The critical role of weather datasets in resource adequacy analysis

Elaine Hart, *Moment Energy Insights*

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GridLAB MOMENT ENERGY INSIGHTS Blue Marble Analytics

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GridPath RA Toolkit

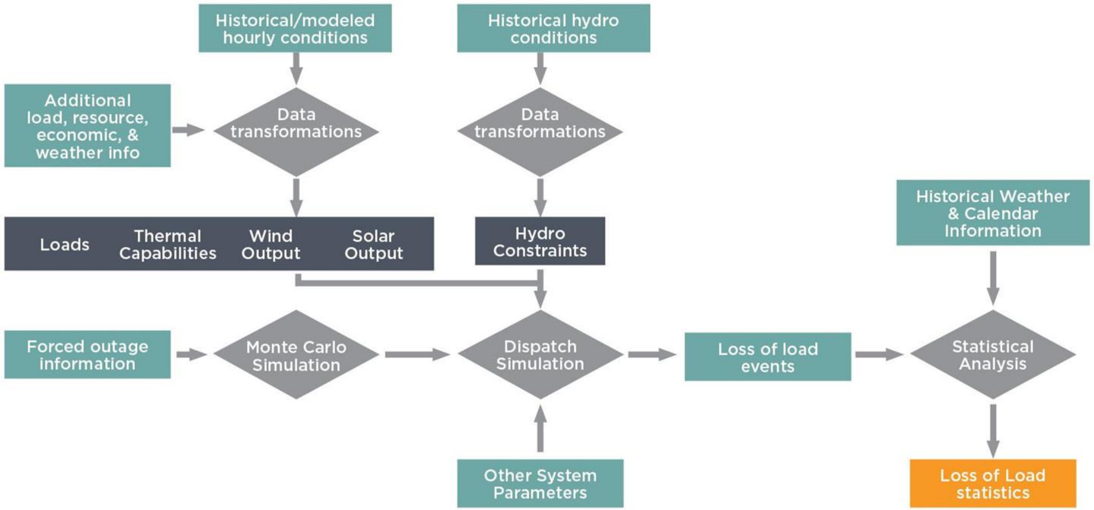
Open-source Toolkit for conducting RA analysis in the Western US using publicly available data.

The Toolkit consists of:

- **GridPath**, Blue Marble's open-source power system platform, which includes capacity expansion, production cost, and RA modeling: https://github.com/blue-marble/gridpath
- **Accompanying code** to develop and post-process RA runs in GridPath: https://github.com/MomentEI/GridPath_RA_Toolkit
- **Study Report and Western US Dataset**, which includes the load, resource, and transmission data for conducting RA assessments of the Western US in 2026: www.gridlab.org/GridPathRAToolkit

Users can customize the datasets to evaluate other systems, years, or portfolios. Users can also modify the code to leverage additional capabilities in GridPath or to create new functionality.

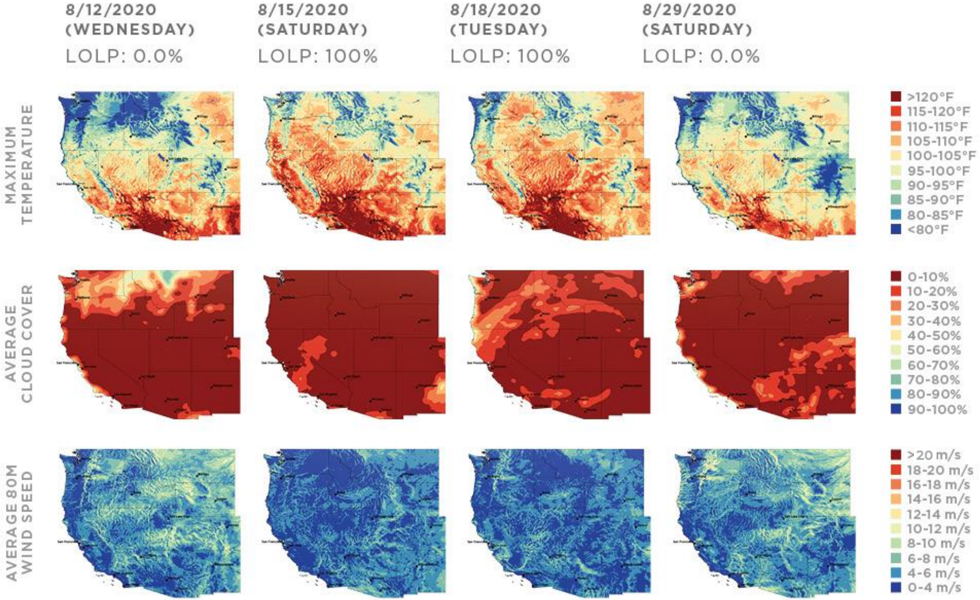
Weather-Synchronized simulation



- Weather-synchronized simulation tests several years of coherent weather conditions and their impacts on load and resource availability
- Ensures that conditions are physically consistent and preserves all correlations
- Allows for transparent investigation into the weather patterns that drive loss of load risk
- Simulated days are limited to conditions with coherent high resolution hourly data

Weather insights

An application of Weather-Synchronized simulation



High LOLPs driven by wide-spread heat events across Western load centers

These events also see relatively low wind speeds

[Data source: NOAA High-Resolution Rapid Refresh (HRRR) Data Archive: AWS Open Data Program (https://mesowest.utah.edu/html/hrrr/)]

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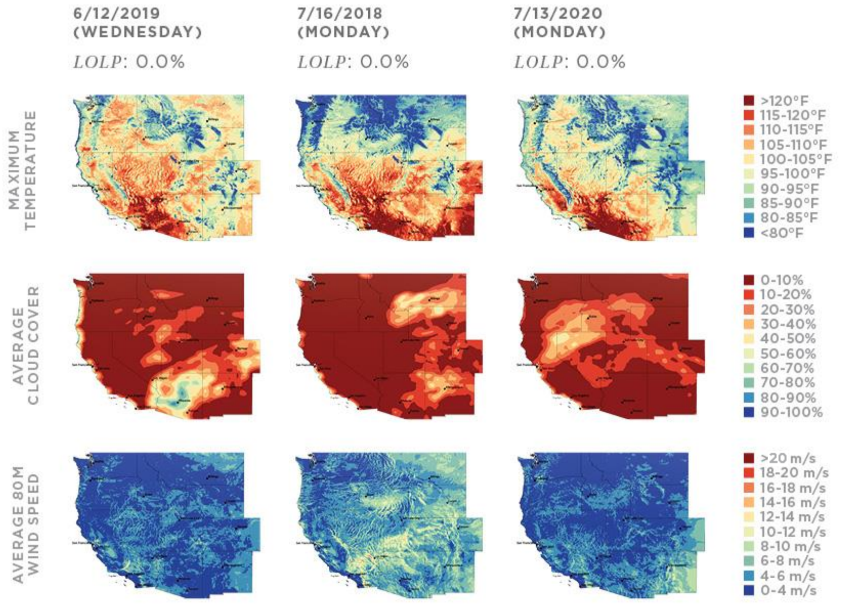
Weather insights

An application of Weather-Synchronized simulation



[Data source: NOAA High-Resolution Rapid Refresh (HRRR) Data Archive: AWS Open Data Program (https://mesowest.utah.edu/html/hrrr/)]

June 12, 2019

Seattle: 95°F
Portland: 98°F
Sacramento: 103°F
Phoenix: 112°F
Los Angeles: 72°F
San Diego: 74°F

July 16, 2018

Seattle: 92°F
Portland: 98°F
Phoenix: 105°F
San Francisco: 69°F
LA & San Diego: 79°F

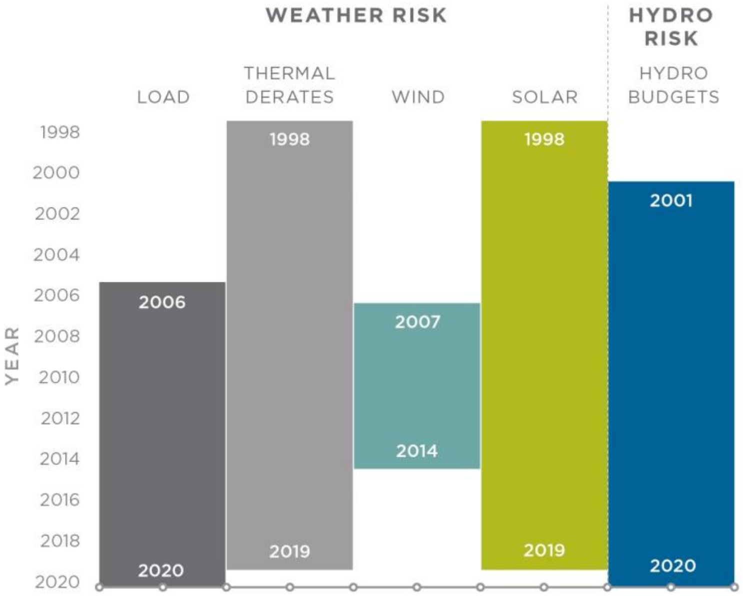
July 13, 2020

Seattle: 76°F
Portland: 80°F
Phoenix: 114°F

Geographically isolated heat does not result in high LOLP due to load diversity

Individual utility plans may overemphasize these events

Weather data availability



Weather-synchronized simulation is severely limited by data availability

Key public data sources:

- Hourly solar and temperature data: National solar radiation database (NSRDB), 1998-2021 weather
- Hourly windspeed at hub height: NREL Wind Toolkit, 2007-2014 weather
- Hourly load: FERC Form 714 (must be transformed to reflect study year energy economy), 2006-2020 weather

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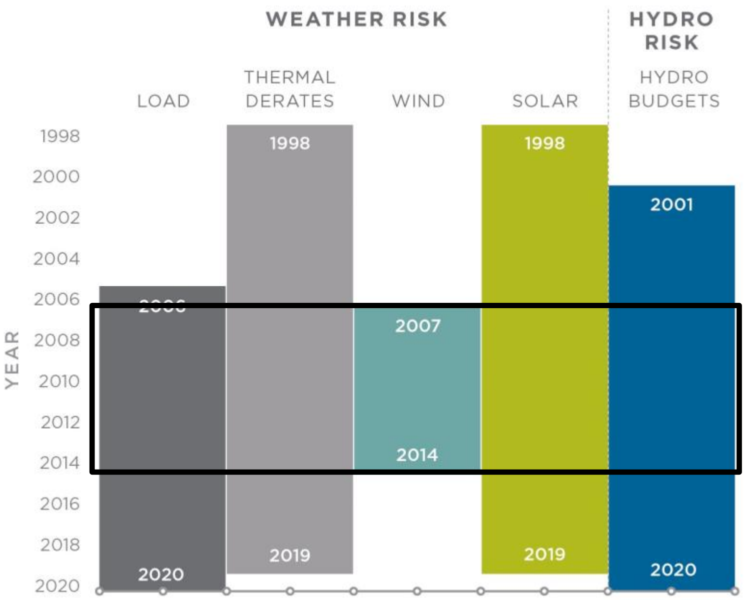
Weather data availability



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These datasets only overlap over 8 years of weather conditions, and they exclude the most recent years, which have seen extreme weather

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RA risk by weather year

LOLE (days per year)

Hydro Year \ Weather Year	2007	2008	2009	2010	2011	2012	2013	2014
2001	0.28	0.00	0.02	0.20	0.30	0.38	0.15	0.00
2002	0.23	0.00	0.01	0.17	0.22	0.32	0.01	0.00
2003	0.21	0.00	0.00	0.12	0.10	0.27	0.00	0.00
2004	0.20	0.00	0.01	0.13	0.11	0.29	0.01	0.00
2005	0.20	0.00	0.00	0.11	0.08	0.25	0.00	0.00
2006	0.20	0.00	0.00	0.10	0.06	0.25	0.00	0.00
2007	0.22	0.00	0.00	0.14	0.11	0.30	0.04	0.00
2008	0.22	0.00	0.00	0.13	0.08	0.27	0.00	0.00
2009	0.25	0.00	0.00	0.20	0.34	0.38	0.00	0.00
2010	0.22	0.00	0.00	0.16	0.18	0.30	0.00	0.00
2011	0.18	0.00	0.00	0.00	0.00	0.05	0.00	0.00
2012	0.20	0.00	0.00	0.03	0.00	0.11	0.00	0.00
2013	0.25	0.00	0.01	0.18	0.23	0.33	0.02	0.00
2014	0.29	0.00	0.01	0.20	0.32	0.41	0.00	0.00
2015	0.31	0.04	0.07	0.21	0.48	0.63	0.18	0.00
2016	0.27	0.01	0.01	0.20	0.29	0.38	0.07	0.00
2017	0.20	0.00	0.00	0.11	0.08	0.28	0.00	0.00
2018	0.22	0.00	0.00	0.16	0.19	0.32	0.00	0.00
2019	0.21	0.00	0.00	0.11	0.11	0.25	0.01	0.00
2020	0.21	0.00	0.00	0.12	0.08	0.27	0.03	0.00

- If limited to weather in 2007-2014, LOLE = 0.11 days/yr
- The system is apparently very close to meeting a 1 day in 10 year standard
- RA risk is driven by weather years 2007 & 2010-2012

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RA risk by weather year

LOLE (days per year)

Hydro Year \ Weather Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
2001	0.28	0.00	0.02	0.20	0.30	0.38	0.15	0.00	0.10	0.50	0.77	0.79	0.45	1.57
2002	0.23	0.00	0.01	0.17	0.22	0.32	0.01	0.00	0.00	0.20	0.69	0.48	0.23	1.27
2003	0.21	0.00	0.00	0.12	0.10	0.27	0.00	0.00	0.00	0.19	0.58	0.35	0.15	1.04
2004	0.20	0.00	0.01	0.13	0.11	0.29	0.01	0.00	0.00	0.20	0.58	0.38	0.06	1.05
2005	0.20	0.00	0.00	0.11	0.08	0.25	0.00	0.00	0.00	0.07	0.51	0.22	0.11	0.99
2006	0.20	0.00	0.00	0.10	0.06	0.25	0.00	0.00	0.00	0.03	0.46	0.23	0.10	0.93
2007	0.22	0.00	0.00	0.14	0.11	0.30	0.04	0.00	0.01	0.17	0.66	0.32	0.23	1.19
2008	0.22	0.00	0.00	0.13	0.08	0.27	0.00	0.00	0.00	0.07	0.56	0.24	0.19	1.19
2009	0.25	0.00	0.00	0.20	0.34	0.38	0.00	0.00	0.02	0.19	0.73	0.53	0.33	1.44
2010	0.22	0.00	0.00	0.16	0.18	0.30	0.00	0.00	0.01	0.08	0.62	0.31	0.13	1.14
2011	0.18	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.16	0.01	0.00	0.69
2012	0.20	0.00	0.00	0.03	0.00	0.11	0.00	0.00	0.00	0.00	0.22	0.10	0.05	0.77
2013	0.25	0.00	0.01	0.18	0.23	0.33	0.02	0.00	0.02	0.14	0.71	0.38	0.30	1.39
2014	0.29	0.00	0.01	0.20	0.32	0.41	0.00	0.00	0.03	0.17	0.81	0.44	0.49	1.54
2015	0.31	0.04	0.07	0.21	0.48	0.63	0.18	0.00	0.24	0.56	0.91	0.84	0.75	1.72
2016	0.27	0.01	0.01	0.20	0.29	0.38	0.07	0.00	0.04	0.32	0.75	0.70	0.35	1.48
2017	0.20	0.00	0.00	0.11	0.08	0.28	0.00	0.00	0.00	0.09	0.52	0.25	0.03	1.03
2018	0.22	0.00	0.00	0.16	0.19	0.32	0.00	0.00	0.00	0.22	0.67	0.46	0.22	1.20
2019	0.21	0.00	0.00	0.11	0.11	0.25	0.01	0.00	0.00	0.28	0.58	0.51	0.11	1.01
2020	0.21	0.00	0.00	0.12	0.08	0.27	0.03	0.00	0.00	0.14	0.59	0.31	0.21	1.06

- In the study, we extended the weather record through 2020 using day matching to approximate wind conditions after 2014
- When considering 2007-2020, LOLE = 0.25 days/year
- RA risk is driven by many more weather years, especially 2020

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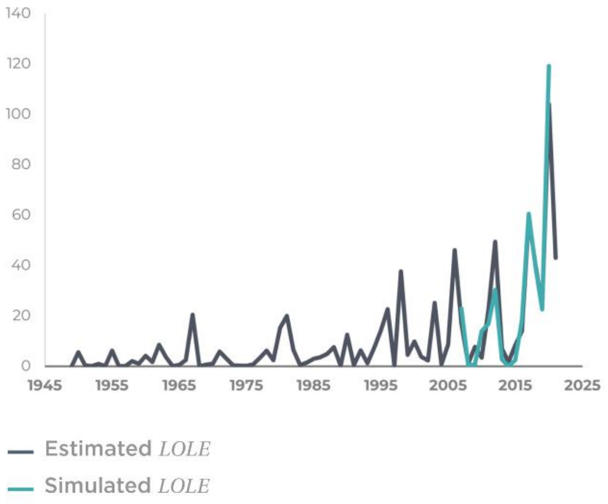
Examining impacts of weather trends

An application of Weather-Synchronized simulation

LOLE (DAYS EVERY 10 YEARS)



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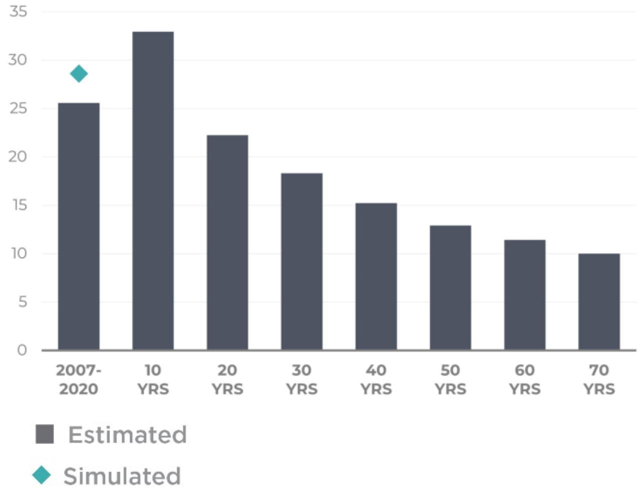

Longer term weather record may not be indicative of the near future. The selection of which weather years to consider is a policy decision

For more information…

Final report and data available at:
www.gridlab.org/GridPathRAToolkit

Or you can reach out to us:

Elaine Hart
elaine@momentenergyinsights.com

Ana Mileva
ana@bluemarble.run