Don’t .PANic : Investigating the effects of PVsyst .PAN file variability

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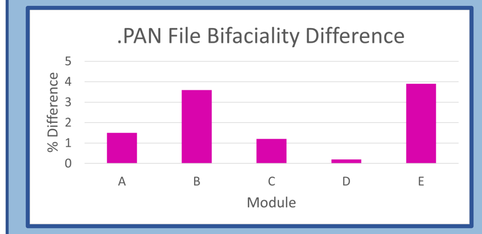
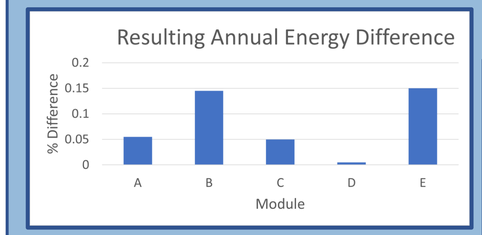
Summary

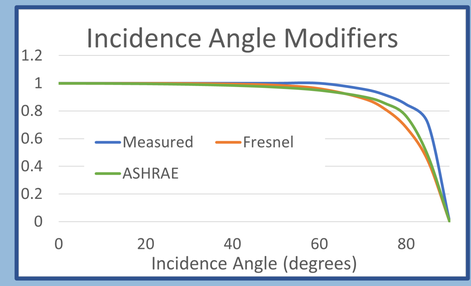
Accurate and unbiased PVsyst .PAN files are essential for both energy generation prediction and financeability of utility scale PV systems. Though module manufacturers can create these files themselves, more credence is given to those that are created and validated by an independent 3rd party test laboratory. These .PAN files are based on data encompassing the breadth of typical PV operating conditions, but there is still variability/uncertainty in their parameters. In this work we examine differences in some of the model components in 3rd party .PAN files and evaluate their effect on generation prediction.

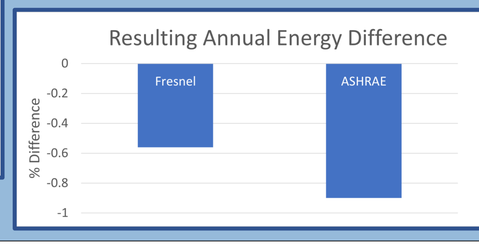
Details

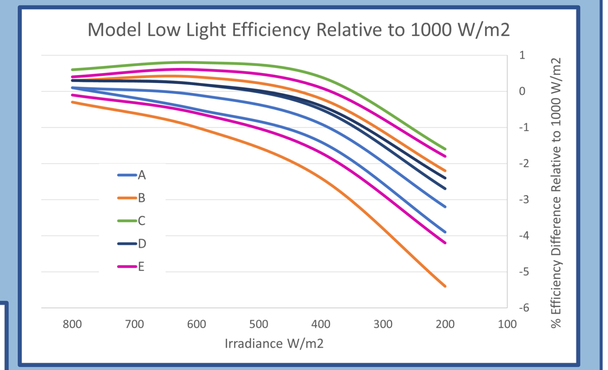
- Compare .PAN files for five bifacial mono PERC modules (identified by letters A-E), each of which has validated .PAN files from at least two third party labs
- .PAN file generation includes stated uncertainty of ±1-1.5°C for temperature and ±2-2.5% for maximum power at STC, increasing to up to 5% for testing at multiple irradiances and temperatures
- Focus on bifaciality, incidence angle modifiers (IAM), low light performance
- Show 3rd party .PAN files’ differences and evaluate resulting impact on annual generation

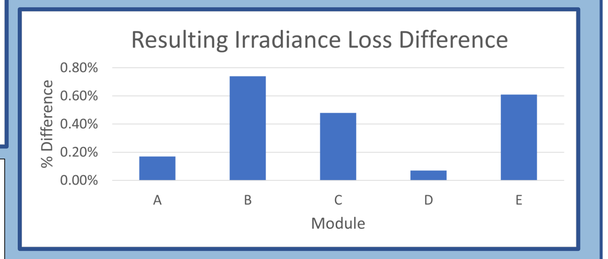






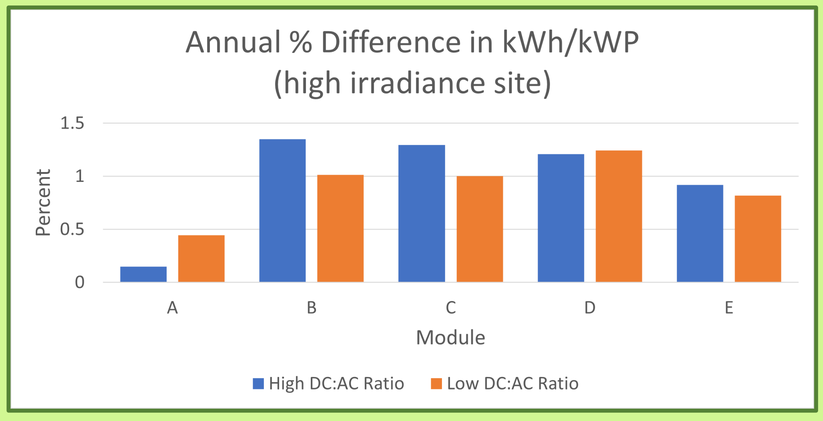


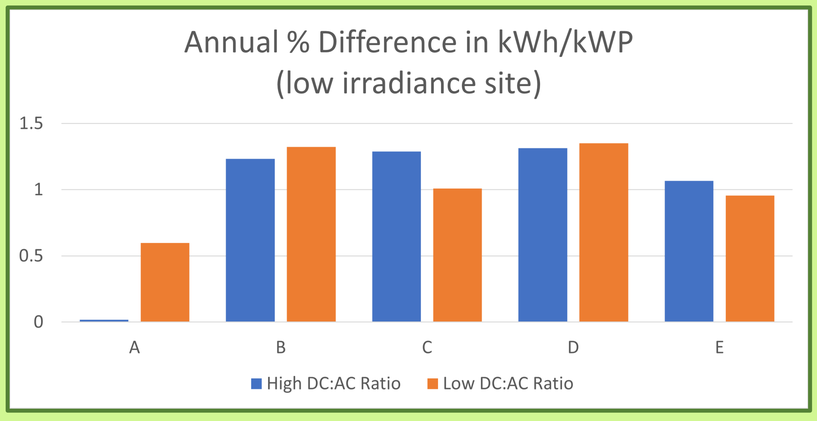




Annual simulations for Colorado site

- Differences in model bifaciality have minimal effect on simulation results
- Using default rather than measured IAM can significantly decrease predicted energy output
- Low light efficiency differences in .PAN files can significantly affect predicted energy output





- Annual simulation of single axis tracking PV systems in high irradiance (Colorado) and low irradiance (Washington) sites with high (1.28) or low (1.10) DC:AC ratios
- kWh/kWP generation varies by ~0.5-1.5% depending on which validated 3rd party .PAN file is used.
- No strong dependence on site irradiance or DC:AC ratio noted.
- For utility scale projects this can add up to millions of dollars over the life of a project
- Important to talk to module manufacturers about .PAN files, both internal and 3rd party and validate match with measured data