Enhancing Weather-Informed Transmission Planning: Weather-to-Grid Linkages at EPRI

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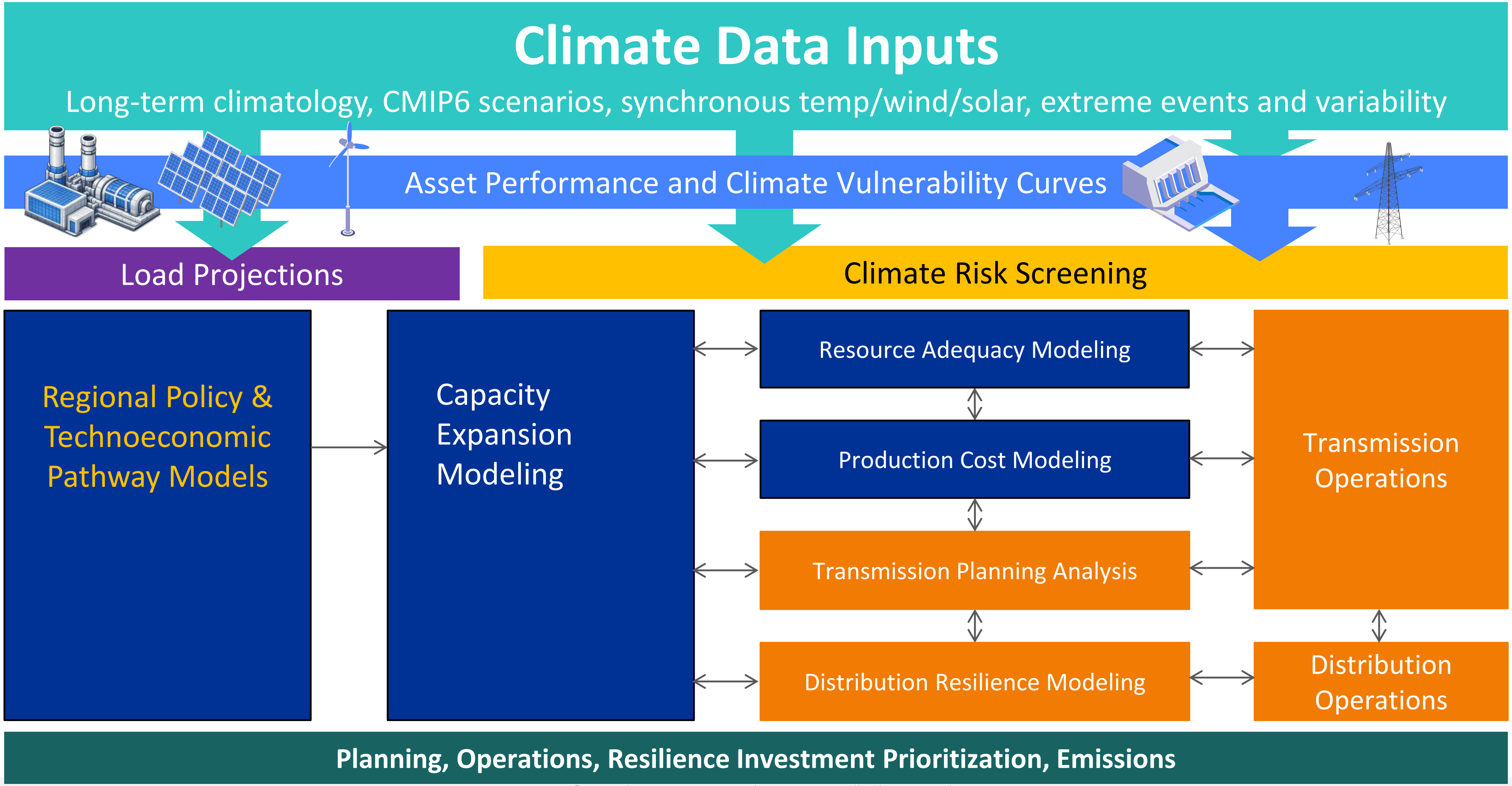
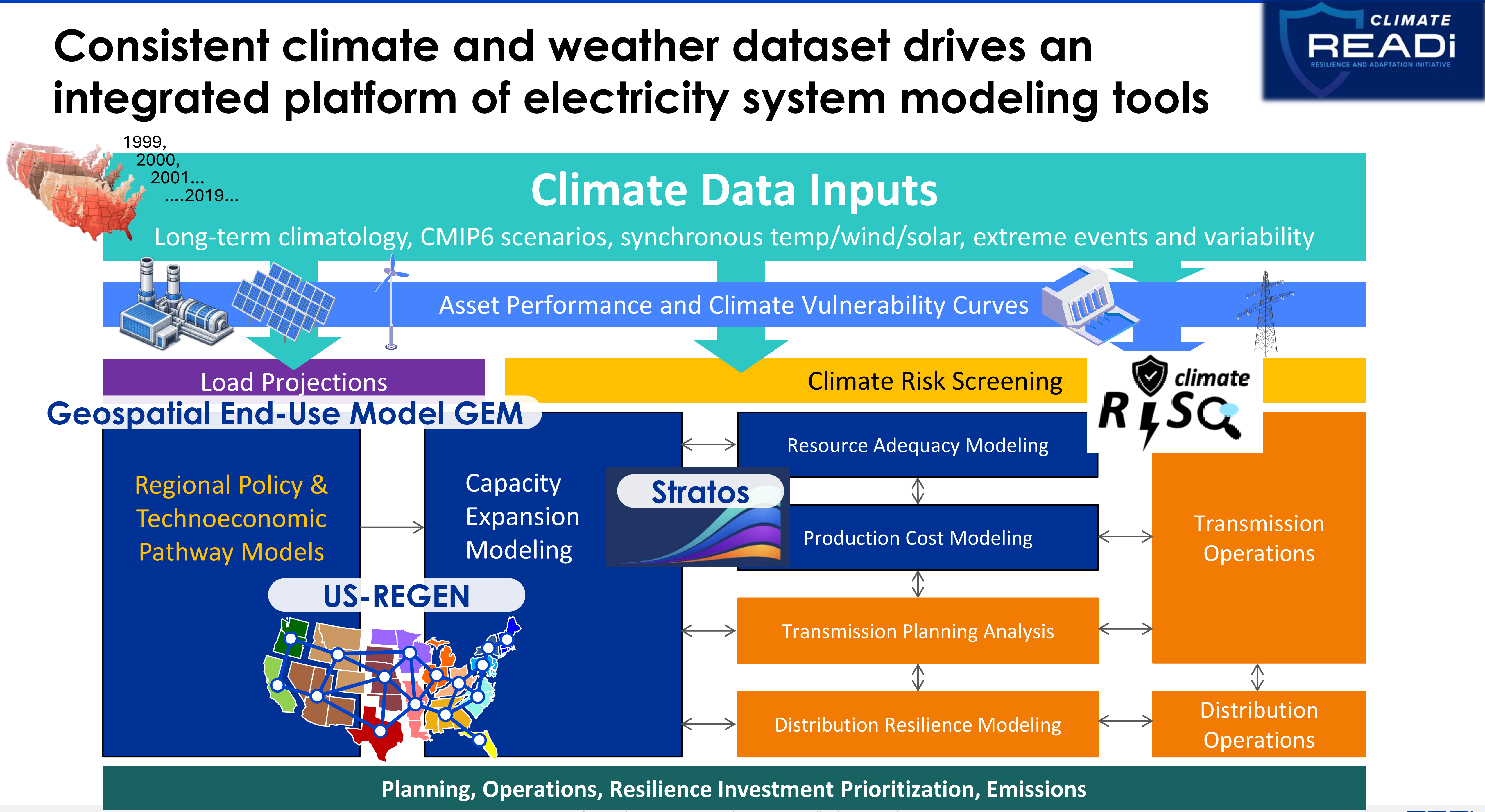
Consistent climate and weather dataset drives an integrated platform of electricity system modeling tools



Consistent climate and weather dataset drives an integrated platform of electricity system modeling tools



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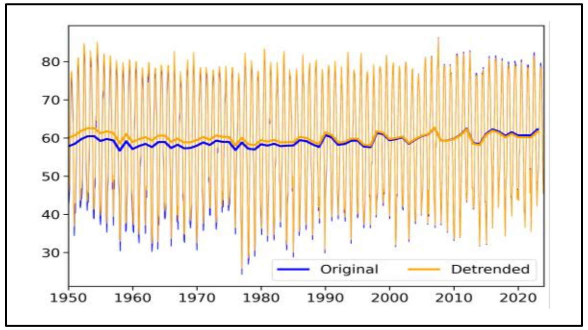
Risk Screening Tool (RiSc)
Moving from weather to system stress

Large Weather Dataset + **Asset Vulnerability Functions** + **Load Projections** = **Identification of High-Stress Operating Periods**

RiSc Tool is open-source and available at https://github.com/epri-dev/Risk-Screening-Tool/

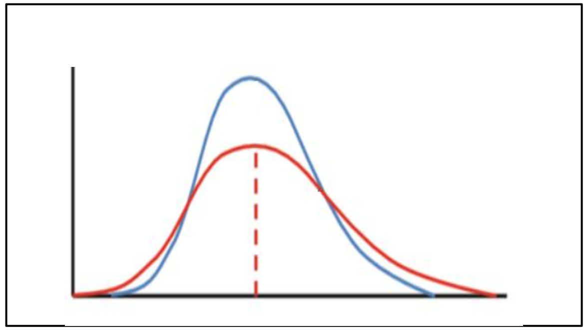
Hourly Future-Climate Weather Timeseries for System Planning

The Quantile Delta Mapping (QDM) method



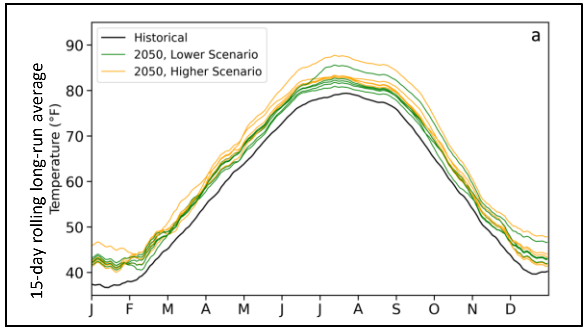
Step 1: Detrend

Expand the set of representative weather years and detrend



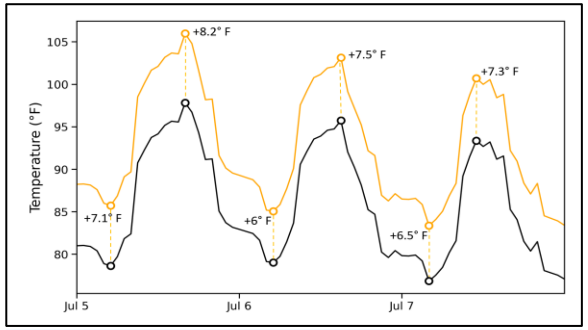
Step 2: Calculate change

Calculate the quantile-specific, monthly "delta" in daily min/max temperatures between baseline and projected



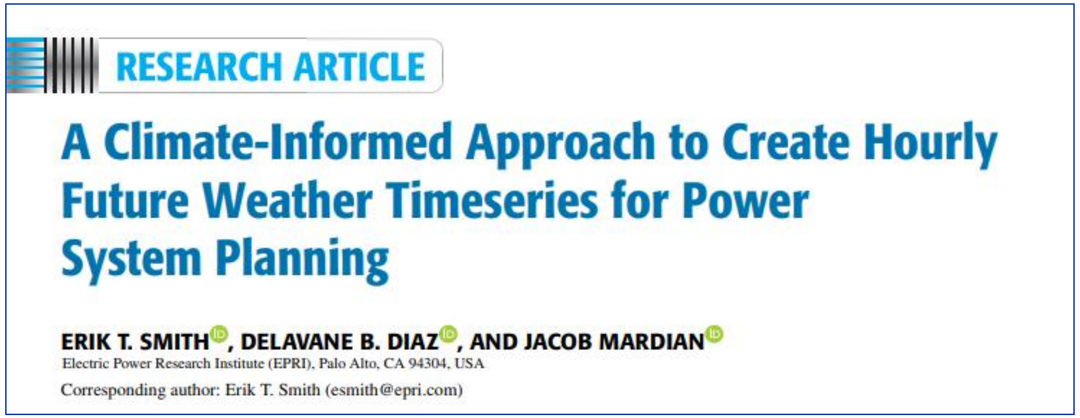
Step 3: Shift reference

Shift historical reference daily max + min temperatures to a future climate year



Step 4: Scale diurnal pattern

Convert the shifted daily min/max T to hourly data based on historical diurnal pattern


RESEARCH ARTICLE

A Climate-Informed Approach to Create Hourly Future Weather Timeseries for Power System Planning

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https://ieeexplore.ieee.org/document/10990270

https://www.epri.com/research/products/000000003002036195

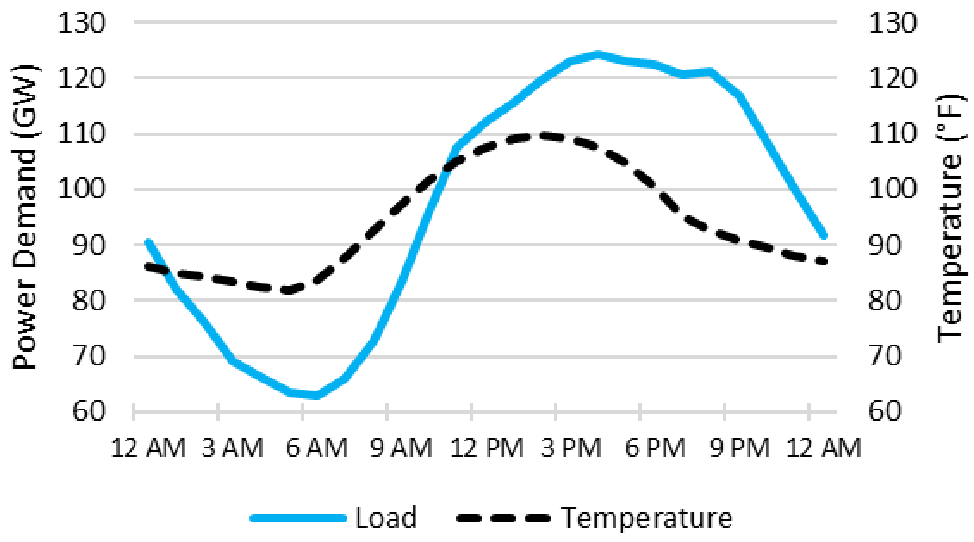
Pass Weather Data through Asset Vulnerability Functions

Define asset vulnerability matrix and derating factors as a function of weather variables

Resource Type	Weather Variable 1	Threshold 1	Weather Variable 2	Threshold 2	Derating	Event
Onshore Wind	Temperature	< 32 F	Precipitation	> 0 in	90%	Blade Icing
Onshore Wind	Wind Speed	> 25 m/s			100%	Cutoff Speed
Gas CC	Temperature	> 105 F	Temperature	< 123 F	18%	Temp Derate

Note: These are generic examples; Specific asset vulnerabilities may be dependent on the region of study and design standards.

Estimate electricity demand based on weather data



Electricity demand estimates incorporate:

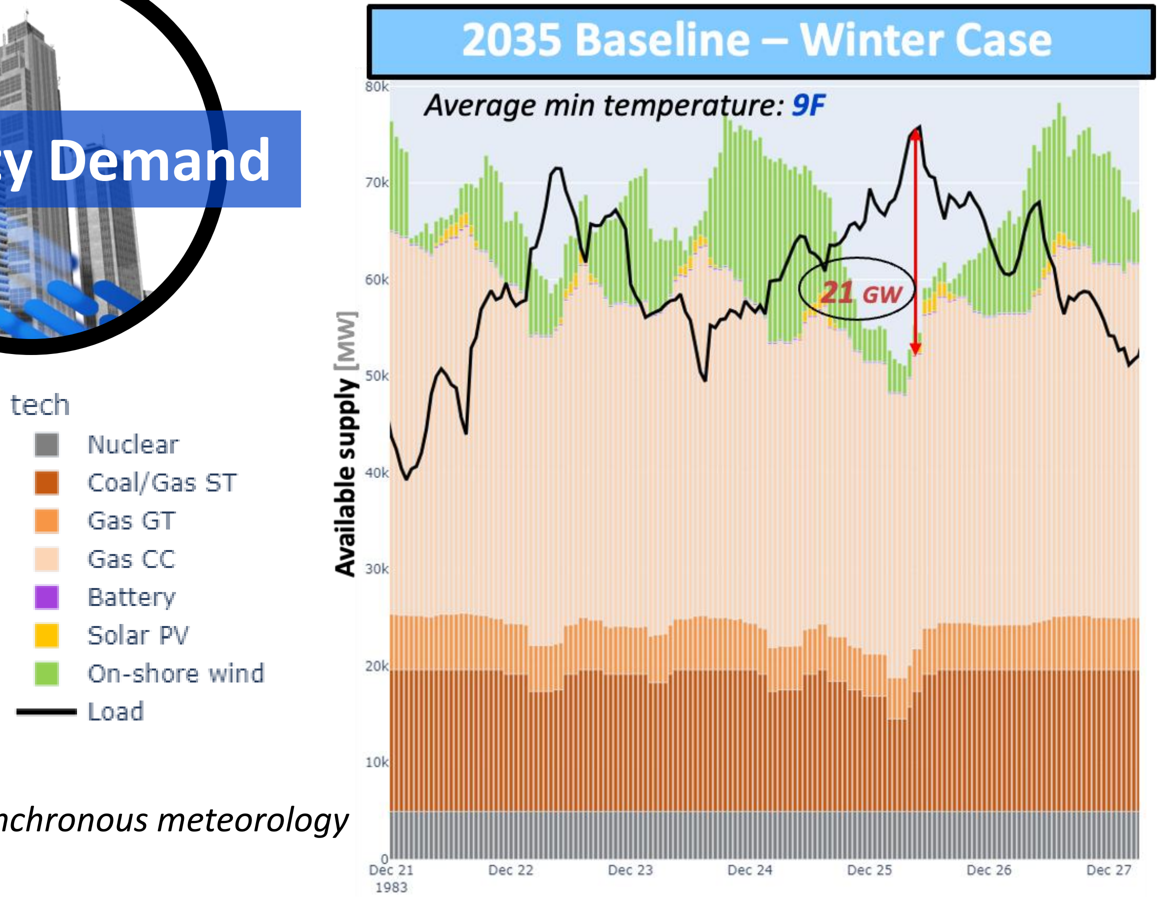
- Local weather sensitivity
- Future technology adoption
- Energy efficiency improvements
- Temporal correlations

Risk Screening Tool: Moving from Weather to System Stress

Large Weather Dataset + **Asset Vulnerability Functions** + **Load Projections** = **Identification of High-Stress Operating Periods**

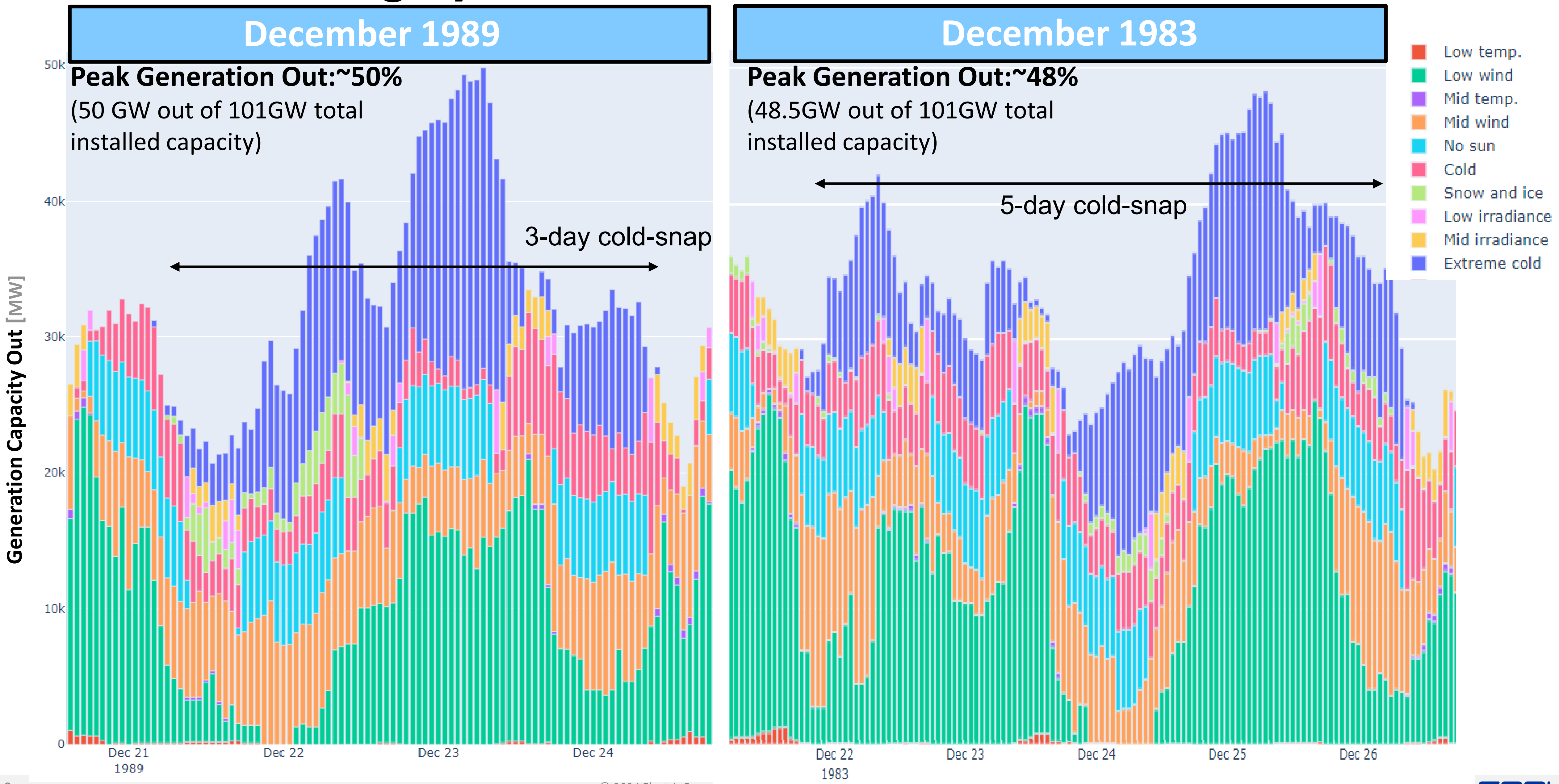
Can quickly screen for changing risks based on:

- New system buildouts
- Addition of adaptation measures
- Different climate data inputs
- Adjusted asset vulnerability functions
- New load assumptions



Simplified representation of synchronous meteorology (temperature, wind, solar, etc.)

Understanding system risks: Dec 1989 versus Dec 1983



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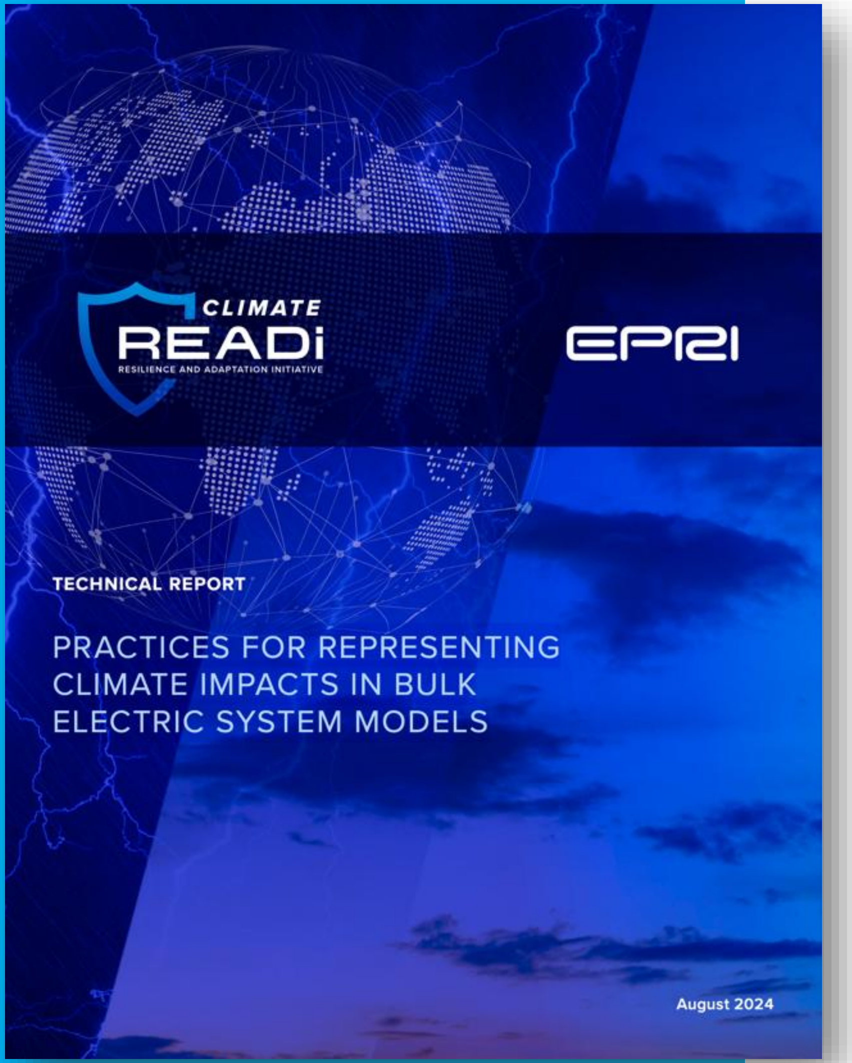
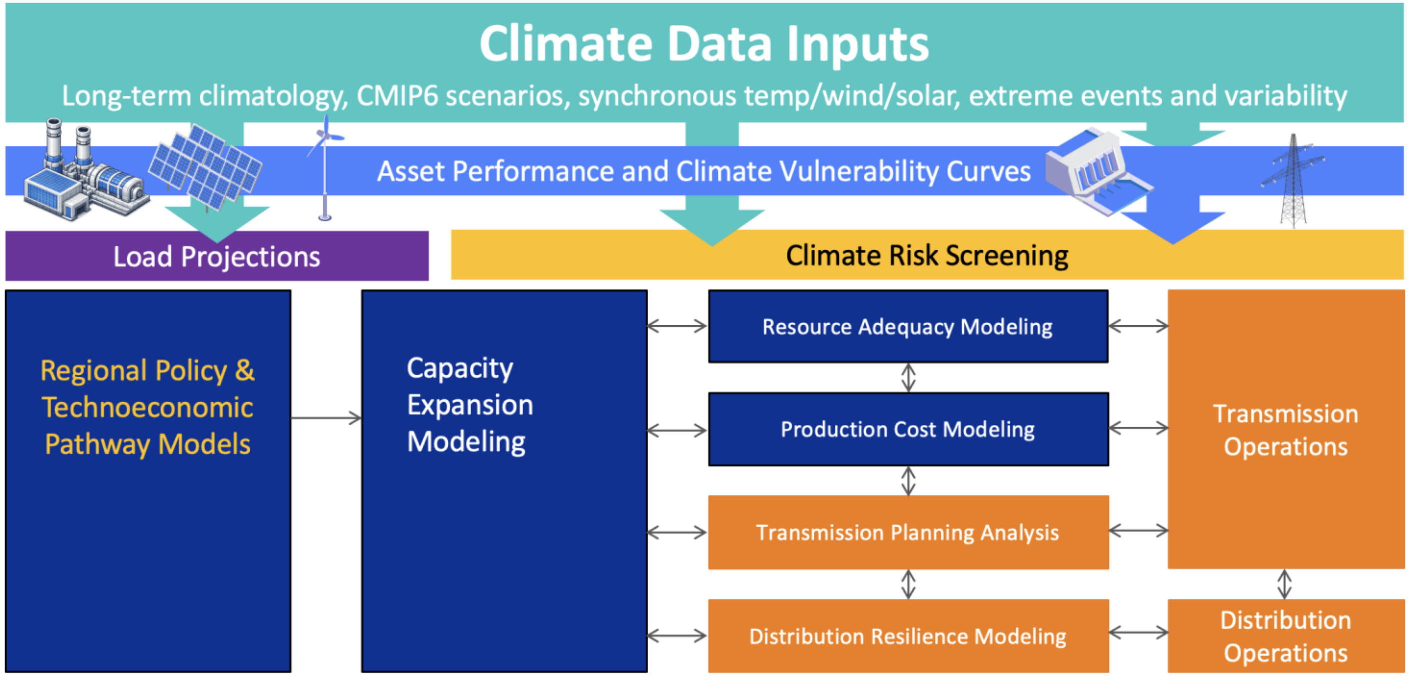
Practices for Representing Climate Impacts in Bulk Electric System Models





Developed to help bulk system planners **understand the passage of climate data and resulting asset impacts into bulk system models**

Walks through **the flow of climate data information across models and processes**, highlighting the data considerations needed to best pair with each model's capabilities

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