Newton Energy Group

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Weather-Correlated Datasets for Power System Planning

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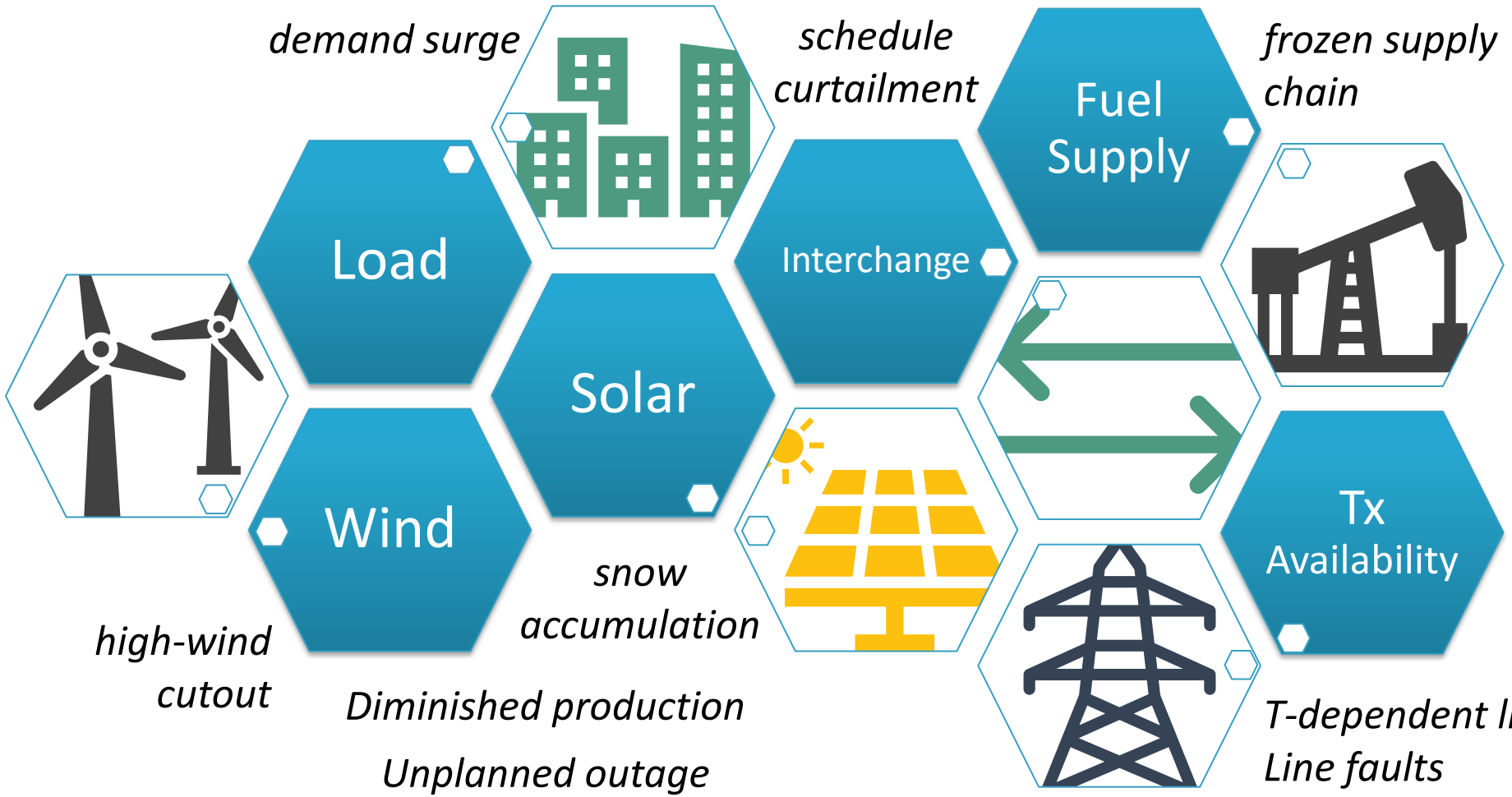
When an Extreme Weather Event Happens…



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The same common-mode event causes ***correlated behavior*** *across the power system*

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

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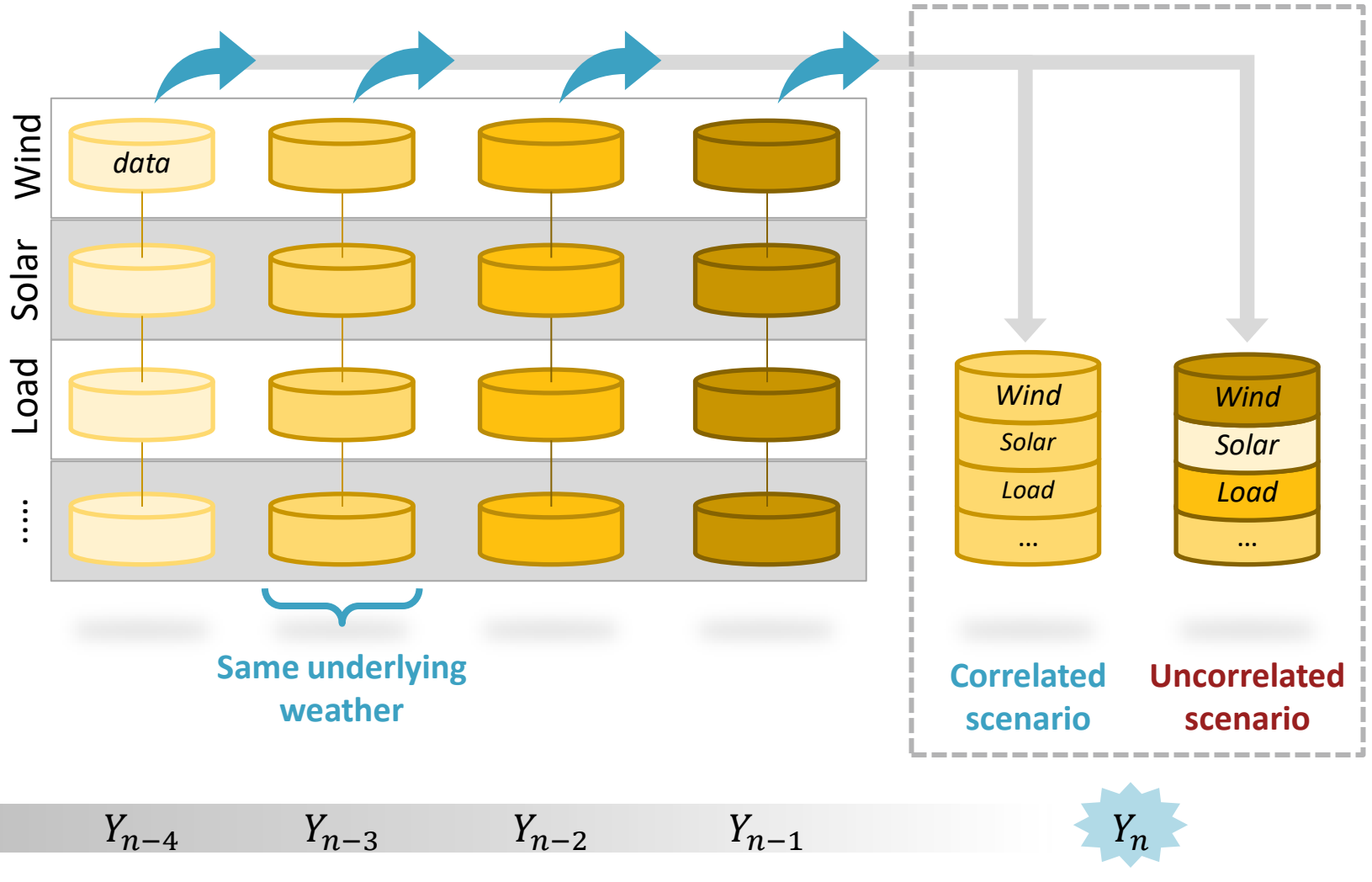
Historical Data for Future Scenarios

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*



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DATASET DEVELOPMENT

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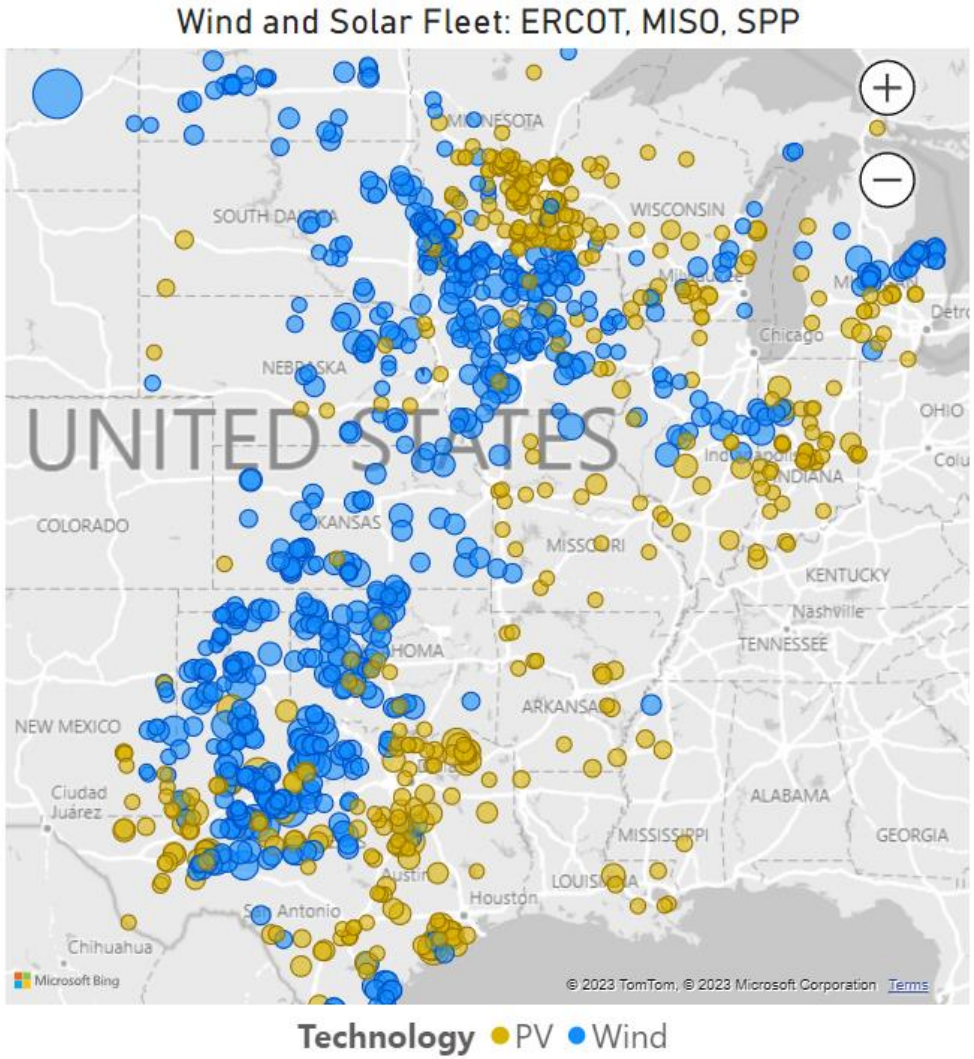
Overview of ENELYTIX Weather

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

- **Existing Plants**
  - location-specific weather data
  - sensitive to plant technology
  - calibrated against historical generation
- **Prospective Plants**
  - API to evaluate new builds



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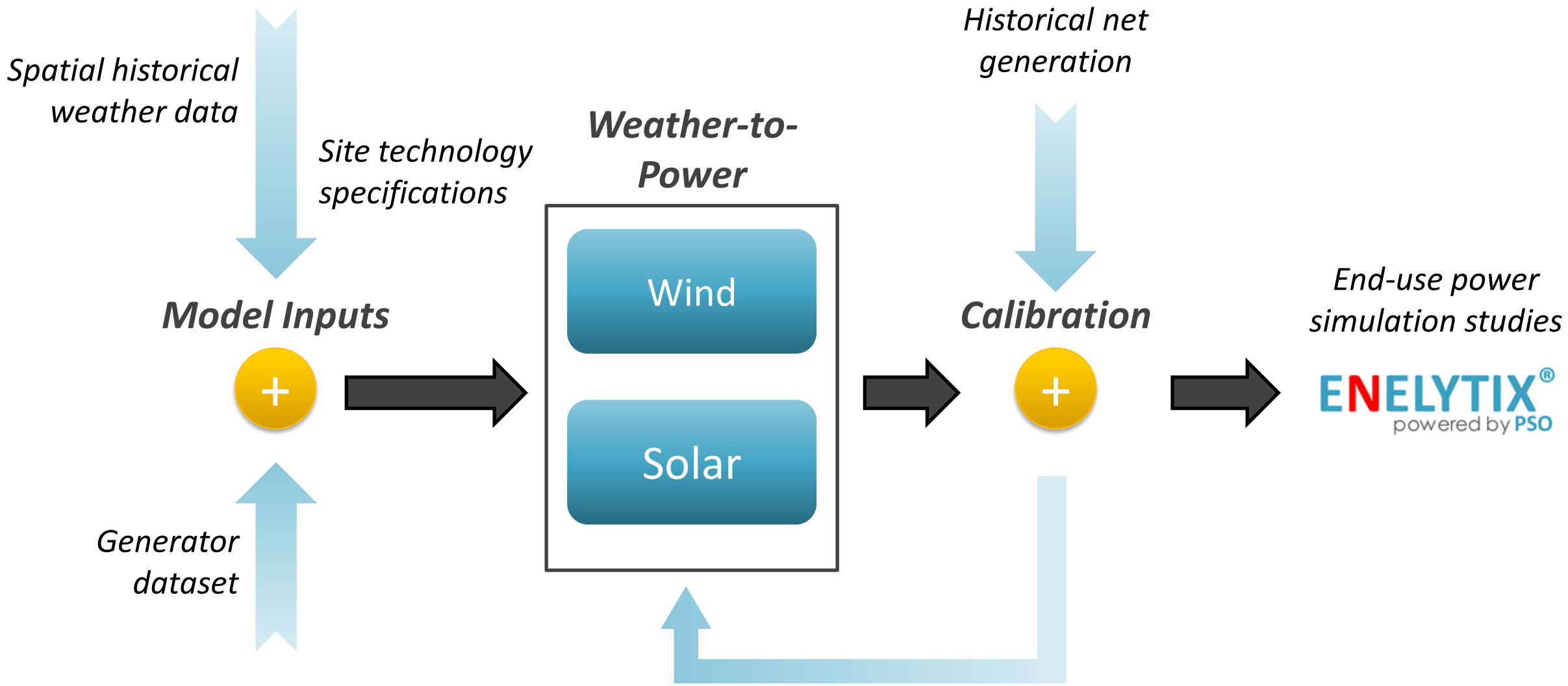
High-Level Data Flow

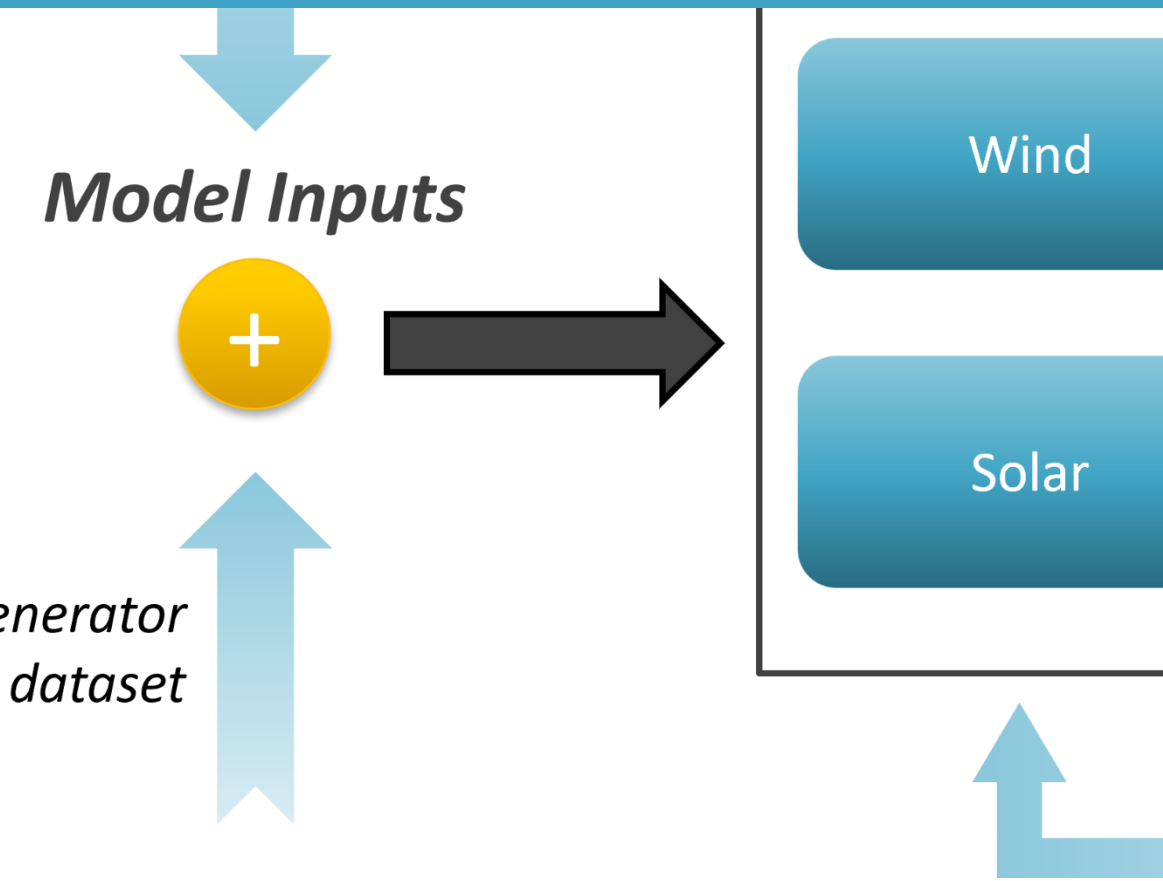


Data Collection: Generators

Requirements

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

Generator dataset



☑ *Available within ENELYTIX data models*

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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~~

Spatial historical weather data

Site technology specifications

Model Inputs

Weather-to-Power

Wind

No product fit all these requirements

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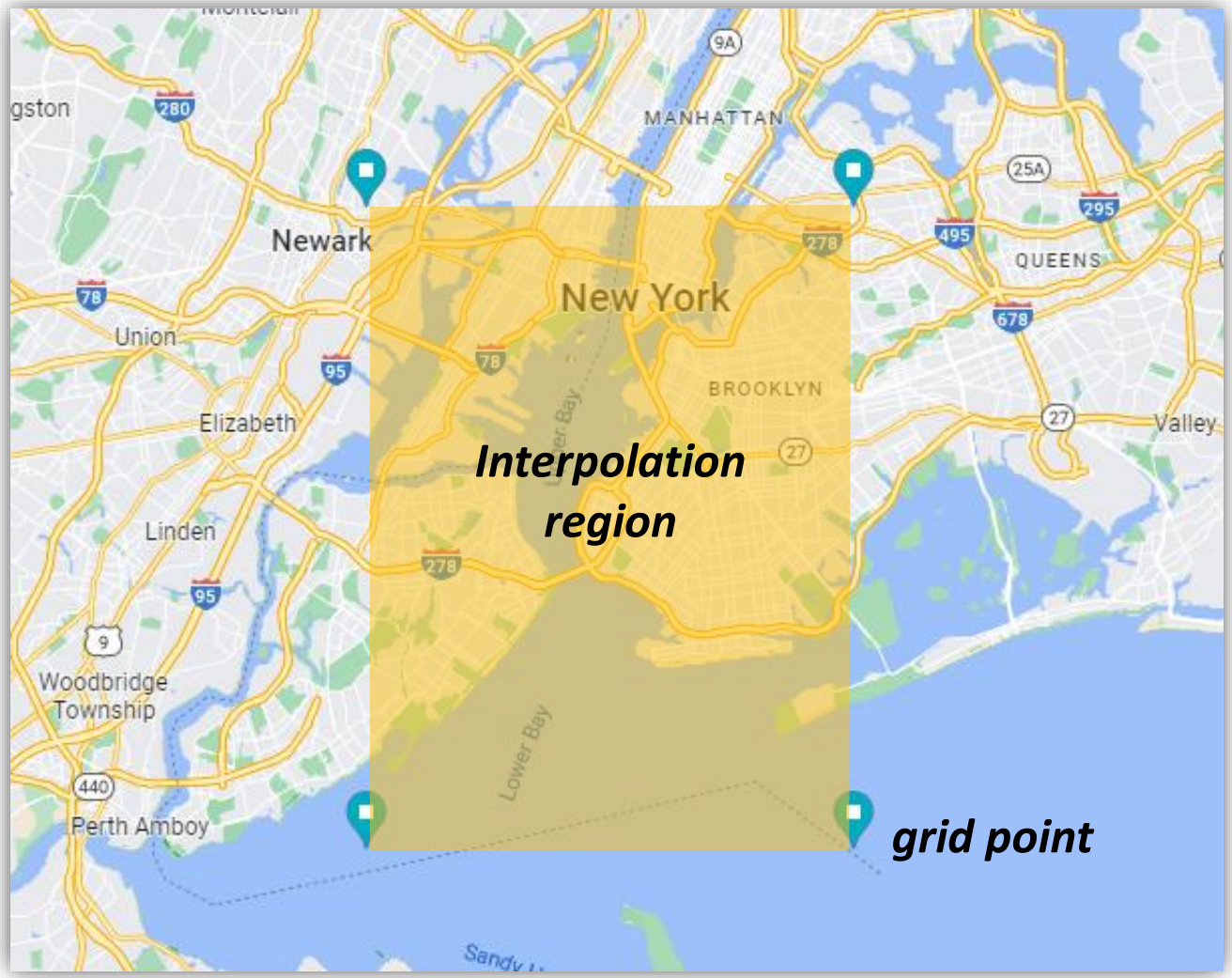
Weather Data Granularity

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

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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

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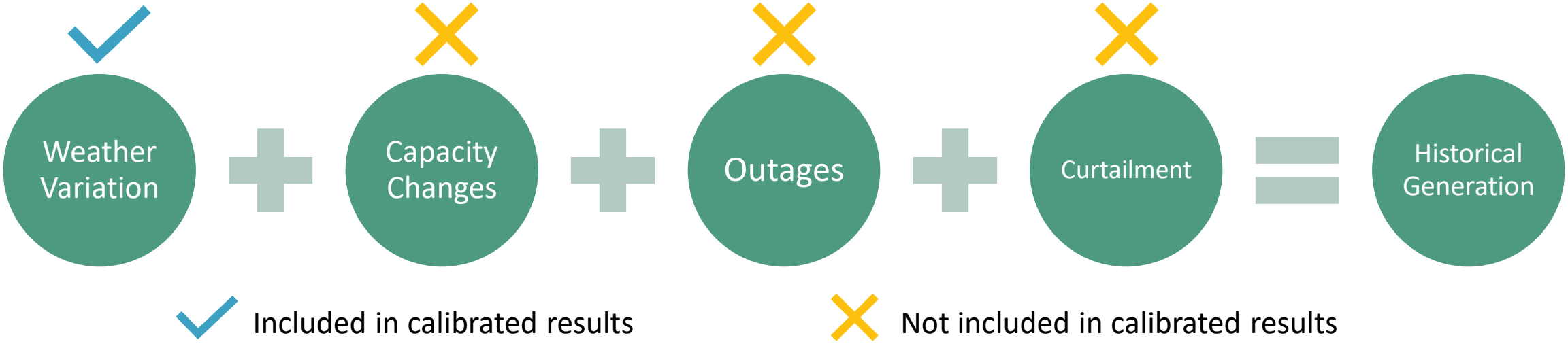
Data Calibration Process

- 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



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RESULTS ANALYSIS

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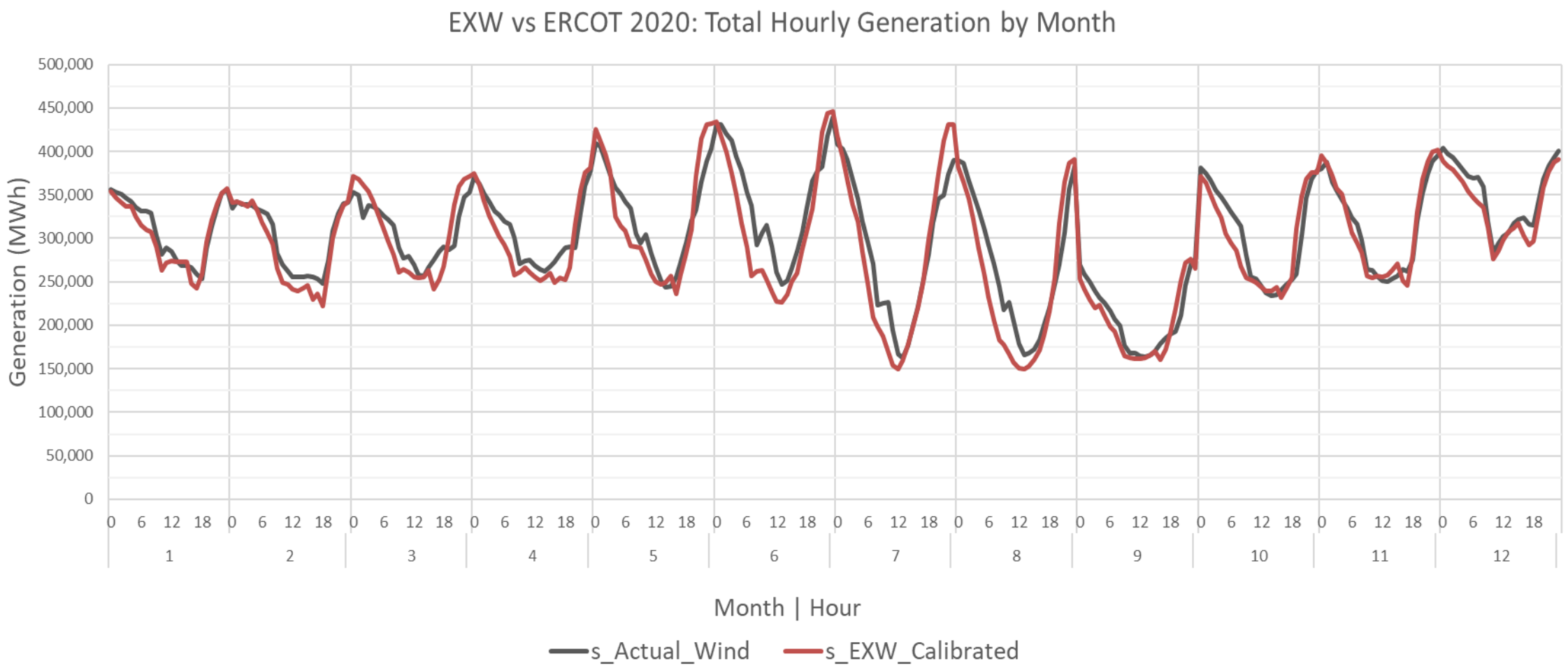
Hourly Alignment with ISO-reported Data



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

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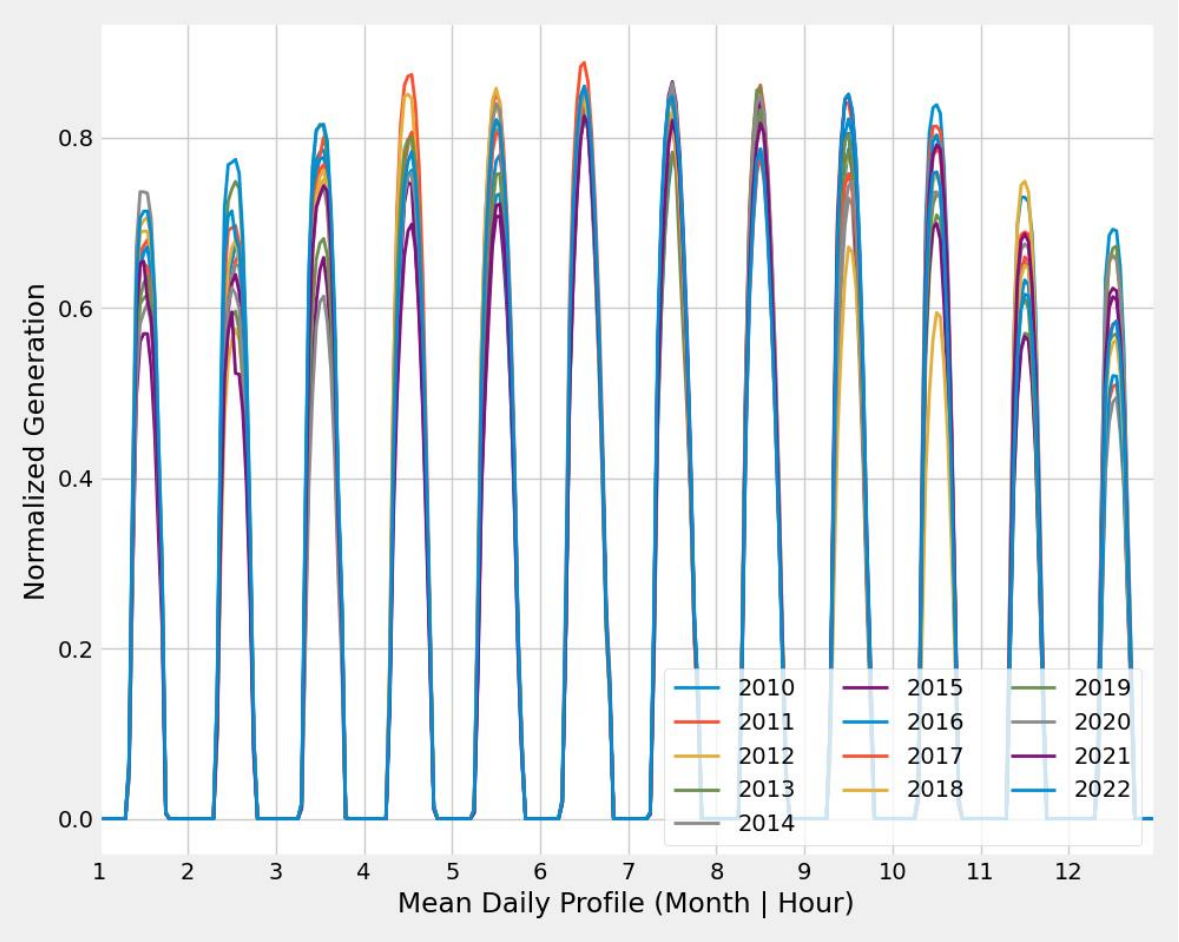
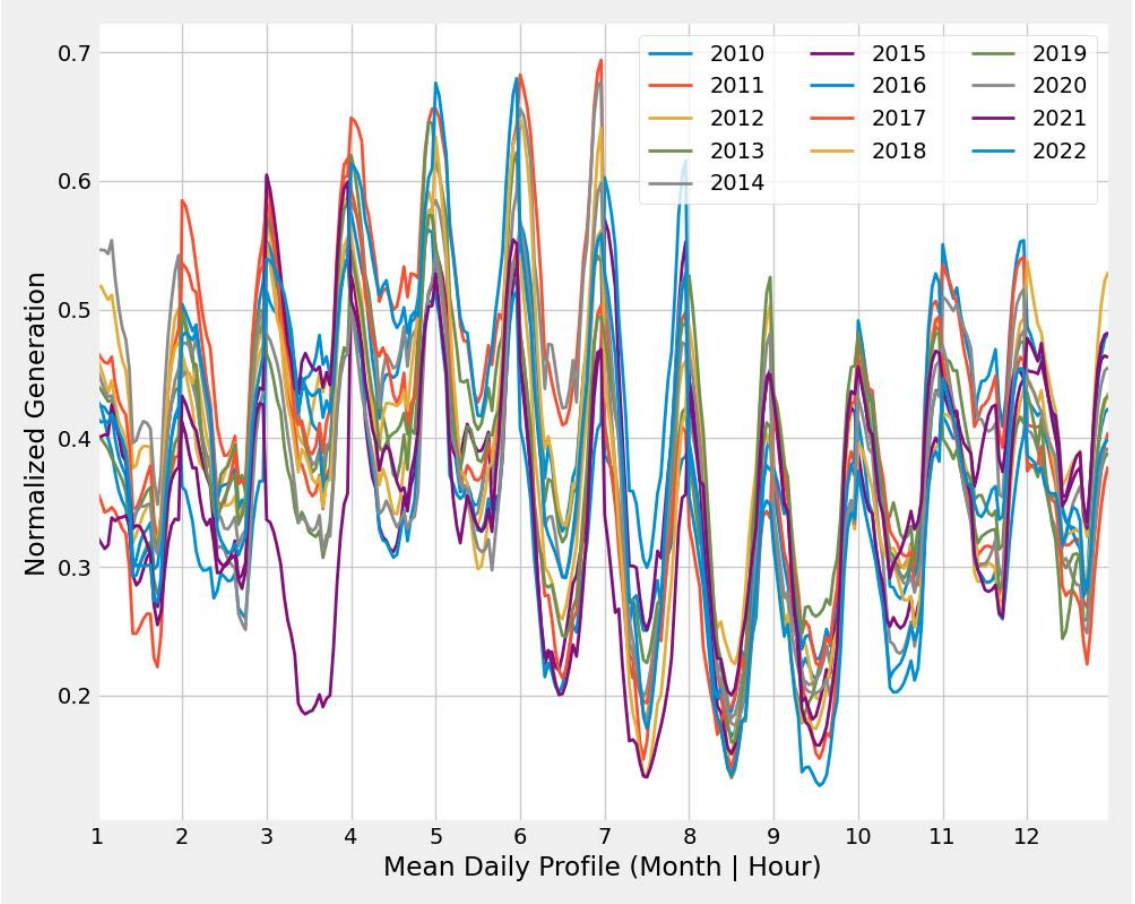
Variability for Planning Studies

Solar



Wind



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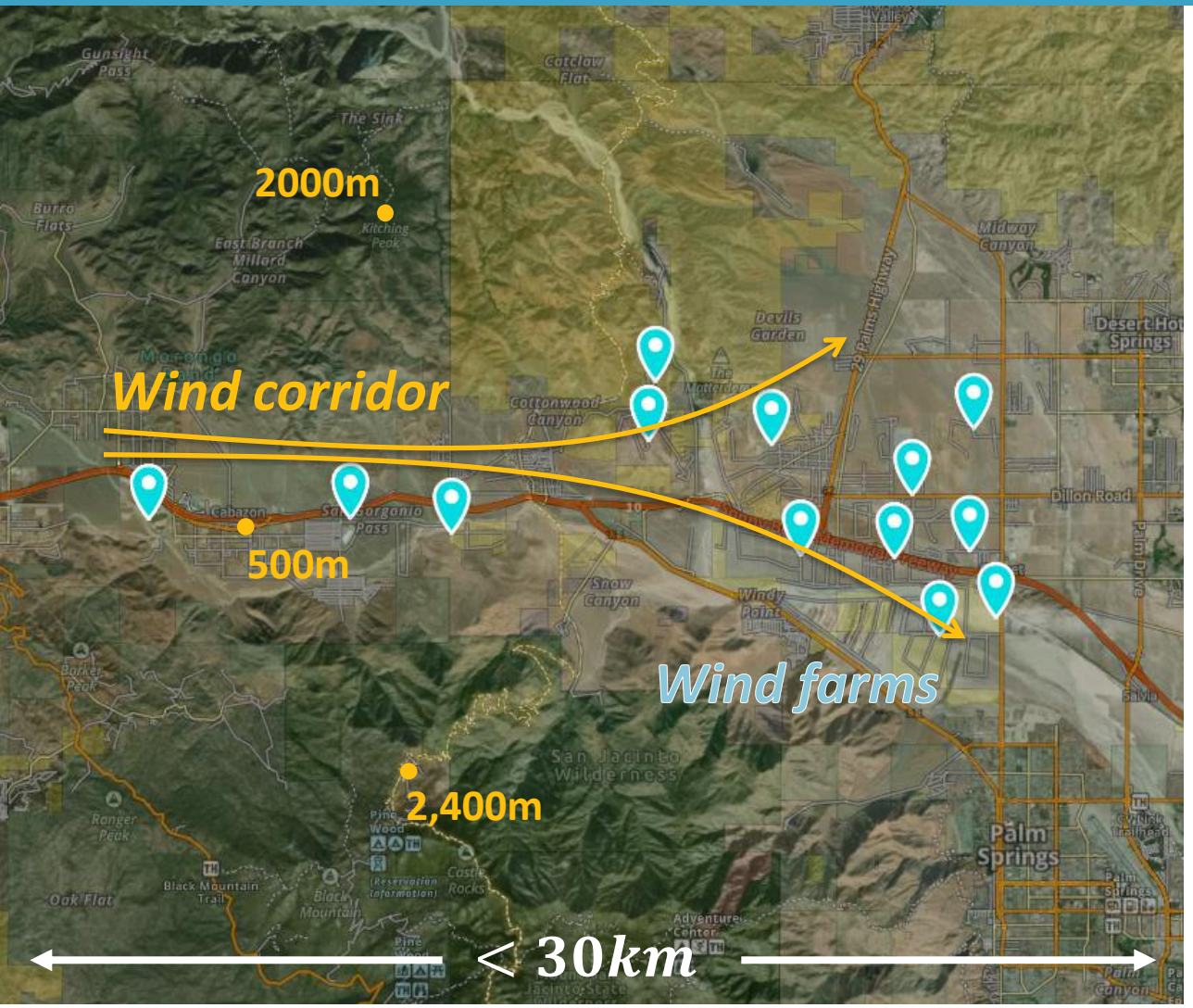
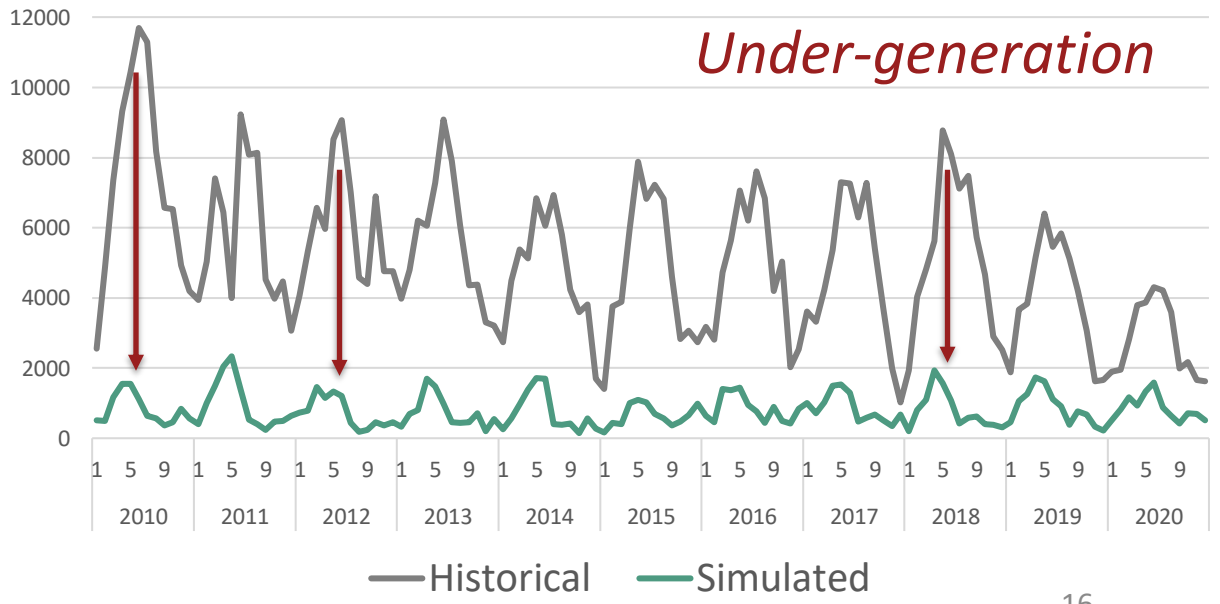
Simulation of ERCOT sites shows significant variability between historical years, especially in the shoulder months.

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



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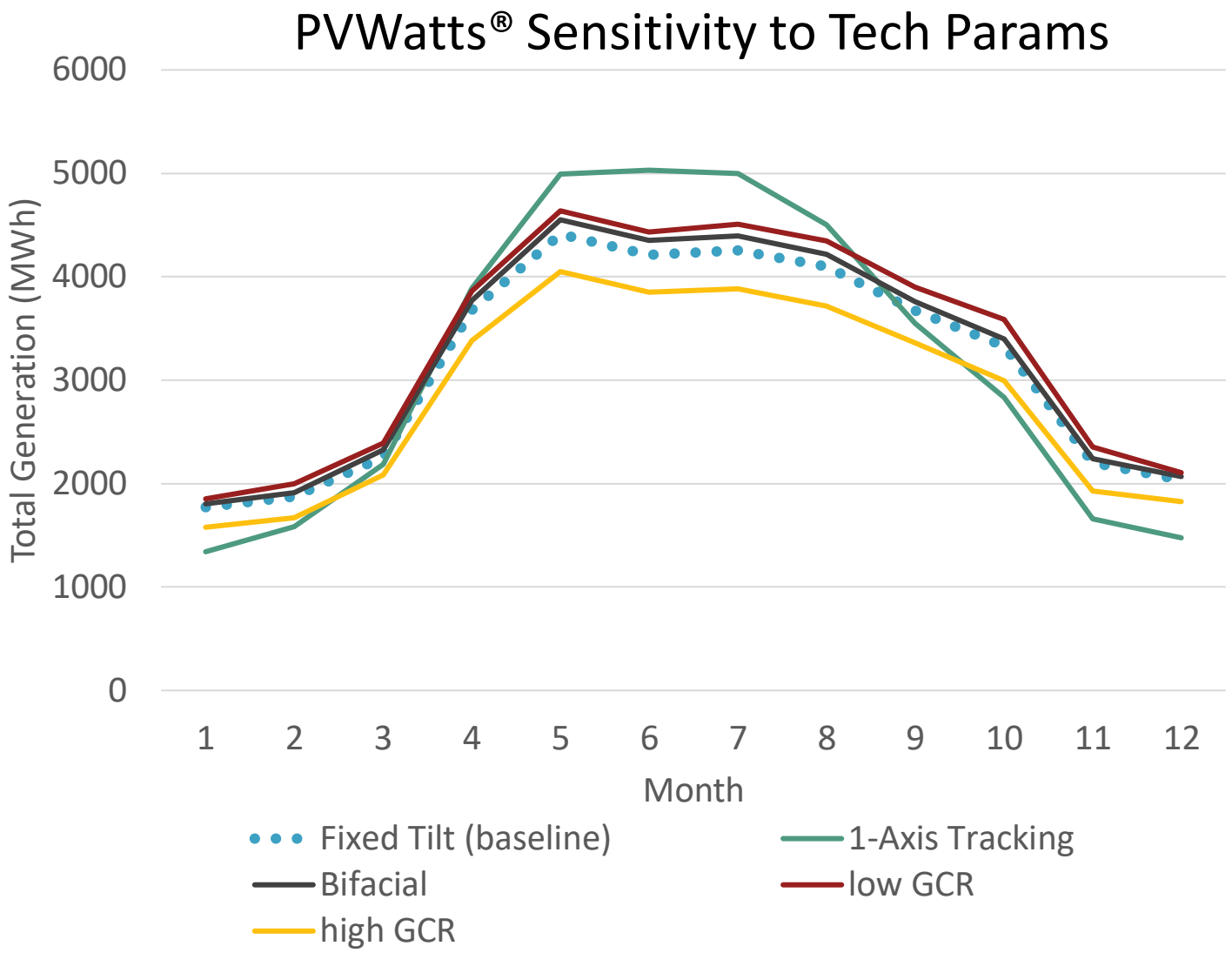
Sensitivity to Plant Technology

- 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?



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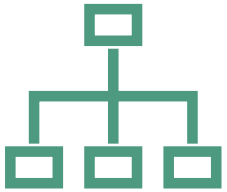
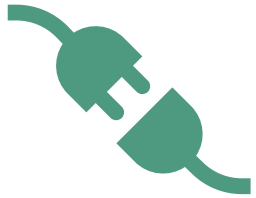
LOOKING FORWARD

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

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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)

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Thank you!

For more information on this topic, please email Ian Schomer at:
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We look forward to hearing from you!

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