

# The Energy Modeling Gap: Transposition models in combination with satellite data impact on Plane-of-Array Irradiance (POA) Assessments.

## Validation of PVsyst and Pvlb Transposition Models Implementations Using Long-Term Operational Data

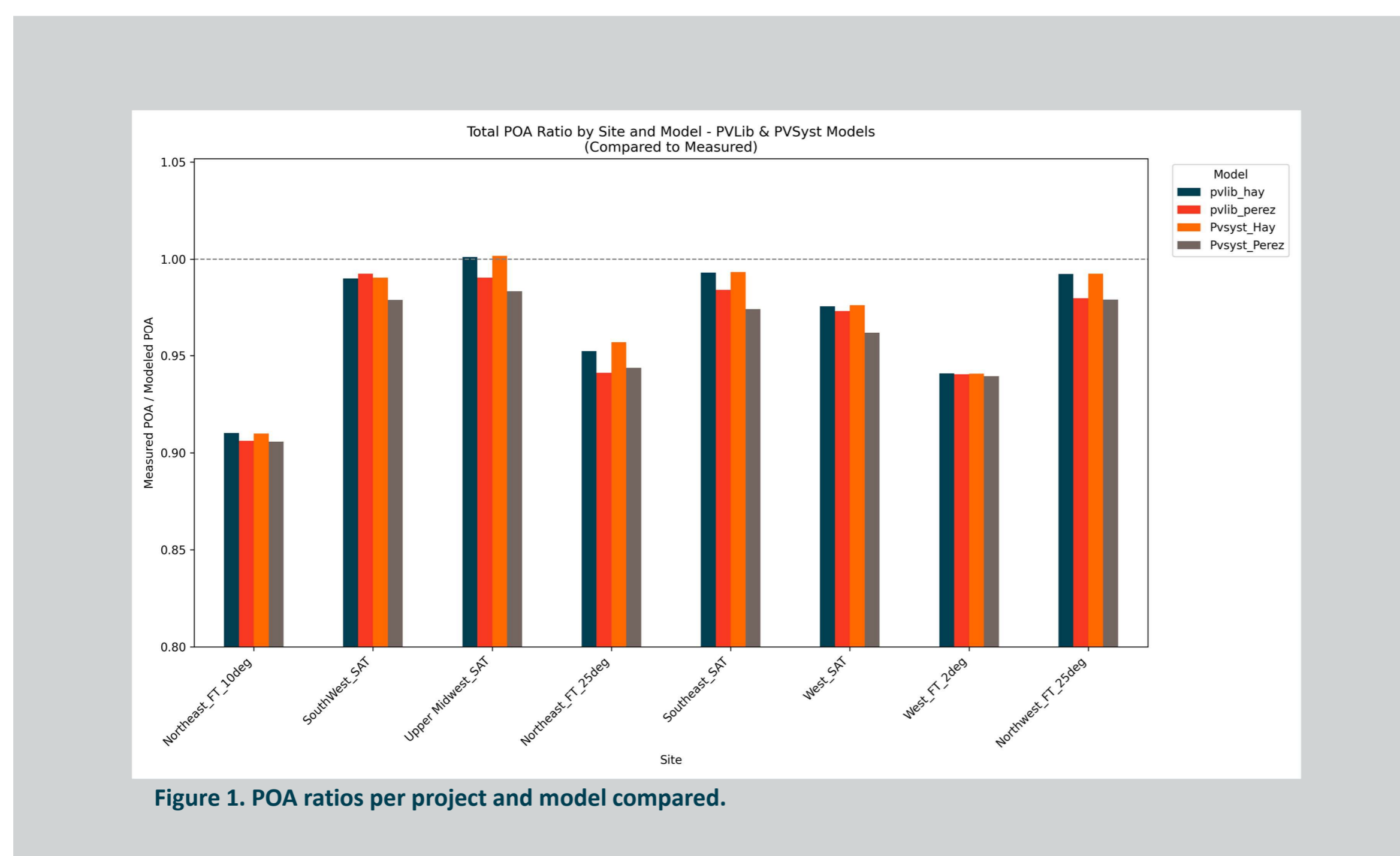


Figure 1. POA ratios per project and model compared.

### Transposition Model Evaluation

Enertis Applus+ has carried out an analysis of operating data from clients for which pre-operational Energy Yield Assessments (EYA) were conducted. This data covers more than 100 projects of varying sizes across different U.S. regions from 2018 to 2024.

Enertis Applus+ chose a sample of eight projects as close as possible to the median in terms of POA ratio (POA\_measured/POA\_modeled\_P50), to compare different implementations of the Hay and Perez transposition models in PVsyst and pvlb. The POA was modeled for the satellite typical meteorological year (TMY) data of each project and compared to the historical measured data.

### Results

- PVsyst and pvlb Hay's model implementations showed the best results across the sample.
- Overall using Hay model was 1.2% better in terms of POA accuracy than using the standard PVsyst's Perez implementation.
- Pvlb's Perez model was 0.5% better in terms of POA accuracy than using the standard PVsyst's Perez implementation.

### Discussion

- All models are still showing, in most cases, results with POA higher than the measured data. Given the length of the measurement period and the validated accuracy of satellite providers in terms of global horizontal irradiance (GHI), Enertis believes that decomposition models used to estimate diffuse horizontal irradiance (DNI) are also a relevant part of the modeling process, affecting the results of these transposition models.

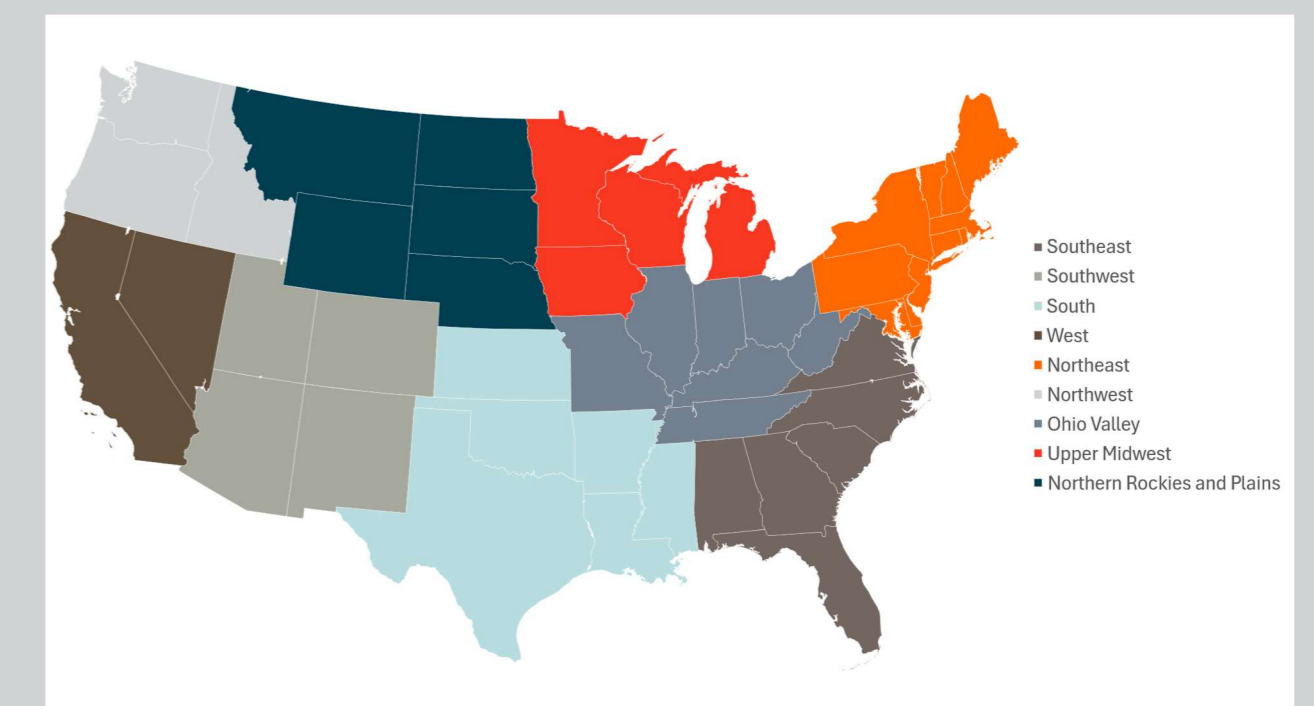


Figure 2. Regional classification based on NOAA criteria.

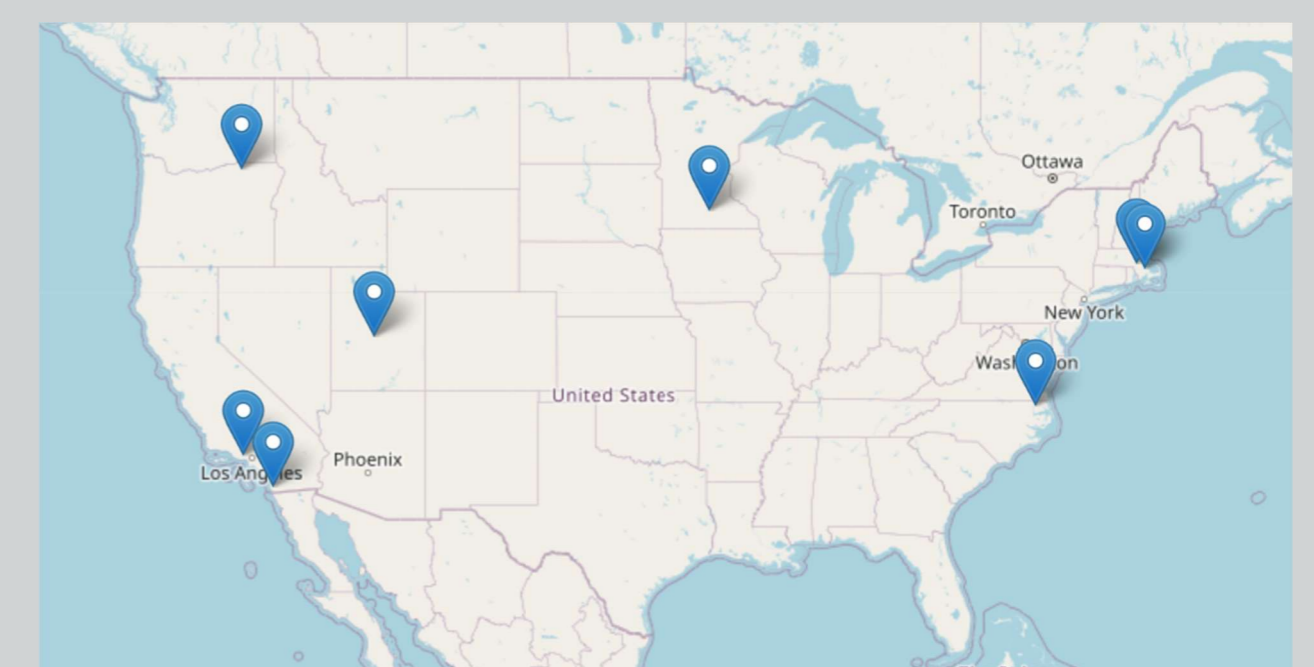


Figure 3. Geographical location of the projects.

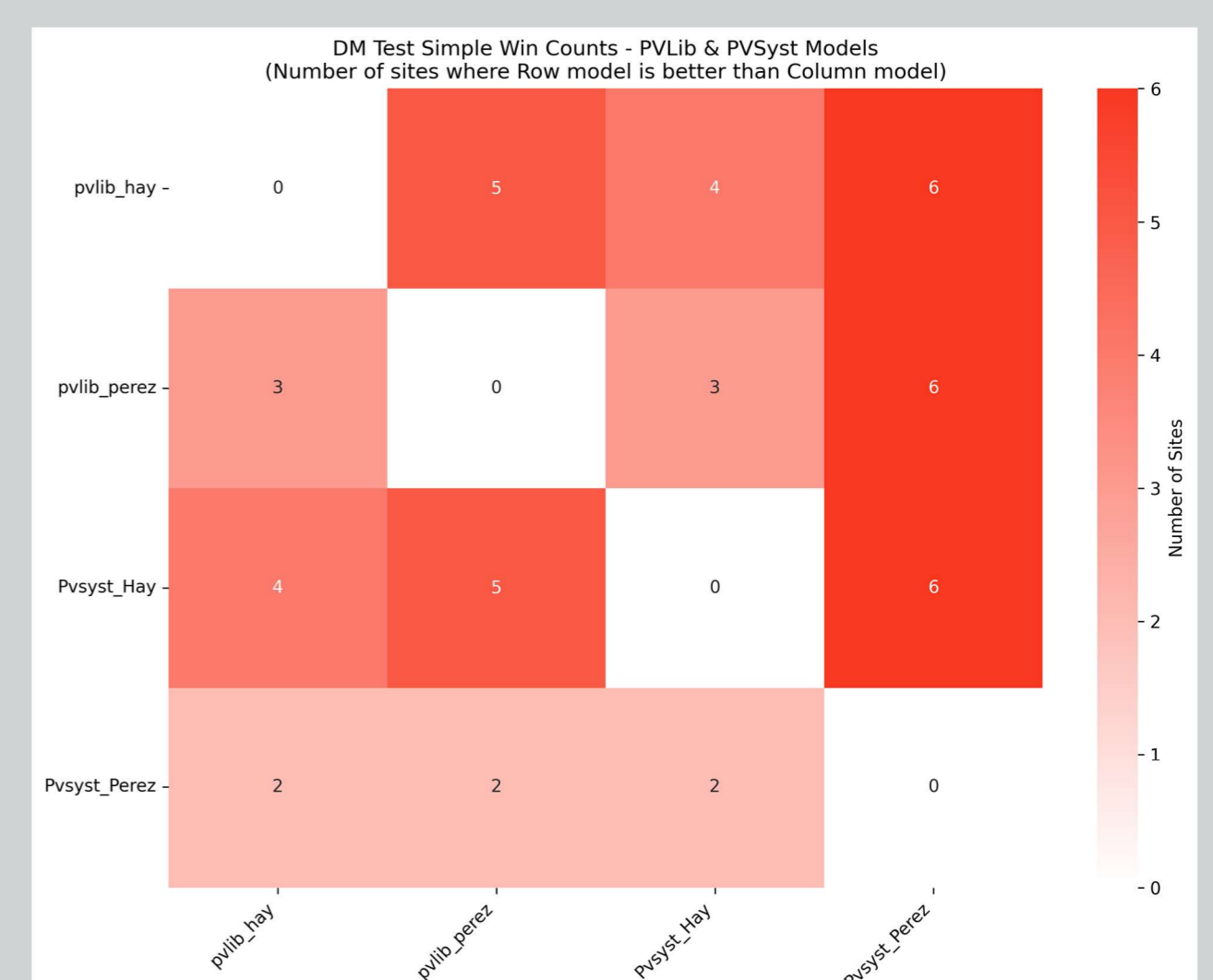


Figure 4. DM Test comparing how many times each model outperforms the others.

All regions show an overall overestimation of the modeled vs. measured POA Irradiance using PVsyst Perez implementation.

The possible sources of POA ratio uncertainty that Enertis Applus+ has considered to explain these results include:

- Pyranometer uncertainty: It is unlikely to be relevant since it would be expected to affect both positively and negatively.
- Plane-of-Array Tilt/Azimuth Modeling vs Measured: The tilt and azimuth used to measure the POA are likely to be slightly different than the average tilt and azimuth used for modeling in PVsyst, which is the average of the structures in the shading scene. This is unlikely to have a relevant impact since it is also arbitrary.
- Overestimation of DNI by satellite data: While satellite data shows low levels of uncertainty in GHI, the levels of uncertainty on DNI are higher, which has an impact on POA modeling results. Enertis Applus+ used a selection method of satellite providers for each site in this study based on which was the closest to the average of all providers on POA. This indicates that providers, on average, could be overestimating DNI.

### Authors

Javier W. Delgado Hernández, Performance Team Manager  
Vivek B. Mahtani, Performance Engineer  
Victor Sánchez de Dios, Performance Engineer  
Brian Custodio, Director of Data Science & Consulting

For more  
information  
contact

Javier W. Delgado Hernández

[javier.delgado@enertisapplus.com](mailto:javier.delgado@enertisapplus.com)

