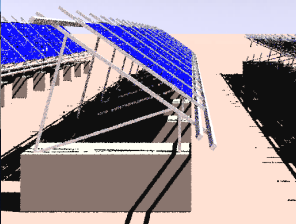


Perspectives on PVPMC 2023



Joshua Stein



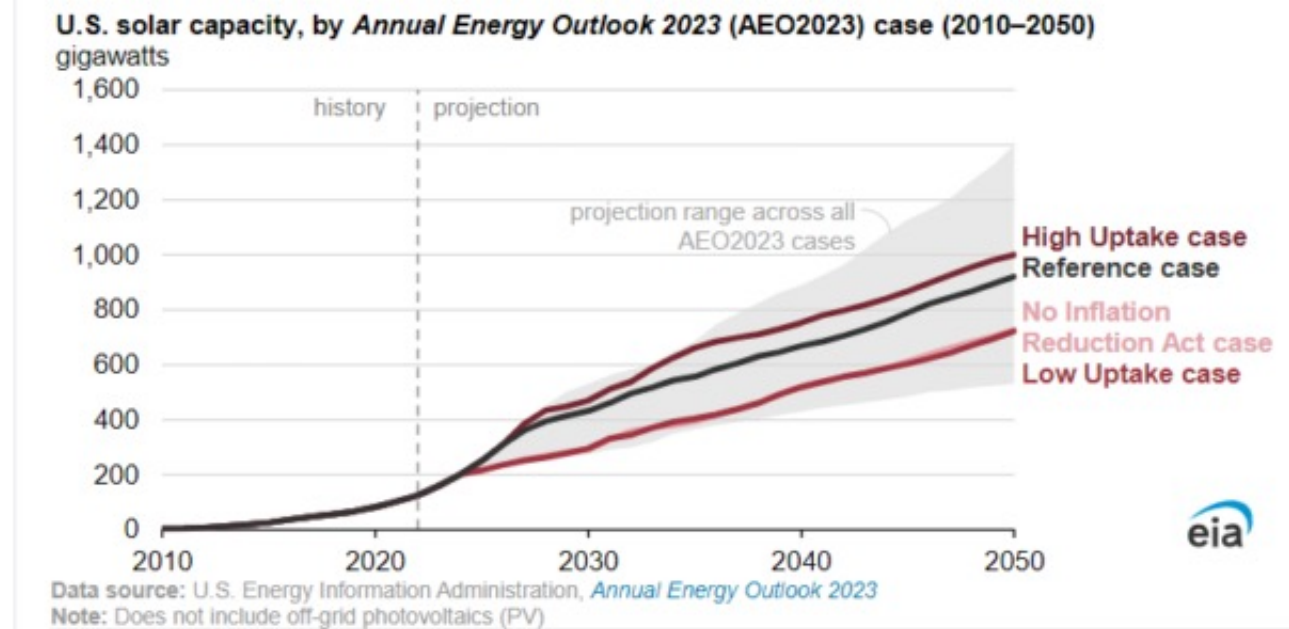
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SAND2023-04054PE

General Thoughts



- 2022: 143 GW installed in the US (~14% of global capacity)
- Projections show 100-300% increases by 2030.
- Where are the pain points with such rapid growth?
 - Human capital
 - Automation
 - Land availability
 - Transmission access
 - Energy storage





Solar Resource

- More offerings for Typical Meteorological Years
 - Critical for fast simulations and applications like PVWatts
 - Commercial projects may want multi-year higher time resolution data (clipping)
- Automated data quality and classification (e.g., shading, GTI/POA) methods are needed to speed up data analysis and increase consistent modeling results.
- Best practices related to rear side irradiance monitoring should reduce uncertainties.



PV Capacity Testing

- PV plant underperformance needs to be better quantified and understood so it can be addressed.
- Modules flash testing below name plate is still a problem.
 - 3rd party testing is essential to establish baseline module capacity
- PV systems are getting more complex (e.g., topography, mixed modules, high DC/AC ratios, bifacial) and capacity testing becoming more difficult.
- Automated software (e.g., pvcaptest) helps improve this process, but many companies resist automation (still insist on using Excel).

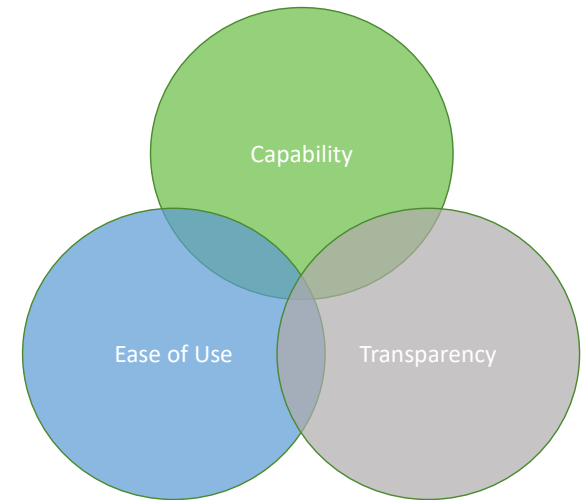


PV System Monitoring

- Monitoring with reference modules with in situ IV curves is getting easier with commercial solutions becoming available.
 - Better performance metrics (FTCPR) are being developed – more transparency...
- Performance data is still hard to get. Nice to see new efforts to share datasets to support modeling and monitoring applications.

PV Modeling Tool Updates

- Exciting new features from modeling applications
- Integration of plant design, performance modeling, and monitoring
 - Digital Twins
- More focus on blending Capability, Transparency, Usability. Use of open-source software to develop custom applications. Scalability is also important.
- Capabilities to simulate increasingly complex system designs
 - Topography, shading, clipping, bifacial, AgriPV,





PV System Modeling

- Uncertainty in albedo measurements can result in small differences in energy yields.
- Hemicycle FE approach offers an efficient method for complex shading calculations in between view factor and ray-tracing.
- SunSolve Yield (PV Lighthouse) comparison with conventional modeling methods shows a 2% difference in results due to system optics, solar spectrum, thermal model, Perez implementation.
- IV curve availability from modules and strings allows more detailed modeling of loss factors.



PV Model Validation

- Complex models do not necessarily perform better than simple models.
 - Many model differences cancel each other out. Differences are more evident when plotted against irradiance, time, temperature, etc.
- Filtering non-linear effects (e.g., curtailment, availability, soiling) is important for reducing bias in model validation studies.
- Blind modeling studies offer opportunities to benchmark models and modeler skills. Lessons learned and best practices emerge from these studies. They are also fun!
 - Win some socks!



PV Tracking on Sloped Terrain

- 3D design tools (e.g., PVcase) integrated with a performance model speed up model setup and throughput for sloped ground.
- Advanced slope-aware tracking algorithms can significantly increase yields on complex terrains by reducing row-to-row shading. Translating to performance models is still a bit involved.
- Is the future just laying modules on the ground?

Announcements



- Need Parking Validation? See Cameron Hunter
- You will receive a survey later today. Please fill it in before you head home.
- Please leave your lanyard at the registration desk so we can reuse next year. Try planting your name tag. Send a photo of what grows.
- Special thanks to GroundWork Renewables for hosting this event!
 - **Cameron Hunter**
 - **Sierra Knapp**
 - **Ann Will**
 - **Jim Crimmins**
 - **Session chairs, abstract reviewers**