

Plant performance analysis with satellite resource data and public power data

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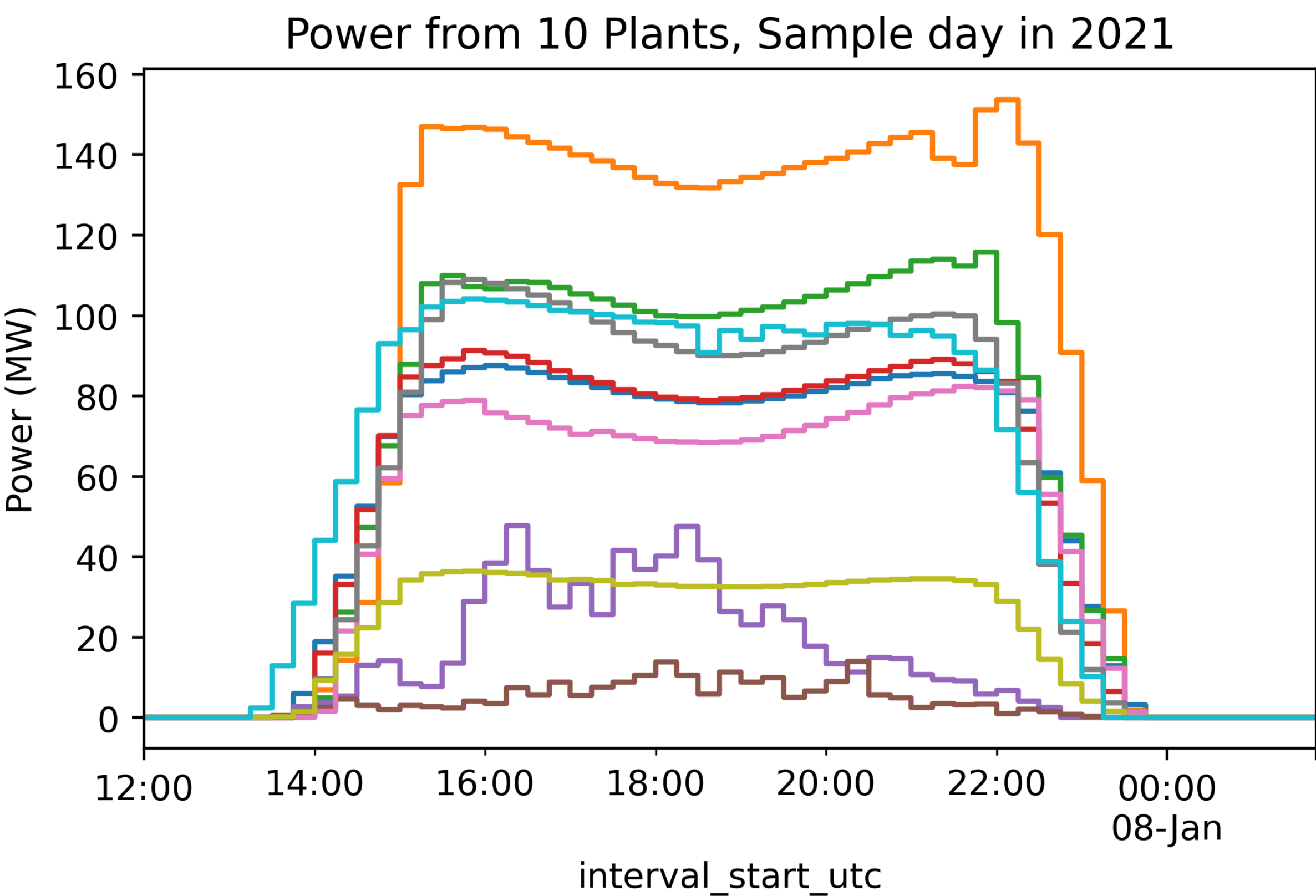


Power data are available for **every solar plant** in ERCOT at 15-min intervals back to 2012. **Someone should analyze it all and publish results.** Here is a small preview.

Data: Generation data are published by ERCOT with a 60-day delay [1]. Archive goes back to 2012 [2]. 3rd-party access from gridstatus.io API goes back to 2018 [3] with paid + free options.

Metadata: ERCOT uses abbreviated codes for plant names, matched with ERCOT CDR reports [4] to get full unit names, capacities, and counties, then matched* with EIA 860 data [5] for key modeling specs (lat/lon, fixed/tracking, cell type, tilt, etc.).

*Matching with EIA was not 100% successful due to inconsistent names. I used fuzzy string matching [6] on portions of plant name + county with ~2/3 of sites being matched (no false positives, I don't think...)

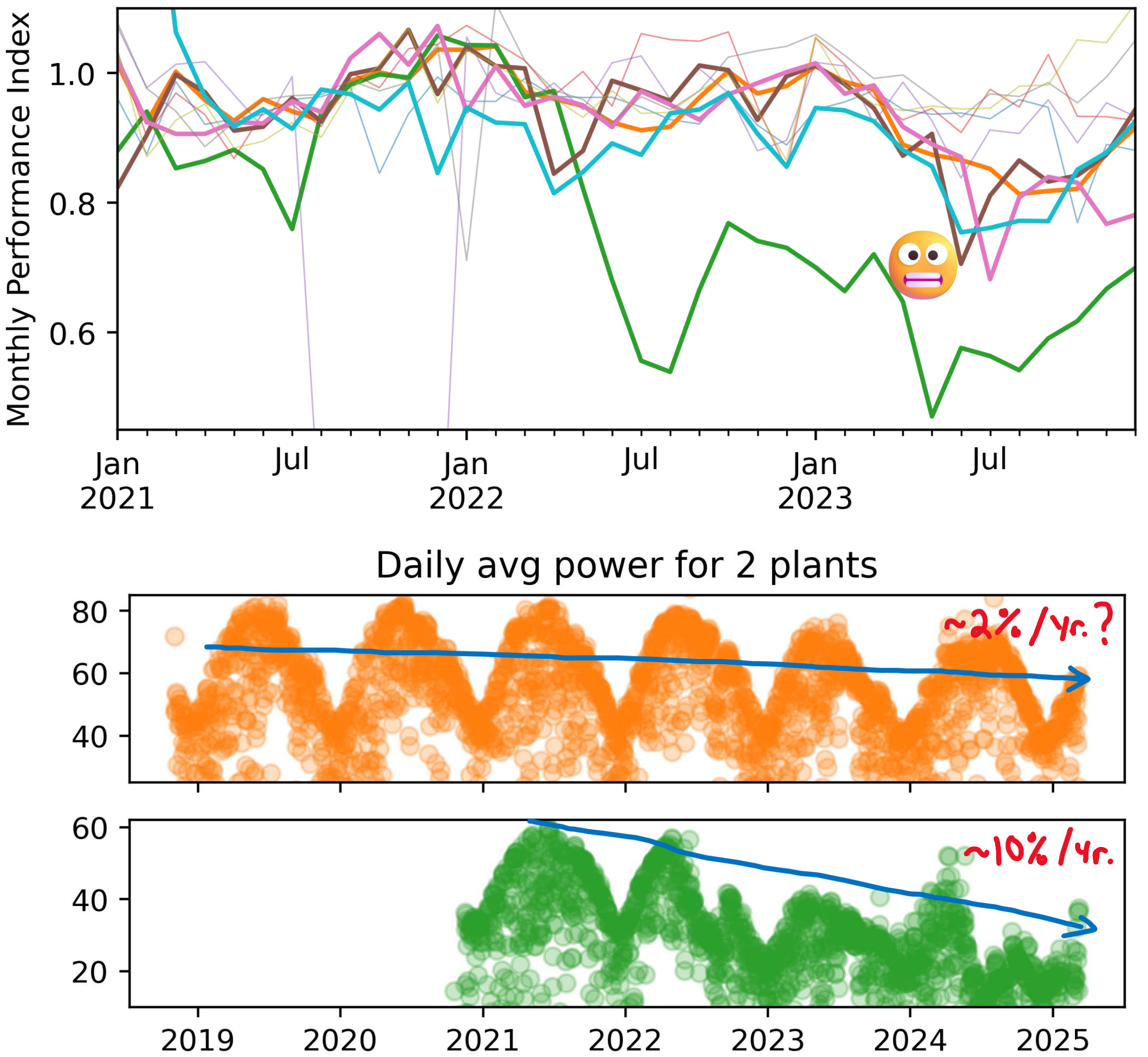


Sample Analysis:

- Semi-random sample of 10 plants
- Modeled expected power with NSRDB PSM4 [7] and pvlib [8] via pv-system-model [9] to calculate **performance index (PI)**
- Estimated parameters not in EIA 860 (gcr, gamma_pdc, dc_loss_fraction) using `scipy.optimize.minimize`.

Initial results: **5 of 10** plants appear to have **big drops in PI** from 2021 to 2023. **1 of 10** looks like 10%/yr power loss rate. What's going on? Maybe major recurring curtailment? **More analysis on more plants is needed.**

What's next? Someone should get *all* this data, do proper (rigorous) analysis, and publish results, similar to PV Fleets.



References:

[1] <https://www.ercot.com/mp/data-products/data-product-details?id=NP3-965-ER>
[2] <https://data.ercot.com/data-product-archive/NP3-965-ER>, free login account needed, 1 .zip file of CSVs per day
[3] https://www.gridstatus.io/datasets/ercot_sced_gen_resource_60_day
[4] https://www.ercot.com/files/docs/2025/02/12/CapacityDemandandReservesReport_December2024.xlsx, from <https://www.ercot.com/gridinfo/resource>,
[5] EIA Form 860, "3_3_Solar_Y2023.xlsx", in <https://www.eia.gov/electricity/data/eia860/xls/eia8602023.zip>, from <https://www.eia.gov/electricity/data/eia860/>
[6] <https://github.com/seatgeek/thefuzz>
[7] <https://developer.nrel.gov/docs/solar/nsrdb/nsrdb-GOES-conus-v4-0-0-download/>, available via pvlib alpha release, https://pvlib-python.readthedocs.io/en/latest/reference/generated/pvlib.iotools.get_nsrdb_psm4_conus.html
[8] Anderson, K., Hansen, C., Holmgren, W., Jensen, A., Mikofski, M., and Driesse, A. "pvlib python: 2023 project update." Journal of Open Source Software, 8(92), 5994, (2023). <https://doi.org/10.21105/joss.05994>
[9] <https://github.com/williamhobbs/pv-system-model>

Code available:

https://github.com/williamhobbs/PVPMC_2025



Acknowledgements:

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