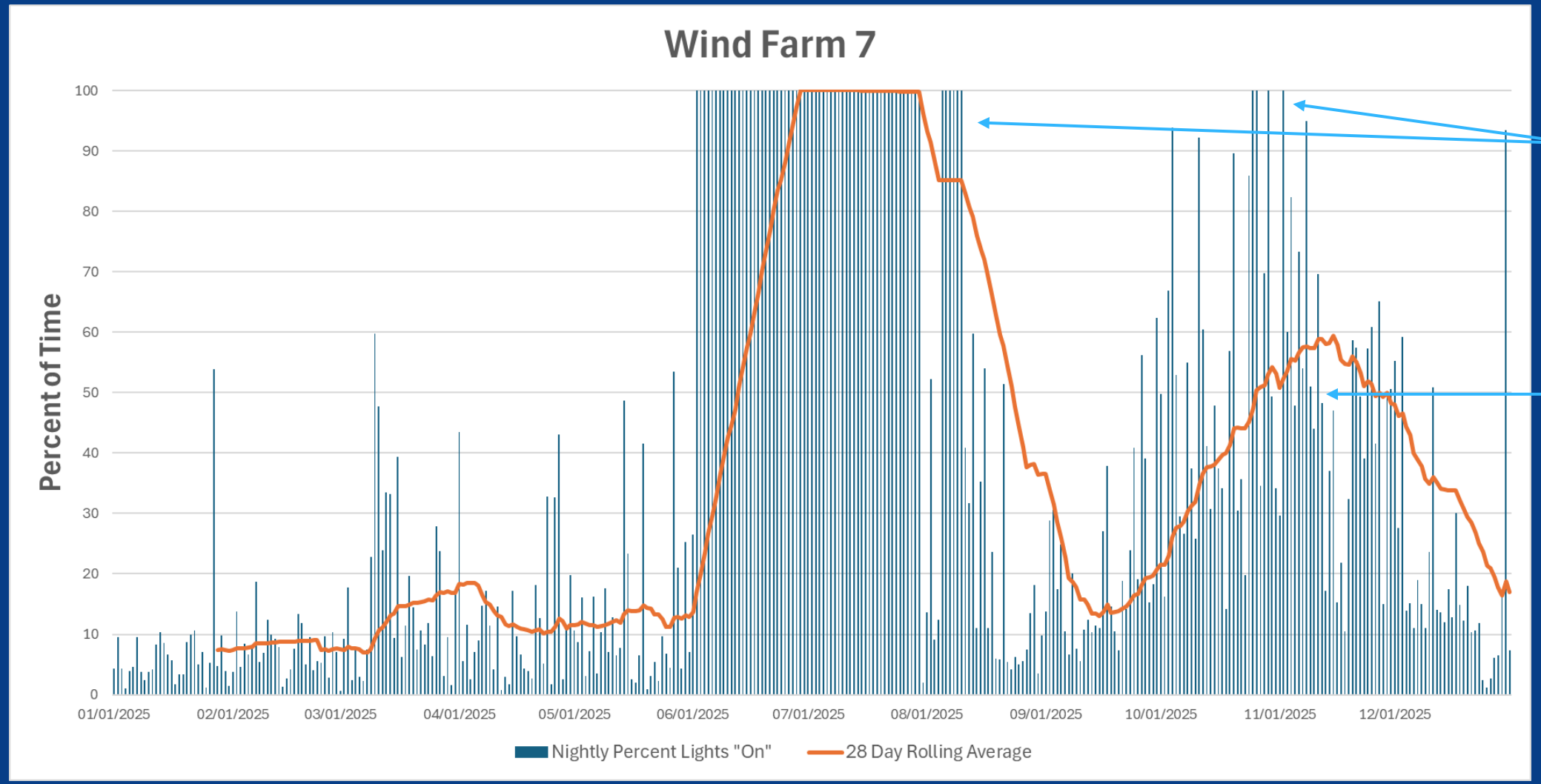
Lights on more in July and August due to weather and aircraft-like targets.

Rolling average indicates lights on 0% to 60% of time.



ADLS outage in November and December.

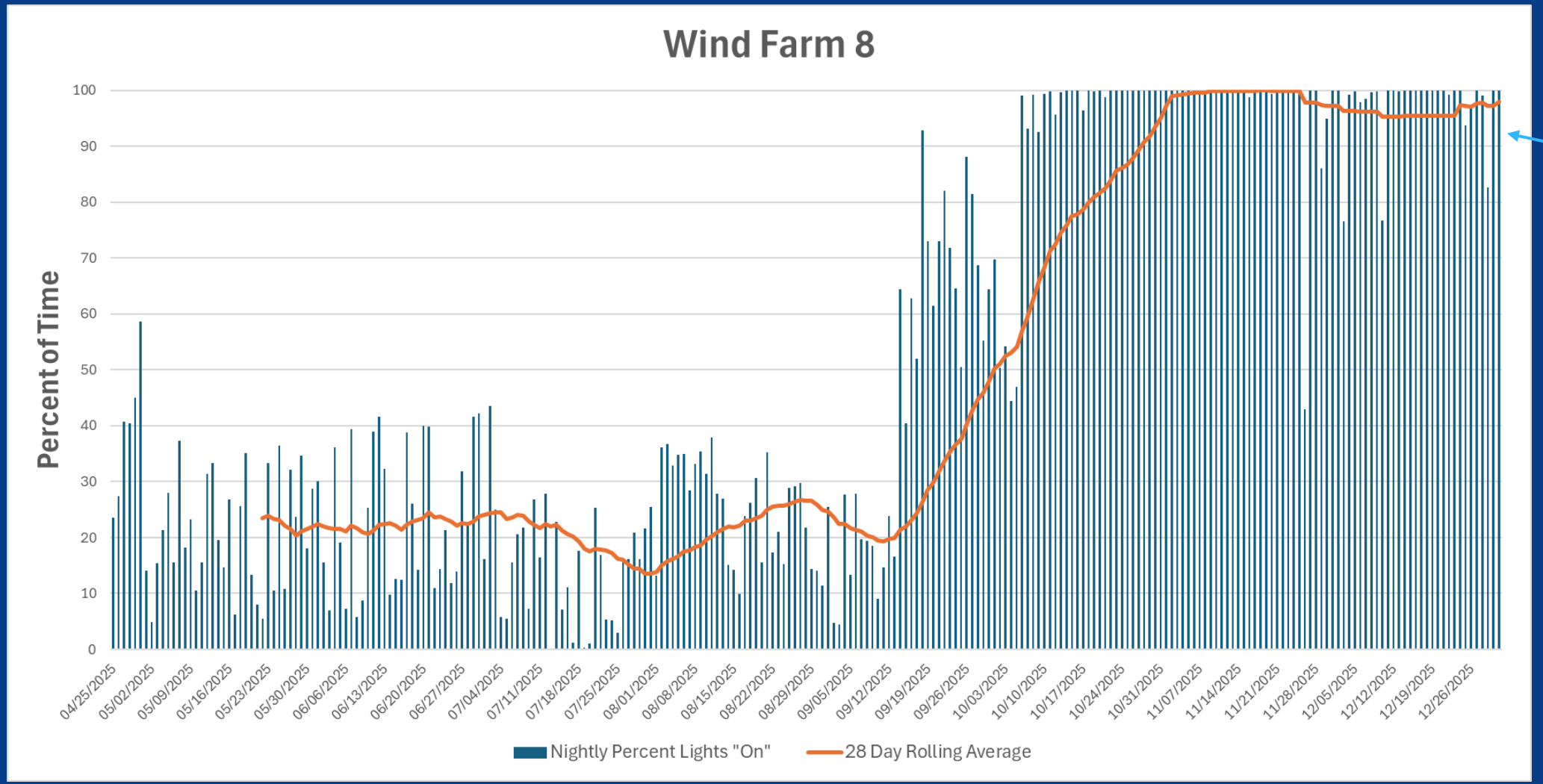
Rolling average indicates lights on 5% to 30% of time without prolonged system issues.



ADLS outage in June, July, part of August, and a few days in October.

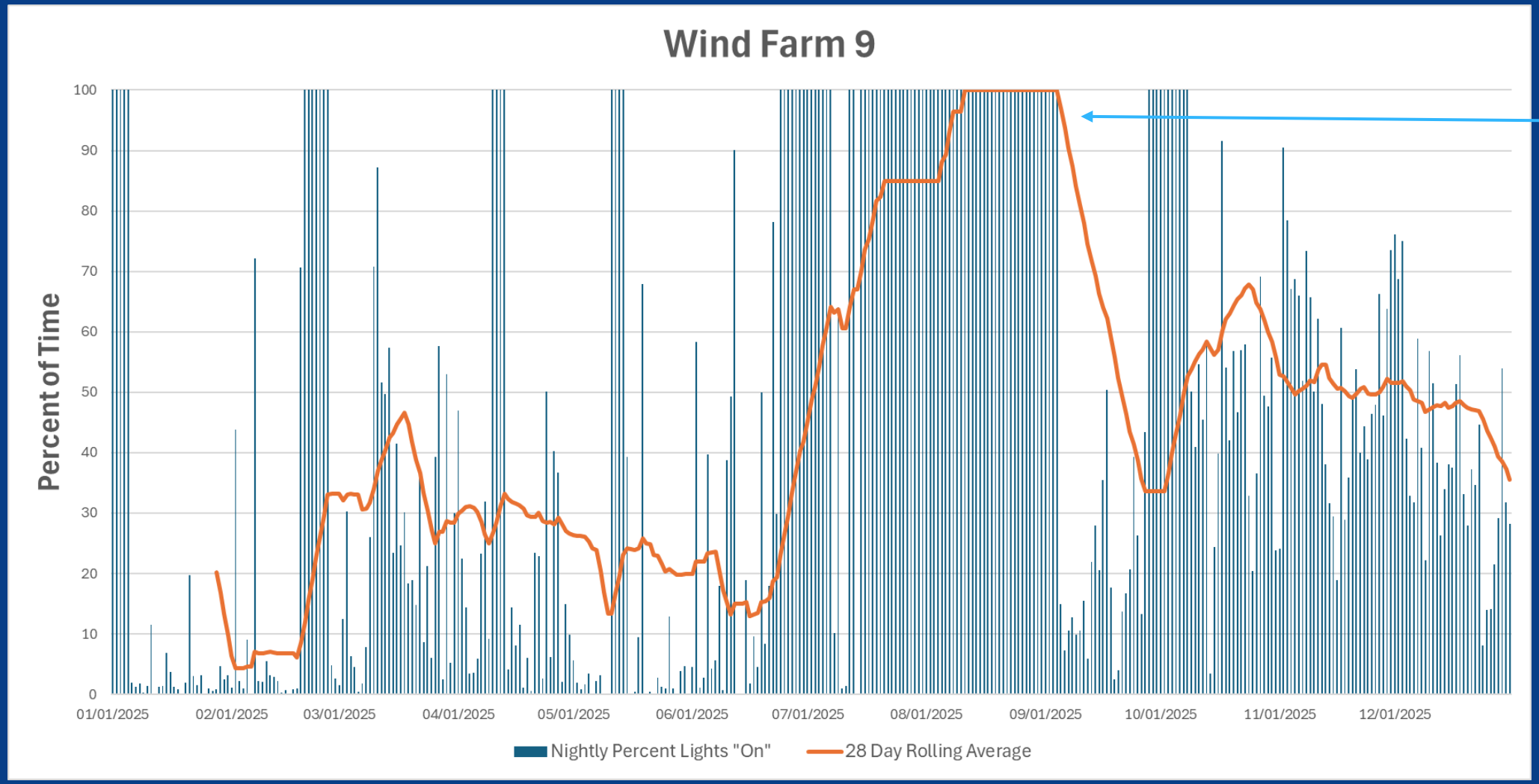
Lights on more frequently in October and November due to aircraft-like targets.

Rolling average indicates lights on 8% to 50% of time excluding prolonged ADLS outages.



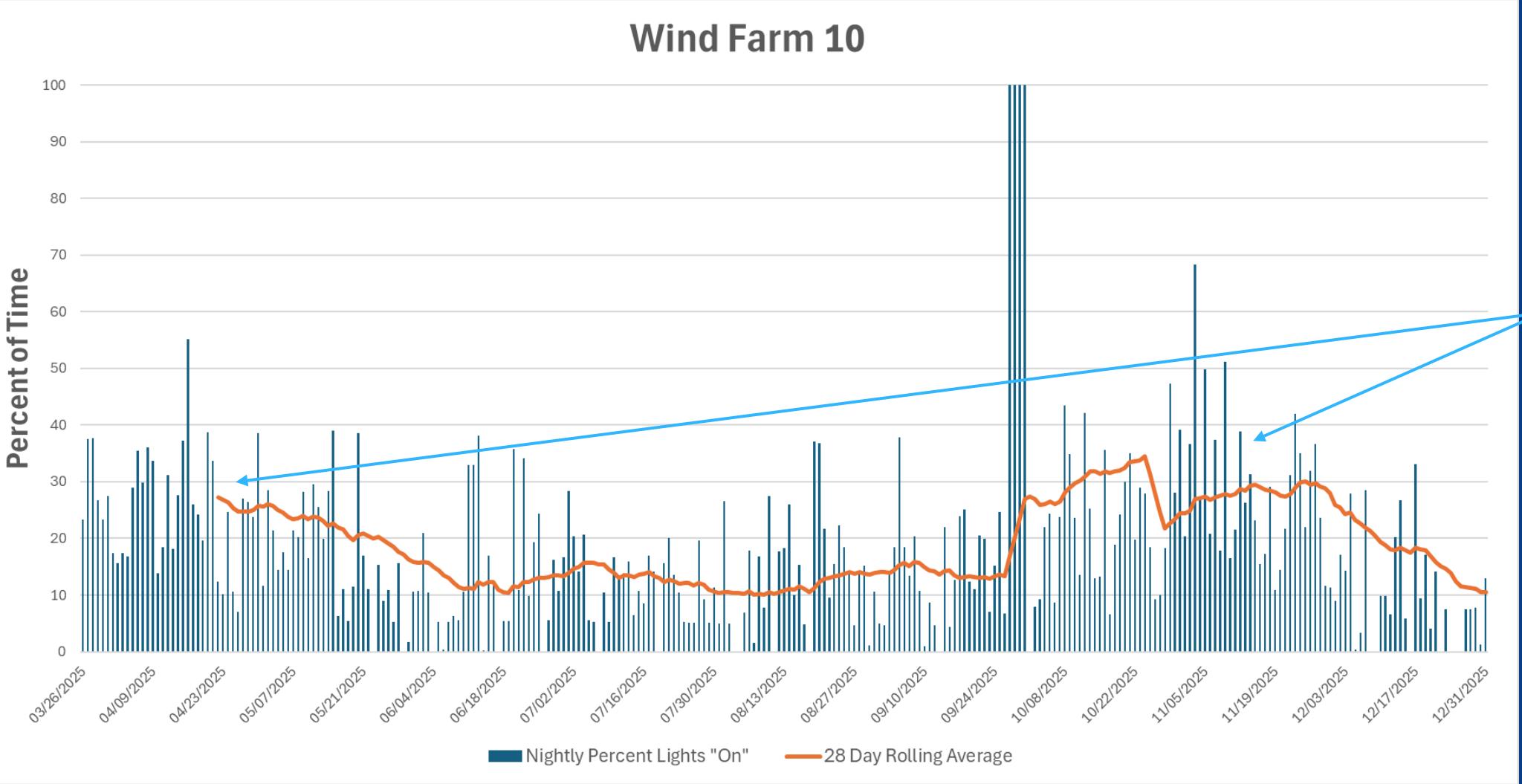
Wind farm did not report the cause of the lights on 100% of the night.

Rolling average indicates lights on 20% to 30% of time when all night lights on events are excluded.



ADLS outage in July and August.

Rolling average indicates lights on 5% to 50% of time when prolonged ADLS outages are excluded.



Higher rolling averages in spring and fall due to waterfowl migration

Rolling average indicates lights on 10% to 30% of time.

Outstanding Questions

- **Why do some wind farm ADLSs perform better than others?**
  - Is the ADLS performance impacted by the wind farm's location?
    - Example: airports near the wind farm, rolling hills with vehicle traffic, or heavy waterfowl migration area.
  - Is the wind farm's ADLS capable of continuous aircraft monitoring?
    - This avoids the need for the FAA's required 30-minute timer and would reduce lights on time
  - Can the wind farm's ADLS be fine-tuned?
    - Can ADLS settings be adjusted to reduce duration lights are on while still meeting FAA requirements and ensuring safety to aircraft?
    - If there is a consistent cause for false positive detections, can the false positives be filtered out while still meeting FAA requirements and ensuring safety to aircraft?

- **Are the lights activated at the same time every night, which doesn't show up in the nightly data collected for this survey?**
  - Example: the windfarm's lights may be on every evening over the same period due to human activity and aircraft-like detections in the area when community members would likely see the obstruction lighting.

Staff's Conclusions

- **Qualitative responses to the question "How often should the community expect wind turbine lights to be off" do not align with the performance data**
  - Eight wind farms responded that the community should expect lights to be off most of the time, whereas the performance data indicates turbine lights are on 10% to 50% of the time, depending upon the wind farm
  - Performance data aligns with what Staff has heard from community members
- **Most wind farms have "lights-on" 28-day rolling averages below 30%, if outages excluded**
  - Staff questions whether some wind farms could further fine-tune their ADLSs to improve performance by filtering out regular false positive detections; however, ADLS OEM's radar technician would need to do this to ensure the fine-tuning does not adversely impact aircraft safety
- **Wind farms are not similarly situated; therefore, performance will vary across wind farms**
  - Factors: location, adjacent airports, terrain, human activity in wind farm area, waterfowl migration corridors, weather patterns, insects, etc.
- **Performance data indicates establishing a numeric threshold for managing ADLS performance is not possible due to the need to ensure safety to aircraft, FAA requirements, and the unique characteristics of each wind farm**
  - Possible solution: the Commission could require wind farms to provide a certification from the ADLS OEM stating that the system was fine-tuned to control wind turbine obstruction lighting at the ADLS' full capability