ERCOT's Growing Wind Resource May be Causing an Increasing Number of Loss of Load Days Per Year

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Motivation for an LOLE Type of Study

1) It's been several years since ERCOT's dropping reserve margin has been studied to see what the predicted number of LOLE loss of load days is now and into the future.

2) ERCOT had emergency events on Aug 13 & 15, 2019 resulting in a $9000/MWh nodal clearing price. I wondered if the LOLE = 2 d/y?
http://www.ercot.com/content/wcm/key_documents_lists/161478/5.1_Summer_2019_Operational_and_Market_Review.pdf

3) The demand price response was estimated to be about 2500 MW.
http://www.ercot.com/content/wcm/lists/200201/49852_ERCOT_Update_Demand_Response_Summer_2019_Assessment.pdf

4) No load was shed in the sense of LOLE type load shedding.

Data Collection Needed to Run the RTS4 Program

1) Historical hourly profiles of load, wind, and solar - ERCOT has posted these in convenient to extract formats from actual hourly average MWs each hour (an hourly energy) which are Per Unitized. Solar installed capacity values over time were obtained from EIA monthly generator data for Sept 2019. These PU profiles were prepared for 2017, 2018, and 2019.

2) Generator data could have been obtained from ERCOT CDR and SARA listings; however, I decided to extract it directly from the summer peak load flow data for years 2018-2027. The load flow data gives the total generation MW and a breakdown of regional wind MWs and capacity factors.

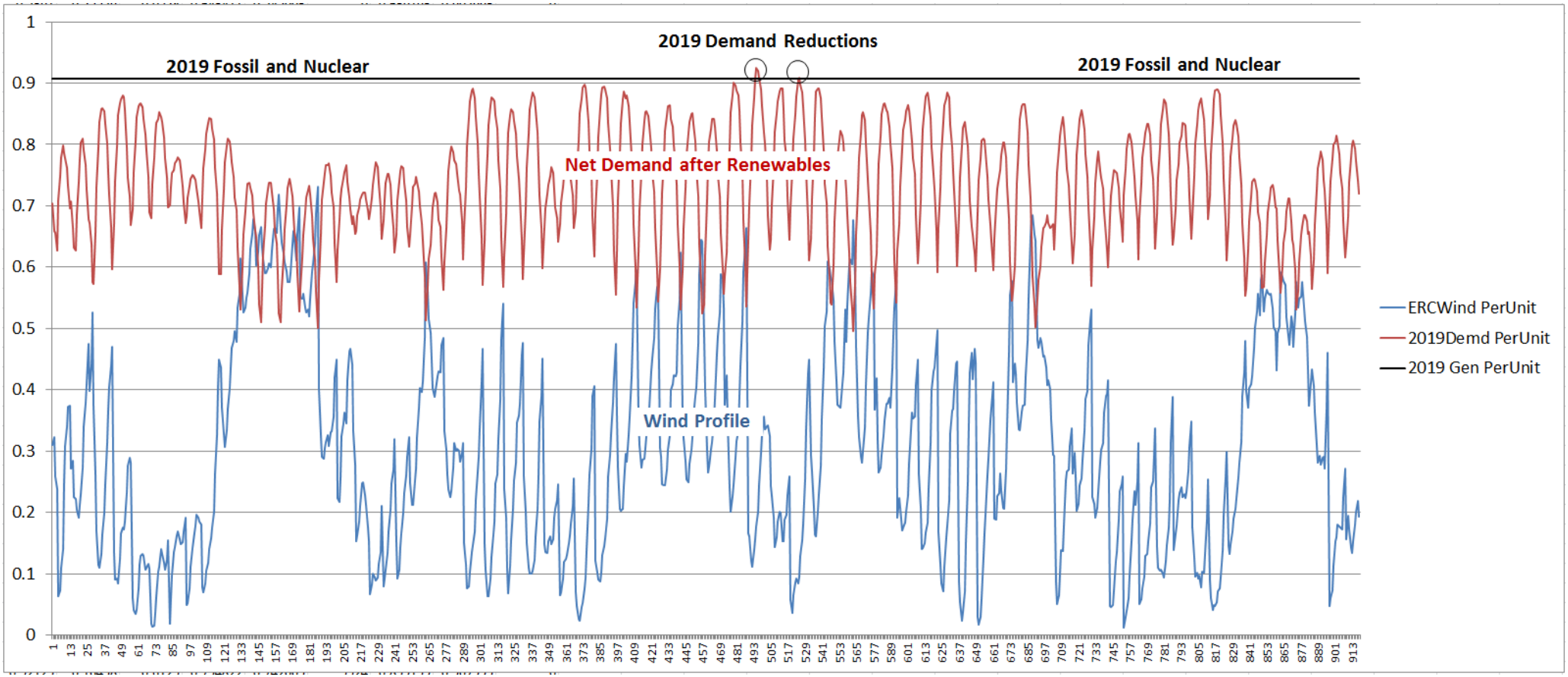
A Discovery Was Made About the Load Flow Data

Year	load flow created	load flow MW gener	CO_2+nucl firm Pmax	Wind Pmax	Wind extra MW	Solar Pmax	short d/y
2018	Feb-18	83219	73417+4981	21744@24%	921	1242@75%	0
2019	Oct-18	85213	72413+4960	26257@28%	2275	1583@75%	2
2021	Jun-19	93346	73648+4960	31239@44%	7850	4150@74%	18
2023	Mar-20	97989	72762+4960	32126@51%	10464	7542@74%	32
2027	Jun-20	104215	72355+4973	35829@52%	11283	11884@76%	54

Note that the load flow data must have enough generation MW to serve the load and losses. When ERCOT is capacity deficient, noncoastal wind is increased above its 14.2% summer average value. The @24% of wind Pmax means that wind is running at 24% of the wind generator max rating. The extra wind generation MW for each year is listed in the extra MW column. 2027 is 11283 MW deficient. Solar is set to ~75% of it's Pmax.

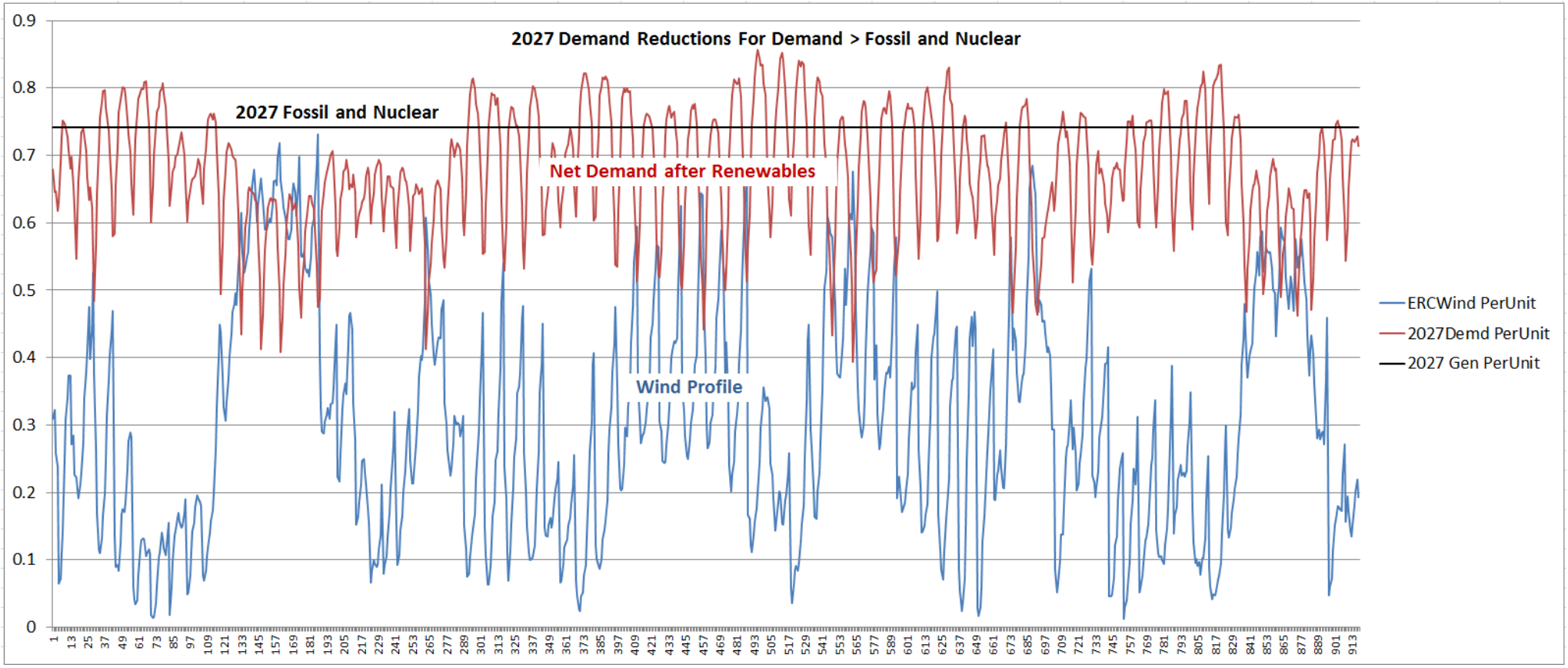
The short d/y column is the number of days in a year generation is insufficient. A simple sweep through the hourly demand, wind, and solar profiles calculates gas MW's needed for no curtailments. If the calculated gas MW's are greater than the CO_2+nuclear Pmax capacity, then that hour has insufficient generation. Counting the number of days this shortage has occurred gives the data in the short d/y column.

Below are the 2019 Capacity Shortages – Barely a Blip



Note the two little circles near the top which are the Aug 13 & 15 dates in 2019. The $9000/MWh occurred at deficiencies of 3100 and 1800 MW. A sweep through the load flow data produces the same deficiencies at a 1650 MW lower value than ERCOT's.

Below are the 2027 Capacity Shortages – Frightening



The only hours shown are demand >0.70 per unit of annual peak. The 2027 capacity shortage is extensive. It would take 99 GW wind and 58 GW solar to reach 0 d/y. A combination of new gas, new solar, battery storage, and DSM is more realistic. <u>It seems unlikely DSM alone will be able to manage this large amount of capacity deficiency.</u>