



WHEN TRUST MATTERS

# Adding Context to P50: A Practical Approach for Pre-Construction Energy Assessments

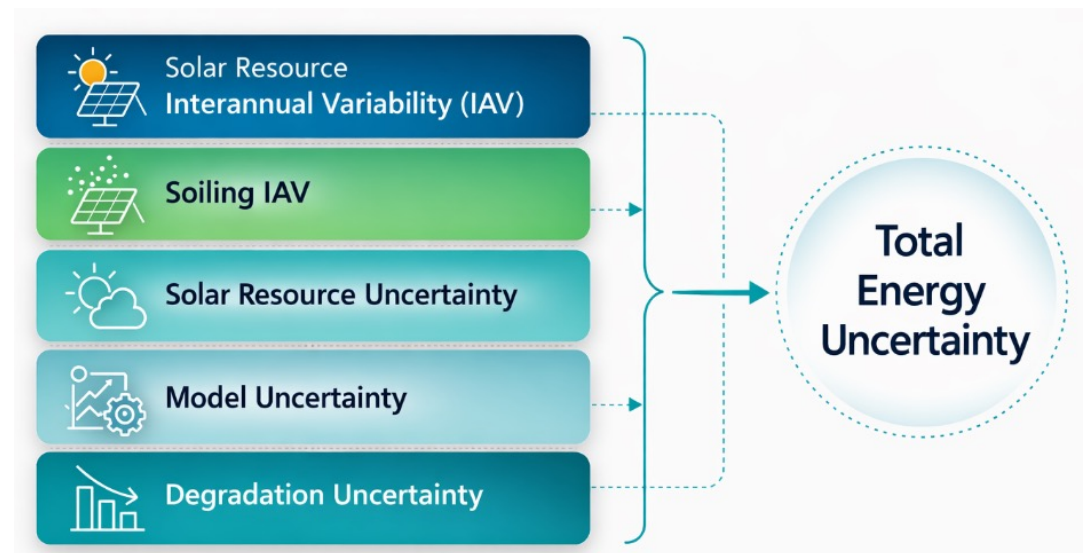
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2026 PVPMC Workshop

13 May 2026

# The Problem with the Standard Workflow

- Industry norm:
  - TMY-based simulation
  - Single “P50” energy value
- Variability handled later:
  - Post-processing to derive PXX
- Implicit assumption:
  - Weather and loss drivers act independently *and* normally
- Reality:
  - Year-to-year variability is physical and correlated



# P50 is Not TMY: A subtle but Important Distinction

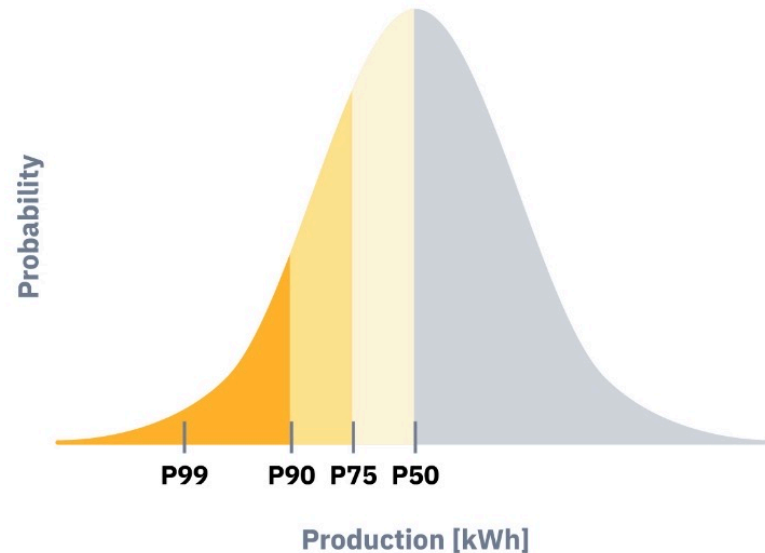
## TMY

- “Typical” meteorological conditions
- Synthetic by construction

## P50

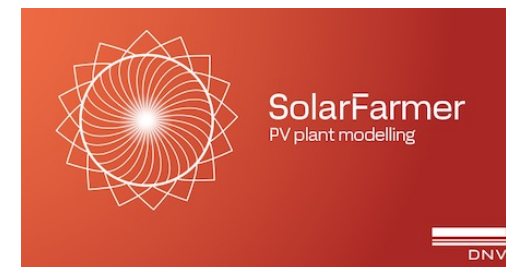
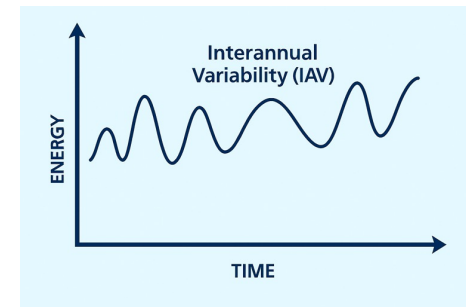
- Median **energy outcome**
- These are not equivalent
- A realistic P50 year includes:
  - Temperature
  - Irradiance mix
  - Soiling
  - Albedo

Together



# DNV Direction: Time-Series Modeling

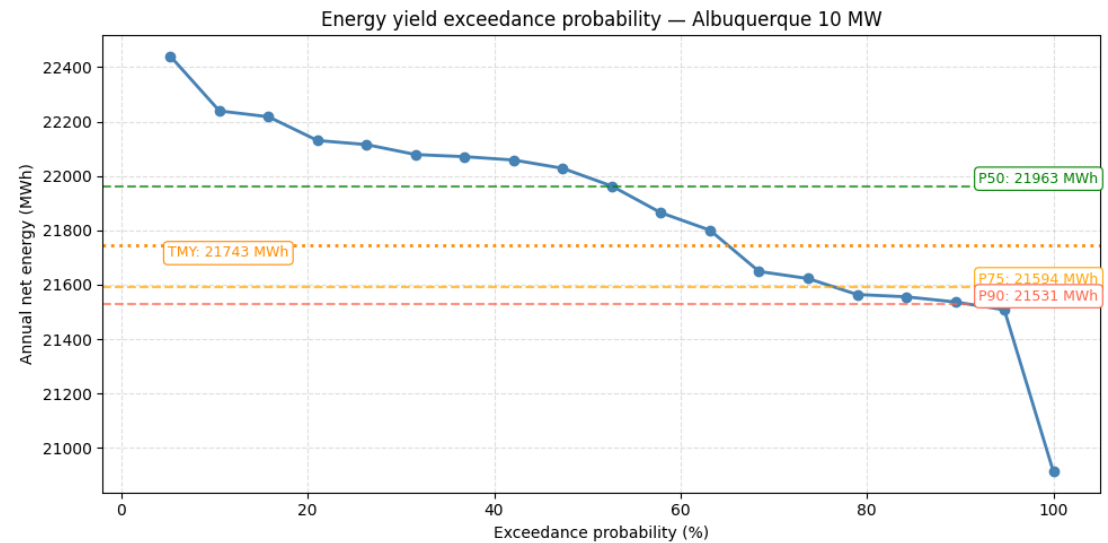
- From static input to intrinsic variability
- Shift in approach:
  - From one representative year to running each historical year
- Each year:
  - Uses real, concurrent weather and loss conditions
- Variability becomes:
  - A modeled result, not a correction
- Enabling factor:
  - Compute power is no longer a bottleneck
  - Modern tools and APIs (e.g., SolarFarmer) make multi-year runs practical



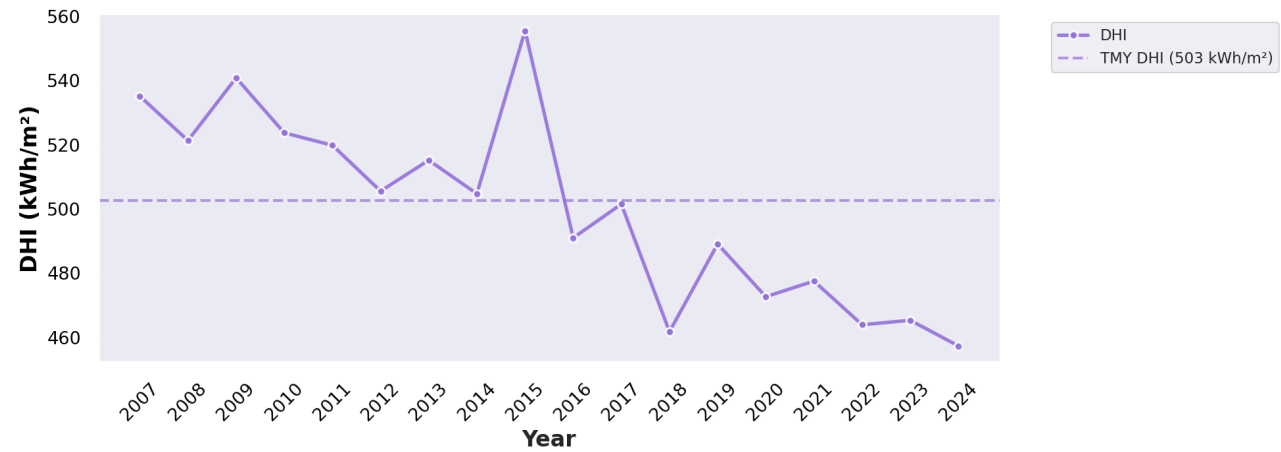
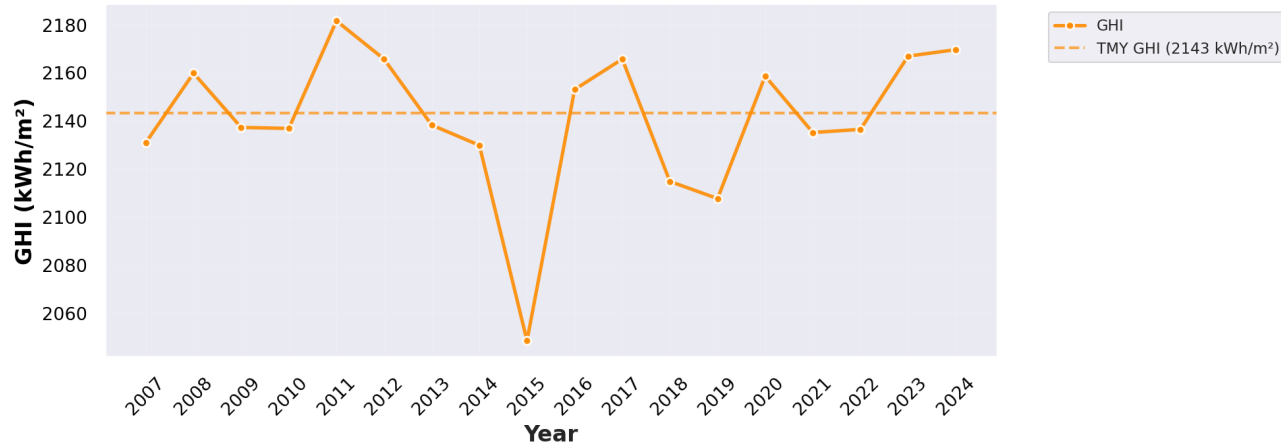
# Case Study: TMY vs P50

- 2 sites in Canada, 1 site in NM, 1 site in AZ
- Two scenarios:
  1. TMY + Long term average (LTA) albedo & soiling
  2. Full historical time series P50
- Includes all resource variability
- Able to be run in both SolarFarmer 2D and 3D using the API
- Based on ~19 years – tail behavior and extreme quantities should be interpreted with caution

Project	TMY	P50	P75	P90
Project A (CA)	<b>290.7</b>	<b>281.2</b>	276.3	274.0
Project B (CA)	<b>251.3</b>	<b>246.0</b>	238.5	236.9
Project C (NM)	<b>21.74</b>	<b>21.96</b>	21.59	21.53
Project D (AZ)	<b>155.2</b>	<b>155.4</b>	154.5	151.3



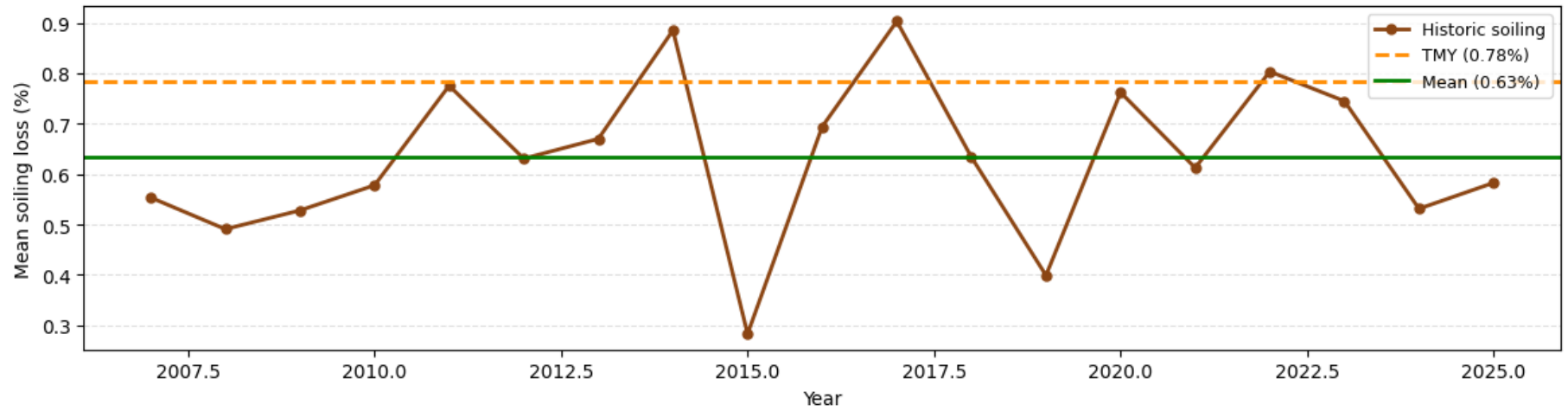
# Case Study: TMY vs P50



# Case Study: TMY vs P50

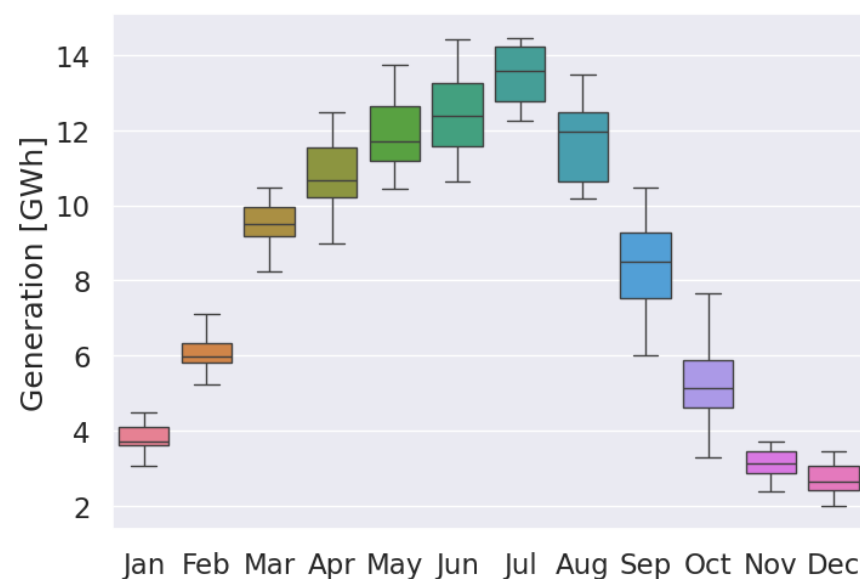


# Case Study: TMY vs P50



# What Changes When You Run Real Years: Energy Becomes a Distribution

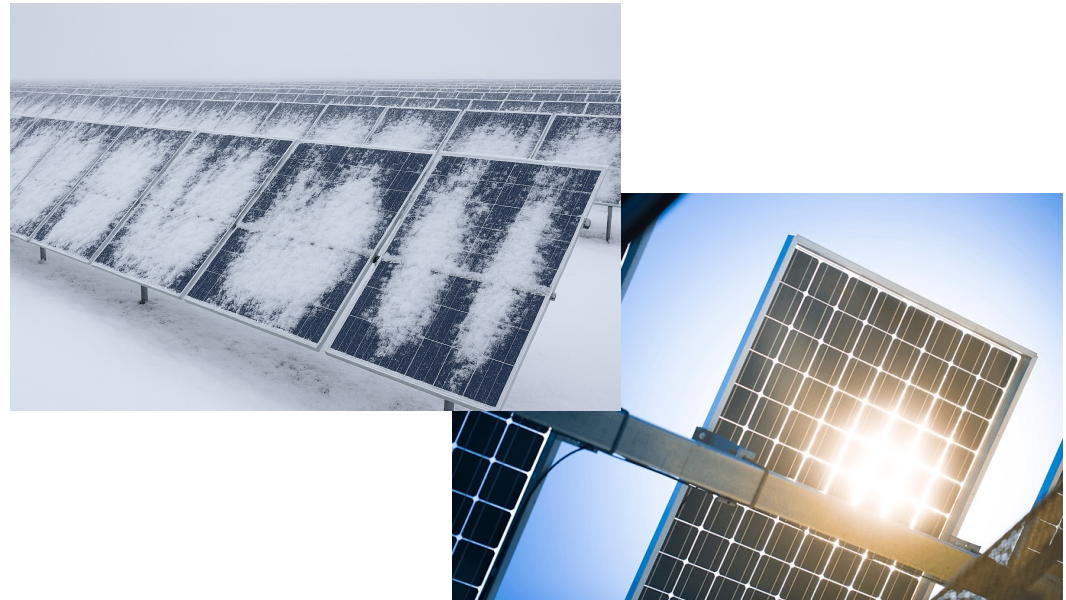
- Each historical year -> one energy outcome
- Results form:
  - A natural annual energy distribution
- Observations:
  - Median  $\neq$  TMY result
  - Spread reflects physical variability
- Downside years are:
  - Realistic, not assumption-driven



# Why Covariance Matters

## Physics We Usually Break in Post-processing

- Hot years:
  - Lower module efficiency
- Clear years:
  - Higher soiling accumulation
- Snowy years:
  - Higher albedo *and* higher availability losses
- Time-series modeling:
  - Preserves covariance automatically



# Implications for P50 and PXX

P50 = Median of modelled annual outcomes



P90 = 10<sup>th</sup>-percentile year from same simulation

- ✓ Same physics
- ✓ Same assumptions
- ✓ No extra layers required

# Key Takeaways

- TMY  $\neq$  P50
- Variability should emerge from the model
- Time-series modeling:
  - Adds realism
  - Reduces assumptions
- Future:
  - Test more sites for TMY vs P50 results
  - Full time-series energy assessments
  - 8760s for each PXX case

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# *Thank you!*

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