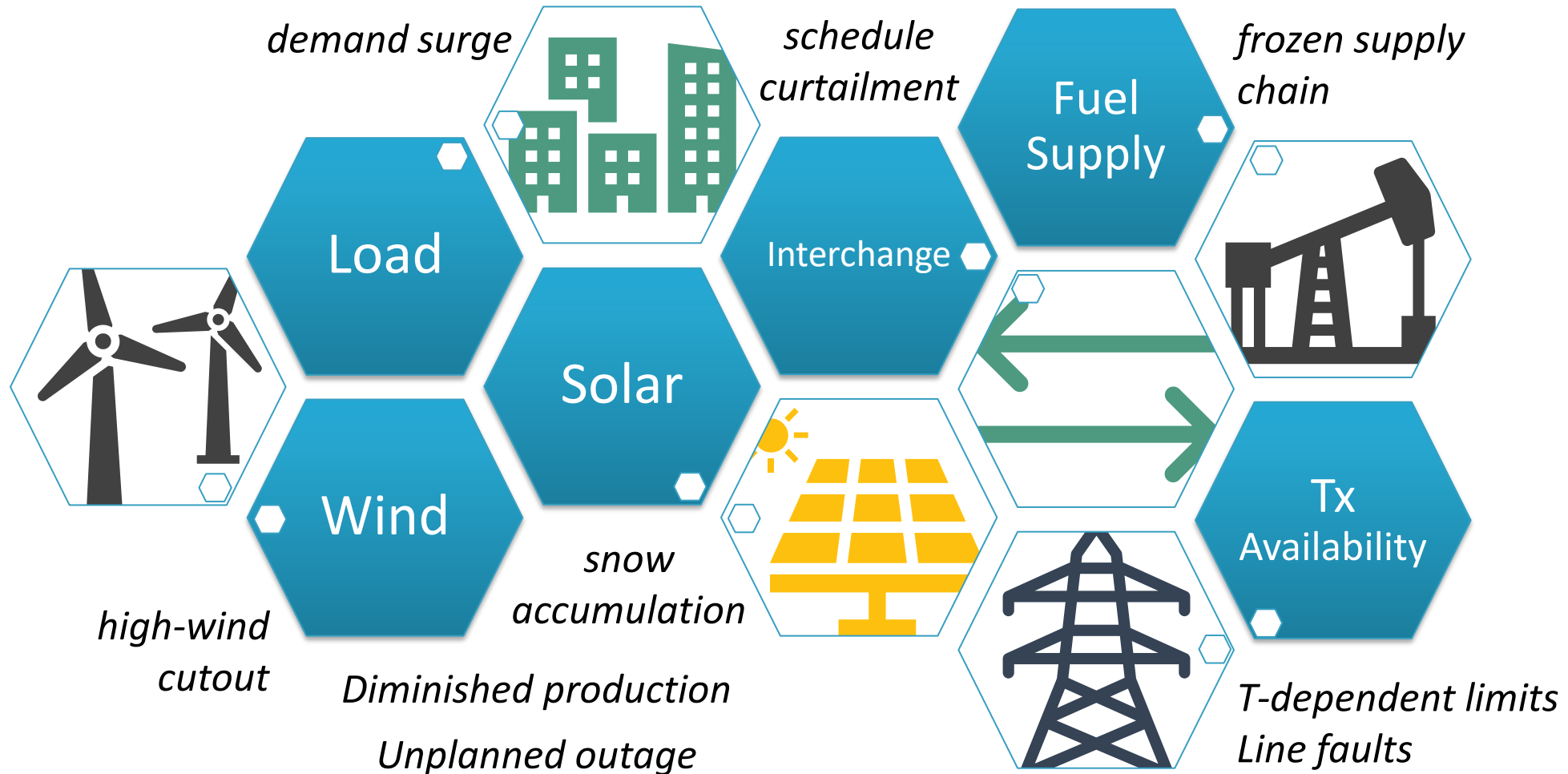




Weather-Correlated Datasets for Power System Planning



When an Extreme Weather Event Happens...



What is a Typical / Atypical Year?

- Applying statistically derived datasets from different vendors
 - What types of correlations have been aggregated away?
 - How to ensure temporal connections?
 - Misalignment of 1-in-10 representations
- P10s, P50s, P90s
 - A P90 for one location not necessarily a P90 for another



Alternative

Lean on historical correlations as scenarios for forward-looking studies

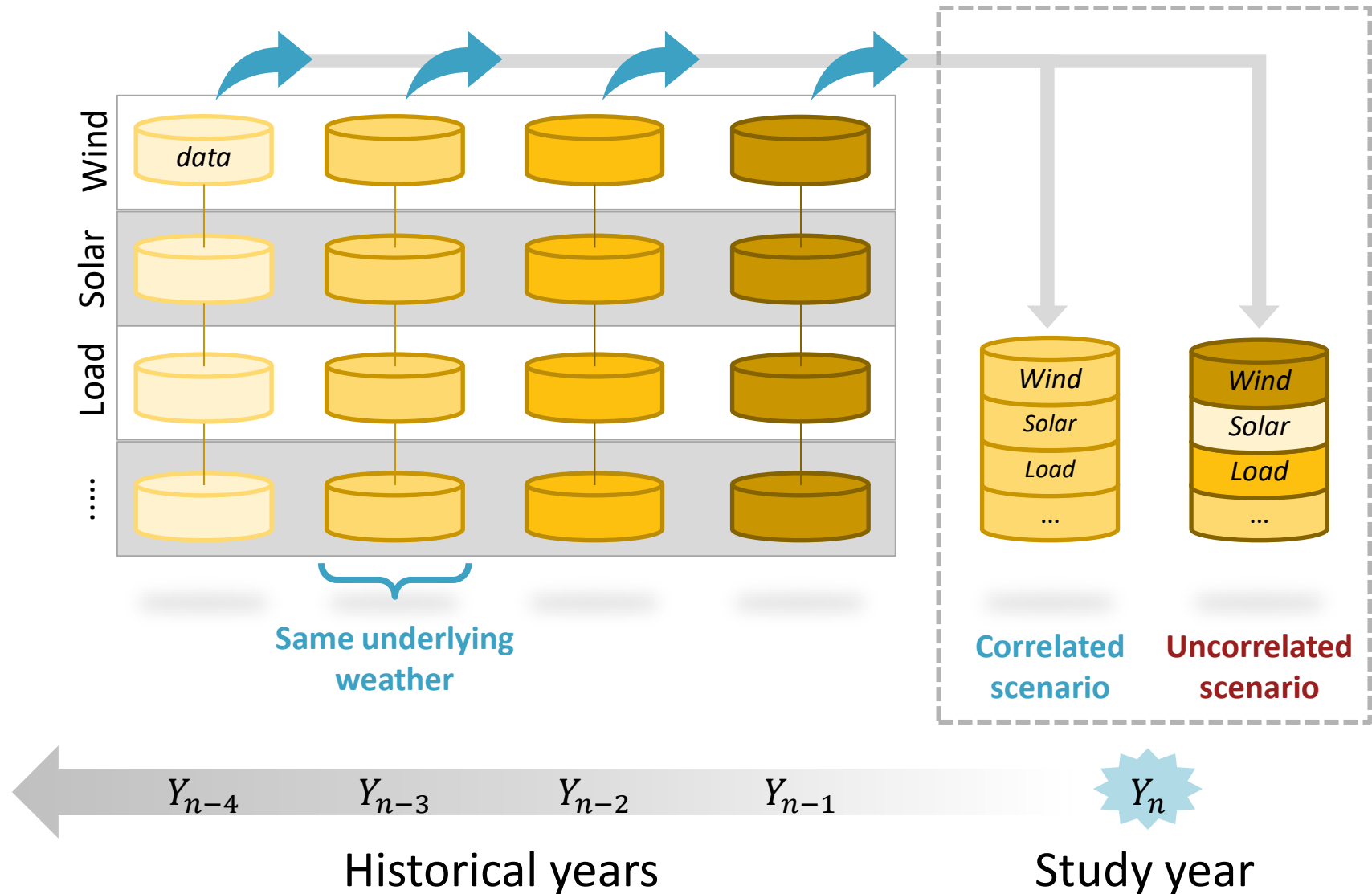
Historical Data for Future Scenarios

Challenges

- Lack of hourly site-level generation data
- Unclear mapping to model new builds

Modeling Approach

- *Start with available historical weather*
- *Model weather-to-power conversion*

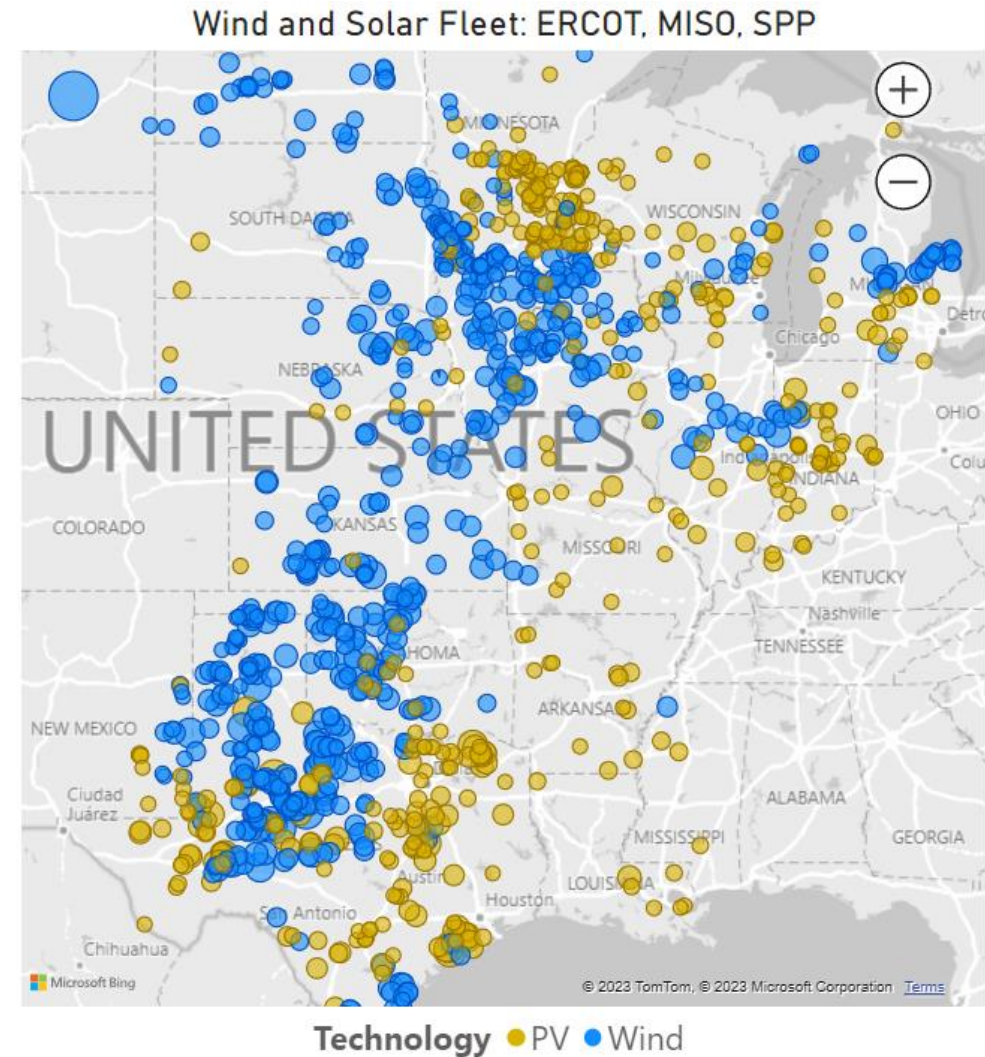
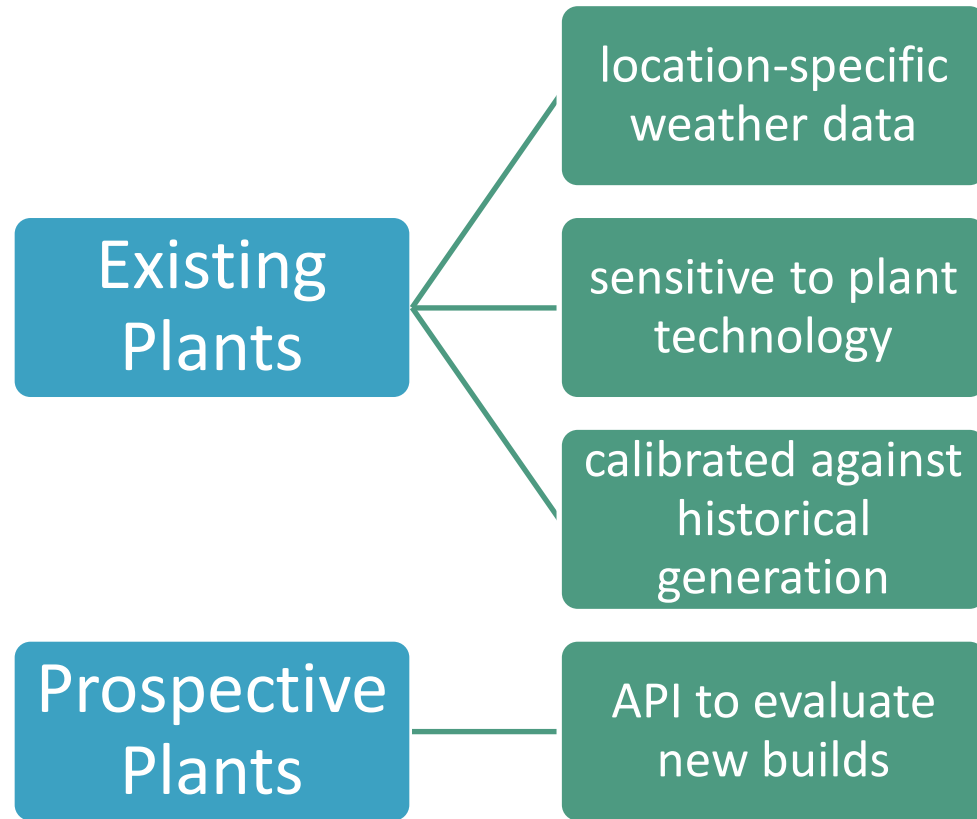


Weather-Correlated Datasets for Power System Planning

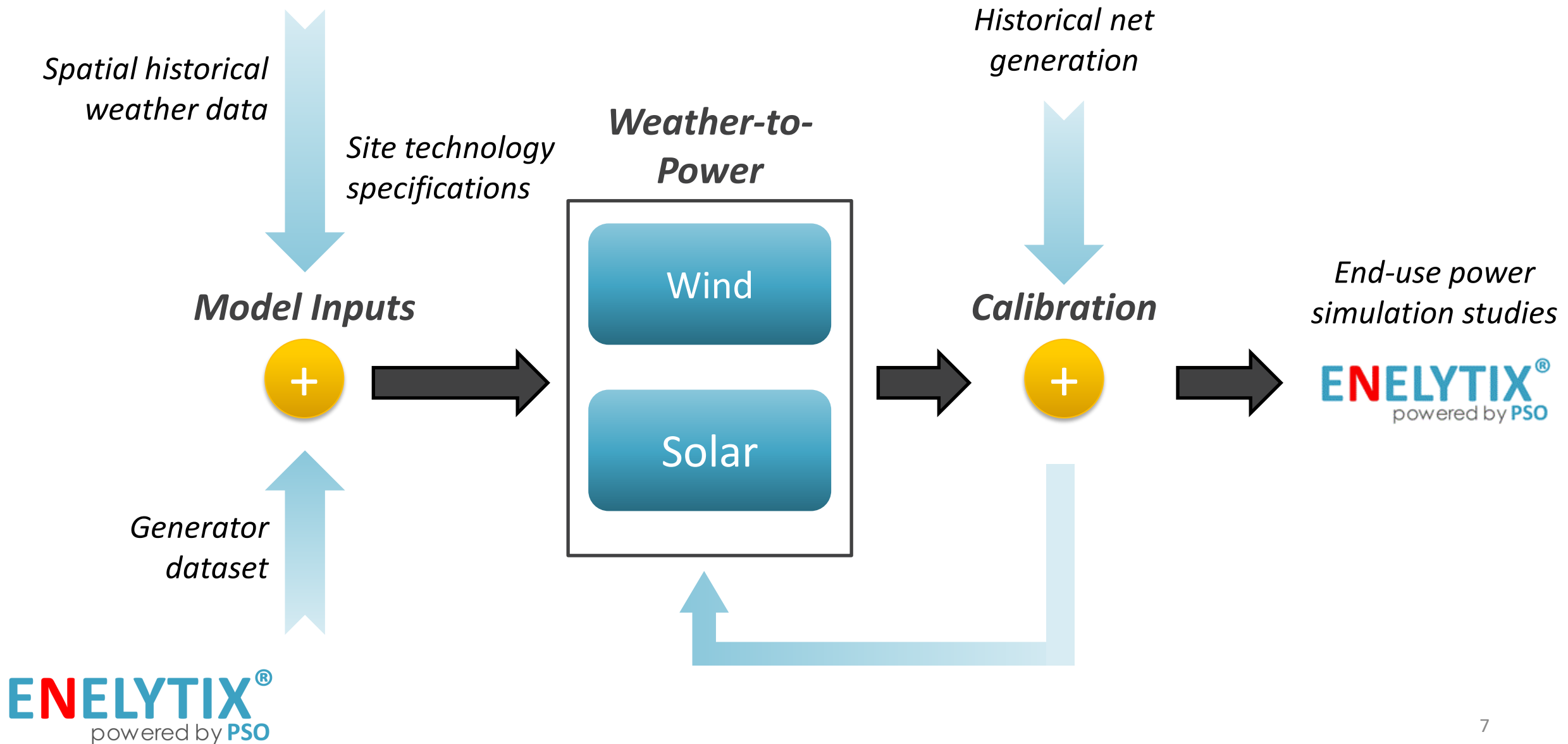
DATASET DEVELOPMENT

Overview of ENELYTIX Weather

ENELYTIX Weather provides weather-informed generation profiles for wind & solar power plants



High-Level Data Flow



Data Collection: Generators

Requirements

- Existing wind & solar fleet across the US
- Geographic location
- Standard identification codes (EIA)



Available within ENELYTIX data models

Model Inputs



Generator dataset



Wind

Solar



Data Collection: Weather Data

Requirements

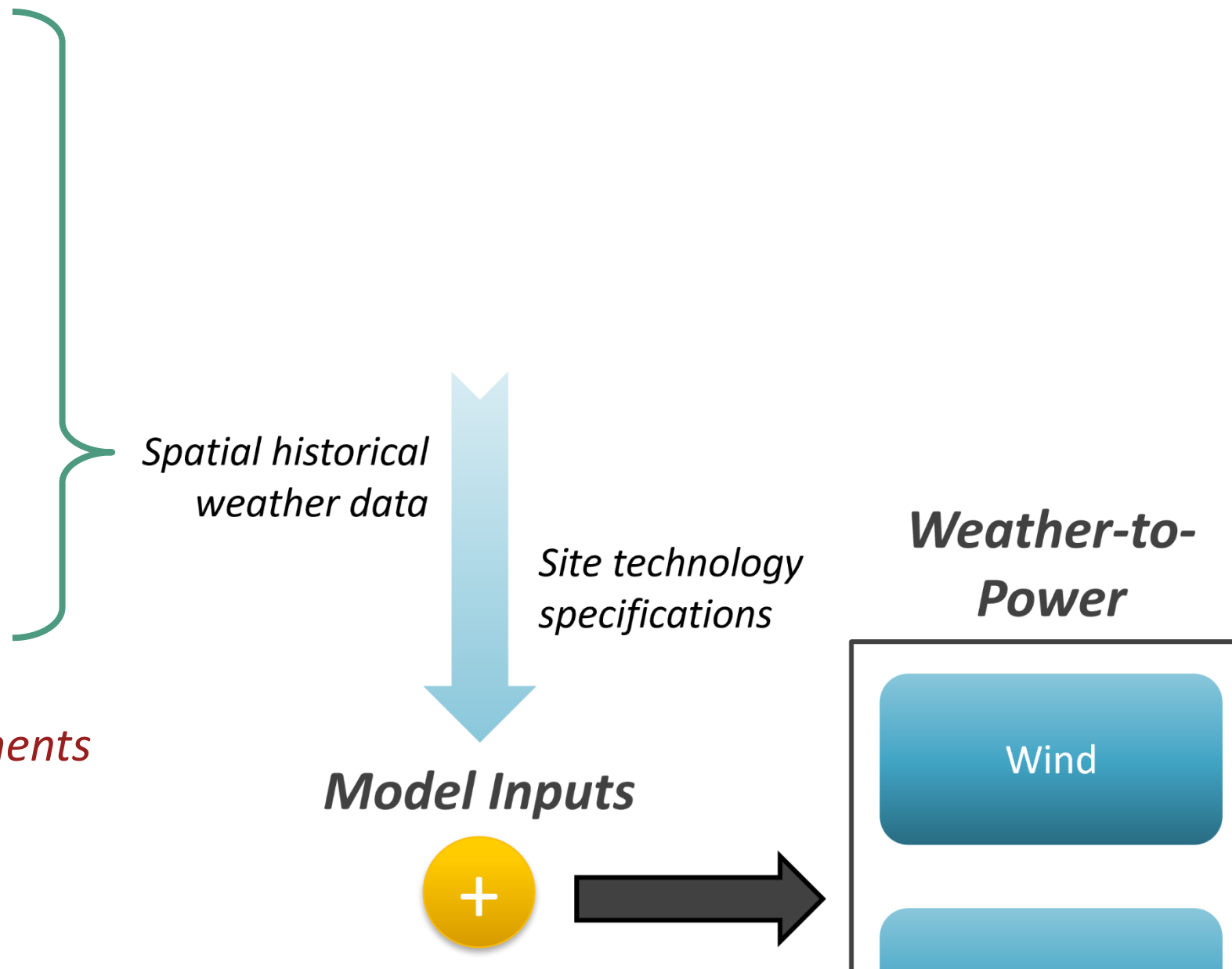
Weather variables

- Wind velocity and direction (multiple heights)
- Irradiance (DNI, DHI, GHI)
- Temperatures, pressure, snow depth, albedo

Data Coverage

- Global
- Hourly resolution
- >10 years
- ~~5km grid~~

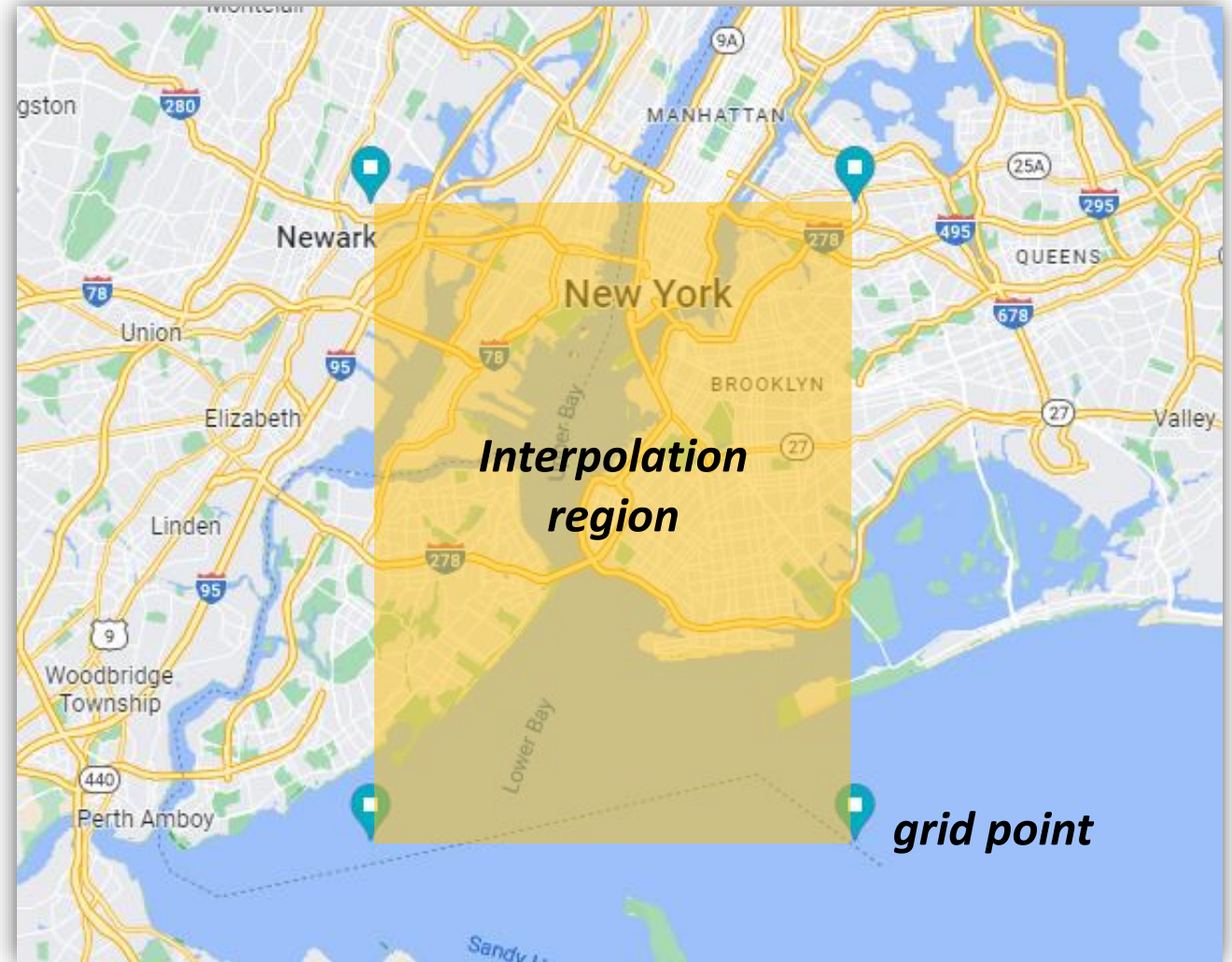
No product fit all these requirements



Weather Data Granularity

*Weather data used by
ENELYTIX Weather is provided
on a regular
 0.25° (31km) grid.*

*Datasets are **global** and can be
used for offshore wind analysis*



New York City shown as reference

Data Collection: Plant Technology

Requirements

Weather variables

- Wind velocity and direction (multiple heights)
- Irradiance (DNI, DHI, GHI)
- Temperatures, pressure, snow depth, albedo

Data Coverage

- Global
- Hourly resolution
- >10 years
- 5km grid

Requirements

- Wind turbine composition (make & model, no. of each type)
- Solar panel technology (efficiency, bifaciality)
- Solar array orientation (tilt & azimuth, tracking)

Spatial historical weather data

Site technology specifications

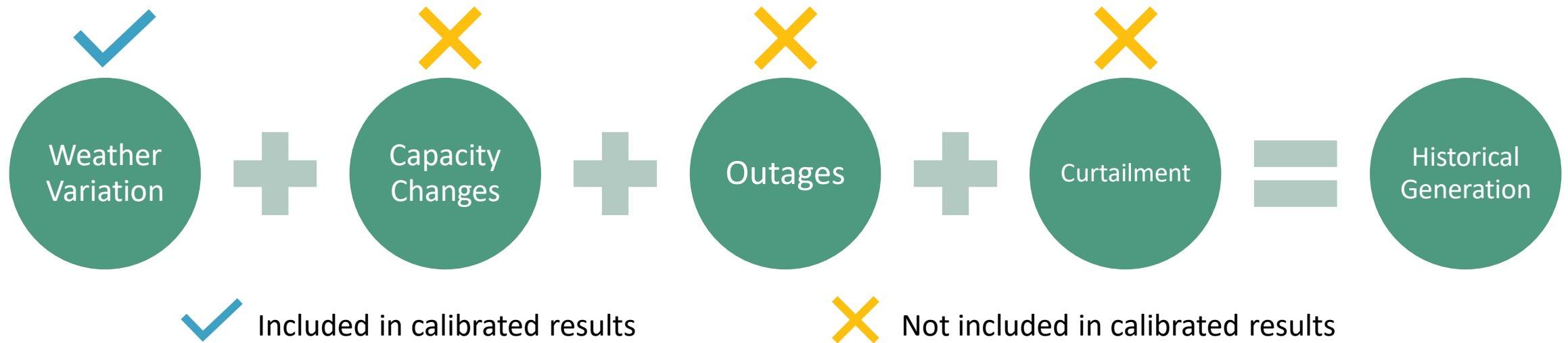
Model Inputs

Weather-to-Power

Wind

Data Calibration Process

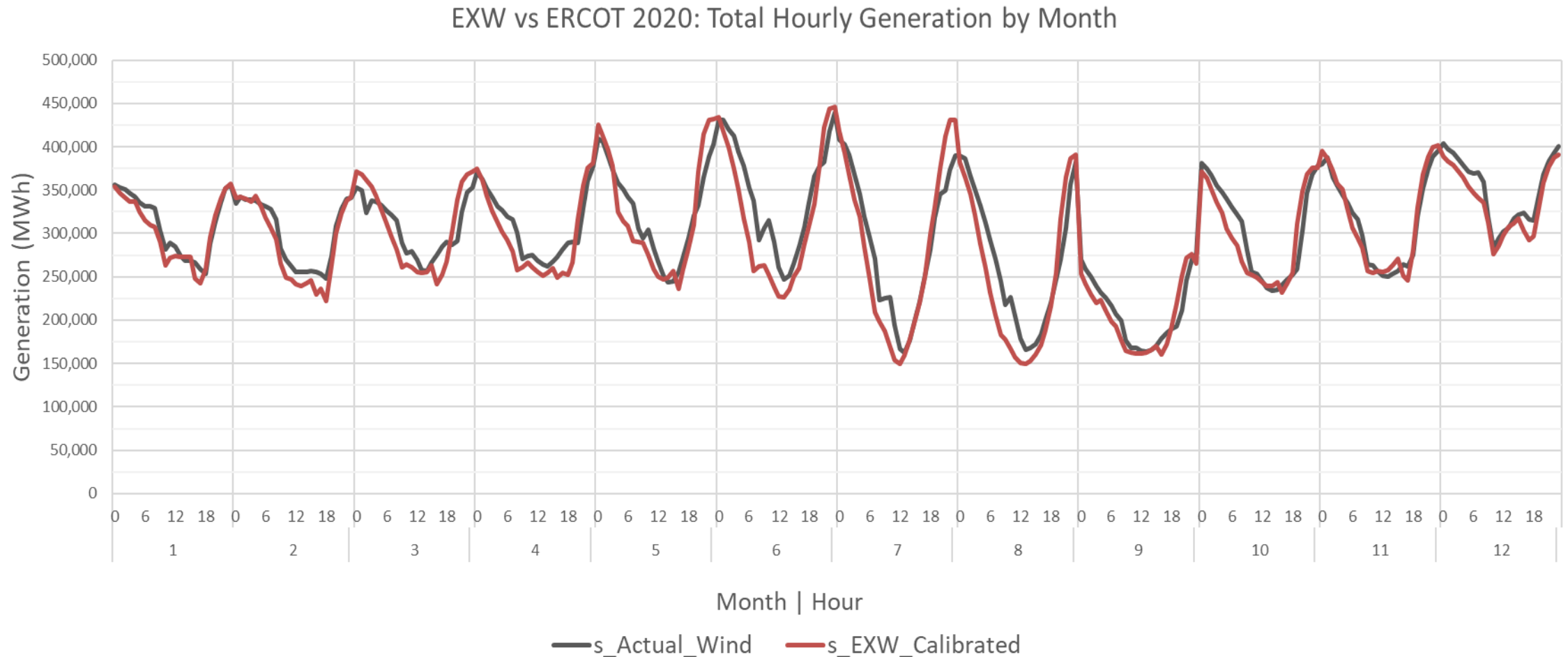
- Calibration performed by-plant, monthly, with handling for years before plant inception
- Design principles when calibrating for future scenarios:
 - Seek to explain generation variation from weather only
 - All historical years are baselined off current plant capacity



Weather-Correlated Datasets for Power System Planning

RESULTS ANALYSIS

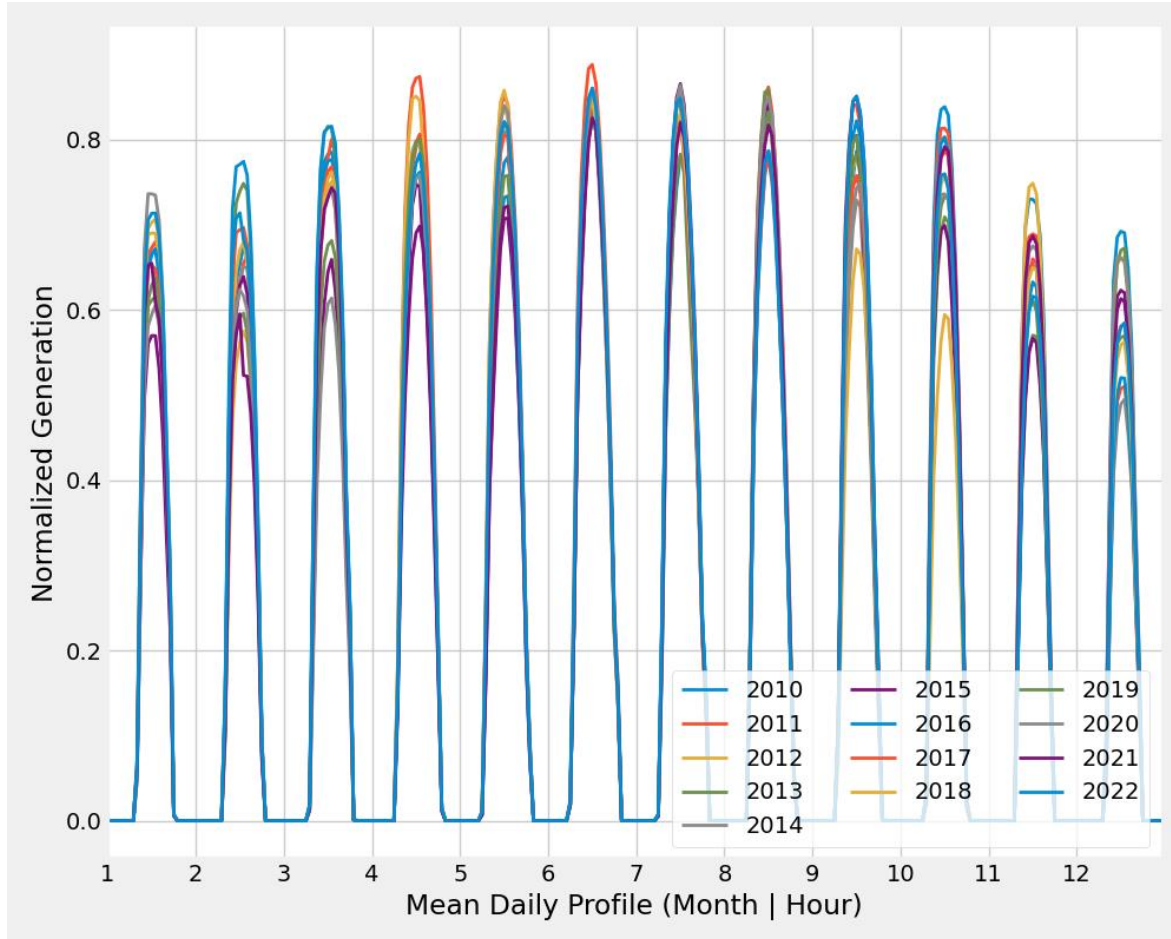
Hourly Alignment with ISO-reported Data



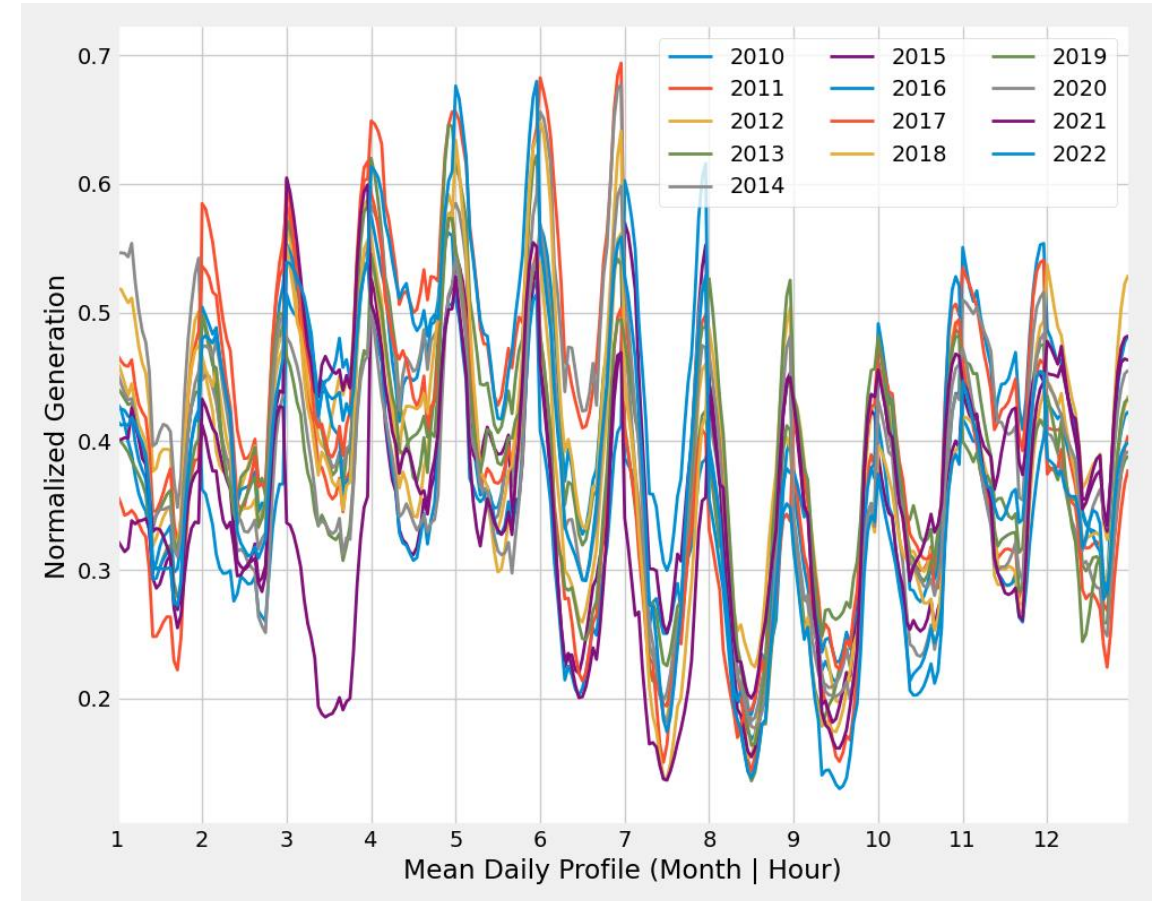
- ✓ Monthly energy trends captured by calibration process
- ✓ Hourly profiles captured by historical weather data

Variability for Planning Studies

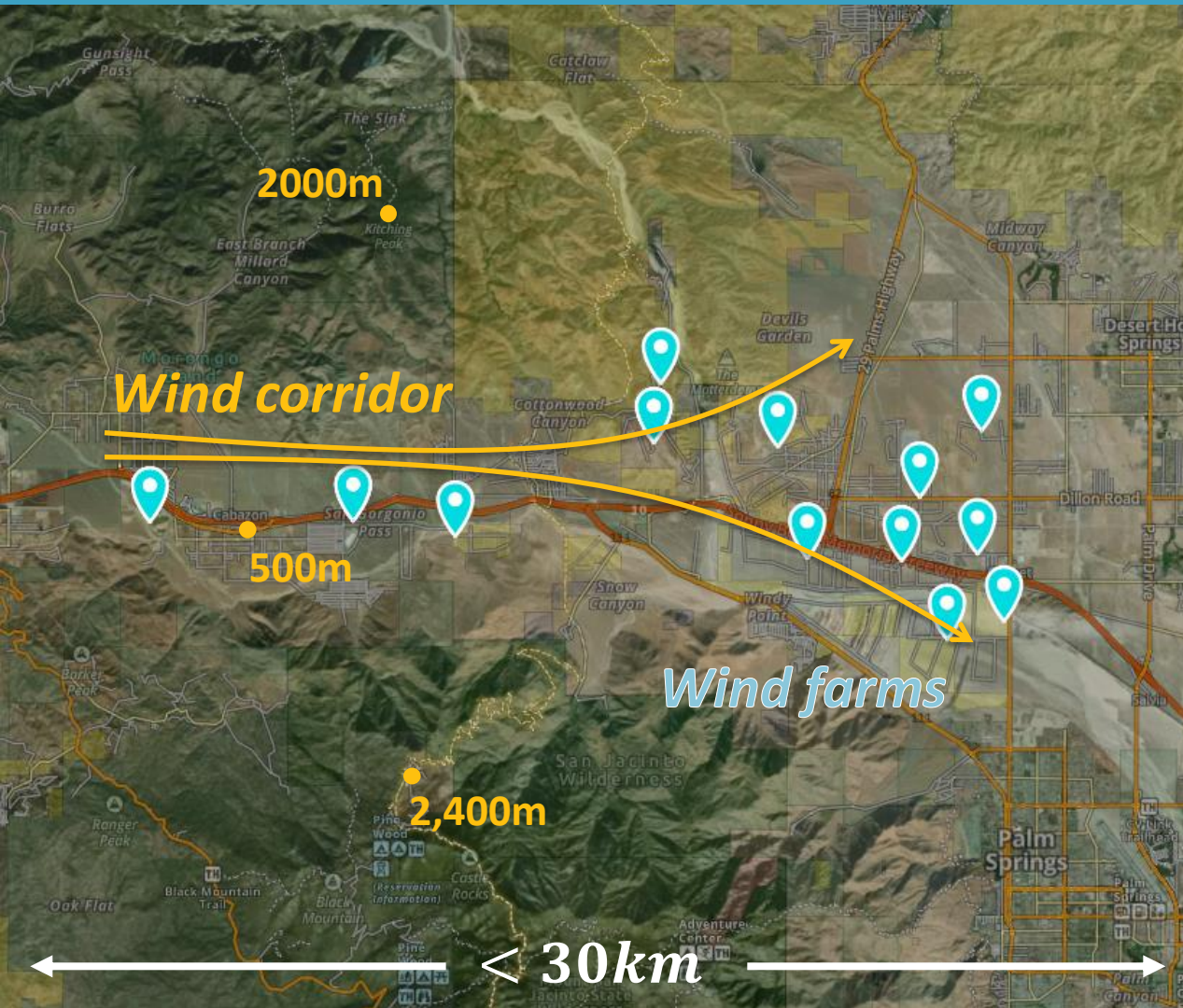
Solar



Wind

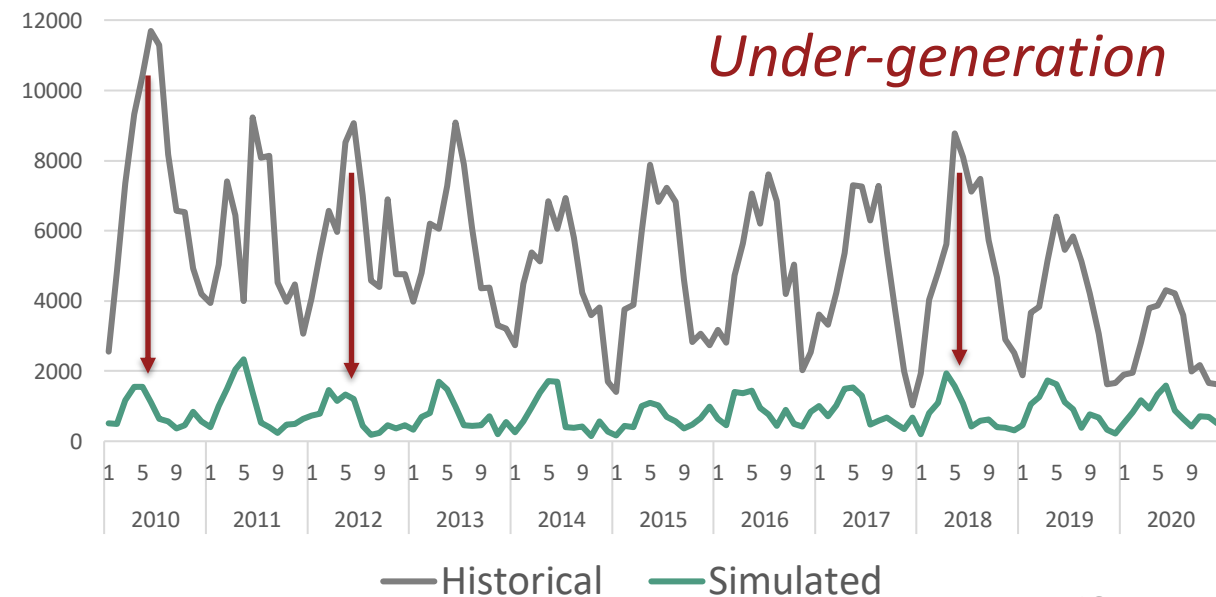


Geographic Complications



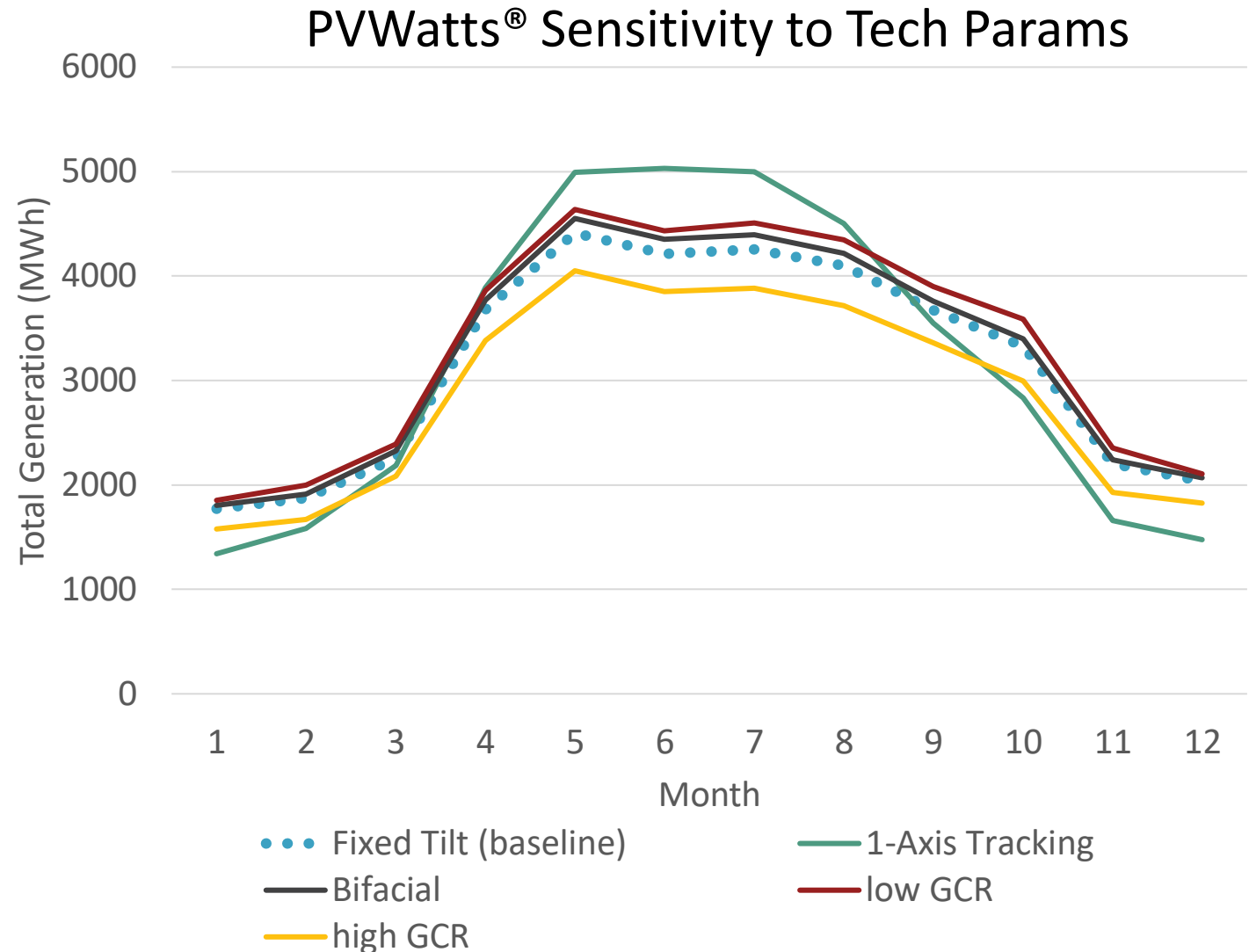
Cabazon → Palm Springs, CA

- [left] Wind through a narrow mountain pass feeds dozens of wind farms
- [below] Uncalibrated simulation results in drastic under-generation



Sensitivity to Plant Technology

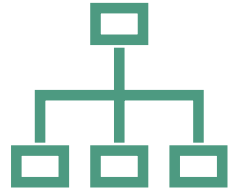
- Weather-to-power conversion relies on a handful of plant technology parameters
- Especially critical:
 - Solar: tracking technology
 - Wind: turbine model, hub height
- What to assume if this data is missing?



Weather-Related Datasets for Power System Planning

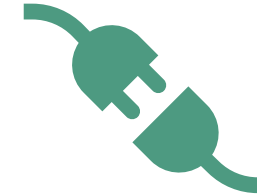
LOOKING FORWARD

Identified needs for weather-correlated datasets



Richer historical weather data

- Finer spatial resolution
 - Better accuracy in diverse-terrain areas
- Inclusion of uncertainty
 - Help planners evaluate risk



Unified weather data format

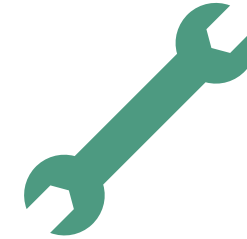
- Plug & play → less time developing data pipelines
- Easier to support multiple vendors who specialize in different regions or applications

Identified needs for weather-correlated datasets



Richer site technology reporting

- Stricter reporting and compliance
- Fill in missing gaps:
 - Turbine Model (often misspelled)
→ Hub heights & rotor lengths
 - Single capacity → reporting of plant degradation



Dataset of historical maintenance and unplanned outages

- Better calibration when combined with historical net generation (already reported)

Thank you!

For more information on this topic, please email Ian Schomer at:
ischomer@negll.com

For general inquiries, please reach out to us at:
info@enelytix.com

We look forward to hearing from you!