INDEPENDENT ENGINEER'S REPORT FOR

FIRST SOLAR PLANTPREDICT

PV MODELING PLATFORM

May 16, 2017

Submitted to:

First Solar, Inc.

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Tempe, AZ 85281

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The Energy Advisory Services group, within the ICF Commercial Energy division, has an integrated team to provide energy market analysis, financial and system modeling, regulatory analysis, technical due diligence including independent engineering and owner's advisory support. Collectively, the Energy Advisory Services group has the experience and expertise to support nearly all types of energy generation and infrastructure assets.

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INTRODUCTION

ICF Resources, LLC ("ICF") has been engaged by First Solar, Inc. ("First Solar") to perform an independent assessment of the modeling platform it developed for utility scale PV systems referred to as PlantPredict ("PlantPredict"). PlantPredict is a cloud-based, web application that enables users to estimate the energy production of specific facilities.

The purpose of this limited due diligence report ("Report") is to summarize, for potential PlantPredict users, the technical aspects that have been reviewed to date. We have reviewed the PlantPredict platform including the user interface, model hierarchy, model algorithms, and integration with other industry tools. We have also reviewed the accuracy assessment provided by First Solar, as well as completing an independent assessment of modeling results. The Report is for use by First Solar in accordance with notice provided at the front of the Report. Further, the Report has been developed based on the needs conveyed by First Solar during the course of review and discussion.

Information presented in the Report have been provided to ICF for review, and may involve exercising engineering judgment and analysis through the course of ICF's review. The achievement of possible outcomes is dependent on risks and uncertainties, that are both known and unknown, which may result in outcomes that differ from those discussed in the Report. ICF does not expect to update or otherwise revise the Report should events or circumstances occur that impact the information or assumptions used for the development of the Report, unless requested by First Solar.

PLATFORM REVIEW

PlantPredict was developed by First Solar, as a result of the evolution of the modeling software First Solar initially created for internal use to model PV system performance. The software was originally developed to offer increased adaptability for comprehensive system modeling. In 2015, First Solar made the decision to formalize their internal software and add a robust user interface to enable solar industry stakeholders to utilize the software for modeling utility-scale PV systems. The platform was named "PlantPredict" and externally released in September 2016.

As part of our scope, we have reviewed the user interface, hierarchy within the platform, underlying algorithms, interface capabilities, and process for managing revisions to the PlantPredict platform. First Solar provides the information and reference associated with the platform in the resource center with PlantPredict ("Resource Center").

User Interface

The PlantPredict user interface is clear and organized. First Solar sets up accounts at a corporation or company level, assigning an administrator within the respective company. The administrator is allowed to assign managers, and add/remove users within the company account. The administrator can also manage the status and access to projects and modeling library components. The user interface is based on a dashboard concept, which organizes the platform into different libraries for projects, weather information, inverters, modules, and platform resources ("Dashboard").

The structure approach with company-level accounts allows for all projects being pursued by an organization to be managed from a single point, referred to as the project library ("Project Library") within PlantPredict. The same is true for weather files ("Weather Library"), inverter files ("Inverter Library") and module files ("Module Library", collectively the "Libraries"). Through the Dashboard, the Libraries can be shared across users within a company.

PlantPredict has integrated status settings that can be used by a company administrator to manage the Libraries. Within the Project Library, status settings can help delineate between various iterations of designs and models for a single project such as draft, bid, contract, as-built, etc. Similar status settings are available in Module Library and Inverter Library.

The Project Library and Weather Library also includes a function that allows quick visual and tabular comparisons of the files within those respective Libraries. First Solar has indicated that similar capabilities will be available for comparisons of module and inverter characteristics. Additionally, PlantPredict has an interface within various project, weather, inverter, and module files to allow the user to enter notes and comments for future reference by other users.

A user's manual, complete with short instructional videos, is provided by First Solar in the Resource Center, the online version of which is searchable through web browser search capabilities. We note that, as the platform is updated over time, it may be necessary to update the short instructional videos to ensure the demonstrated navigation aligns with the current user interface. During our review, we found that in some instances the videos used a slightly different version than the current user interface; however, we generally found that the videos added to the user experience.

Platform Hierarchy and Settings

There are two key hierarchies relevant to the users within PlantPredict. The first is the company-level account hierarchy which has the administrator designation, then followed by the manager designation, and then the user designation. The second hierarchy is for the structure of modeling projects. The global features of projects are established and then independent predictions can be created.

Specifically, a project is first created based on an assigned name and its geographical location. Separate predictions under a project can be developed. Within a prediction, PlantPredict guides the user to first select the weather file and specify environmental attributes ("Environmental Conditions"), then design the PV plant - from the block-level first, down to the array-level, inverter level, and then DC field-level. The AC system design is established separately from the PV plant ("Power Plant Builder"). Lastly, setting for the model simulation are finalized ("Simulation Settings

Throughout PlantPredict, there are default settings and design guidance information presented, which can be adjusted as needed by the user. Categories where default guidance and available settings for adjustment include, but are not limited to, the following areas:

- **Environmental Conditions**
    - Albedo
    - Soiling and Spectral Losses
    - Plant Design Temperatures
- **Power Plant Builder**
    - Transformer Loads and Electrical Losses
    - Auxiliary Loads
    - Module Quality and Mismatch
    - Light Induced Degradation
    - Thermal Loss Coefficients and Parameters
- **Simulation Settings**
    - Decomposition and Transposition Models
    - Thermal Models
    - Inclusion of First-Year Degradation, Soiling, Diffuse Shading and Spectral Losses

  - Air Mass and Direct Shading Model
- **Module Library**
  - Diode model
  - Incident Angle Modifier
  - Spectral Shift Coefficients

A final, notable capability within the PlantPredict is the ability of the platform to accept sub-hourly data. This feature is particularly useful in the case of evaluating a project based on measured data or in an instance when understanding intra-hour variability is important, such as a project on an isolated grid, where a time interval shorter than an hour is valuable.

Model Algorithms

We have reviewed the algorithms employed by PlantPredict for modeling PV system performance. We have also reviewed supporting information referenced by First Solar, as well as other publically available research and our experience in our evaluation. In general, solar position and irradiance calculations are made for a project as a whole. Loss factors related to optical impact, array behavior, and electrical systems are calculated for each block, and then a final weighted average based on the capacity of each block is determined.

Solar Positions

A foundational aspect of estimating the solar resource received by the PV system is determining the relative position of the sun. An approximation is completed through a series of calculations. PlantPredict utilizes the Solar Position Algorithm ("SPA") published by Reda and Andreas through the National Renewable Energy Laboratory ("NREL") in 2008. This is an industry accepted approach.

In addition to estimating the relative position of the sun, PlantPredict includes algorithms for estimating the time of sunrise and sunset, atmospheric refraction, incident angle between the direct sunlight, and the module surface for a project. First Solar has used accepted astrometry algorithms for these calculations.

We note that a few minor details regarding the calculation of sunrise and sunset were not readily available in PlanPredict's publically available documentation. However, through communication with First Solar and our review of model results, we are comfortable that these calculations are implemented appropriately.

Irradiance & Insolation

Relative air mass is used as a measure of the distance the sunlight has to travel through the atmosphere. When the sun is directly overhead a project site (at sea level), the relative air mass is approximately equal to 1. As the sun moves across the sky, the length of path the sunlight travels through the atmosphere increases, as does the relative air mass. PlantPredict includes two options for algorithms for calculating air mass: the 1) Bird & Hulstrom equation and the 2) Kasten equation. The Bird & Hulstrom equation is the default in PlantPredict, but the Kasten equation can be selected by the user, under Simulation Settings – Advance Model Choices within the platform. Both the Bird & Hulstrom and the Kasten equations for air mass are accepted within the atmospheric science and PV modeling industries.

The barometric pressure is estimated based on the elevation of a project site, for the purposes of adjusting relative air mass estimates. A standard empirical atmospheric science algorithm is used estimating the barometric pressure.

Extraterrestrial irradiance (or radiation) is the intensity of the sun outside the atmosphere of earth. Through comparison of the extraterrestrial irradiance and selected input file for global horizontal irradiance ("GHI"), PlantPredict estimates the clearness index of the atmosphere. PlantPredict calculates extraterrestrial irradiance with a standard algorithm that takes into account the day of the year, and ultimately the position of the sun.

Terrestrial irradiance is defined by three components that are all geometrically related: direct normal irradiance ("DNI"), diffuse irradiance ("DHI"), and GHI. Assuming two of the three components are available, it is possible to calculate the third. However, in case where only GHI data is available, a decomposition model can be used to estimate DHI. The GHI data, combined with the estimated DHI, can then be used to estimate DNI. PlantPredict includes three options for decomposition algorithms: the 1) Reindl equation, 2) Erbs equation, and 3) DIRINT equation. The Bird & Hulstrom algorithm for calculating DNI from GHI and DHI is included within PlantPredict. Finally, the irradiance incident in the plane of the module surface is estimated by a transposition model. PlantPredict includes two options for transposition algorithms: the 1) Perez model and 2) Hay-Davies model. The three decomposition equations, the Bird & Hulstrom DNI equation, and the two transpositions models included in PlantPredict are all accepted in peer reviewed literature and in the PV modeling industry.

Optical Impact

There are several items that affect the amount of available irradiance that actually reaches the surface of the PV cell within a module. These include far and near shading, soiling and snow losses, reflection, and spectral losses. It is important to calculate the losses in the order that they physically occur, which is the same as the order in which they are presented. We have reviewed PlantPredict documentation and our understanding of the documentation has been confirmed by First Solar; we find that the order in which these loss factors are applied is appropriate.

Far shading is the result of topography or objects on the horizon that block the DNI component from reaching the module surface. As is typical for many PV modeling systems, PlantPredict assumes that all far shading losses impact the entire facility equally. Near shading is a result of nearby objects blocking the DNI and/or DHI component from reaching the module surface. PlantPredict calculates near shading only for adjacent rows of modules, based on the row spacing. PlantPredict does not consider other obstacles such as tree groves or transmission lines that may be present and shade portions of the facility. First Solar reports this functionality has not been included because for utility-scale systems, which generally occupy a large area, the overall impact is typically negligible. For the DHI near shading calculation, PlantPredict assumes an isotropic sky done.

PlantPredict uses a linear shading model that assumes the shading loss is directly proportional to the portion of the module that is shaded. Typical crystalline silicon ("CSi") modules have been shown to exhibit non-linear losses resulting from shading as a result of the electrical stringing configuration of the individual cells and bypass diodes that make up the modules (the "Electrical Shading Effect"). The Electrical Shading Effect has been shown to result in slightly higher losses than are estimated with a linear shading model. Conversely, First Solar cadmium telluride ("CdTe") modules have been shown to respond to shading with a high degree of linearity. For both CSi and CdTe modules we find that the uncertainty and potential bias associated with the use of a linear shading model is reasonable with respect to the overall uncertainty of typically accepted shading models.

We find that the algorithms and methodologies First Solar incorporated in PlantPredict for calculating far and near shading losses is generally appropriate and aligns with current industry standards for PV modeling of utility-scale PV systems. However, for smaller systems, systems with highly undulating terrain, and/or systems with significant sources of external near shading the shading model assumptions used in PlantPredict may result in unacceptable inaccuracies.

PlantPredict includes a feature to define monthly losses for soiling, snow, or other foreign debris that may accumulate on the modules. The algorithm reduces the incident irradiance available to the module surface via a user-defined percentage. First Solar does not offer any specific guidance on how to calculate the monthly losses.

PlantPredict includes three algorithms to characterize the reflection of irradiance off the front glass of the module as a function of the incident angle with the sun: the 1) Sandia incident angle modifier ("IAM") equation, 2) ASHRAE IAM equation, and 3) a tabular option that creates a cubic spline from user entered data. All three equations included in PlantPredict are accepted in the PV modeling industry. Default IAM values are provided based on manufacturer guidance, however the user may select other values as deemed appropriate.

PV modules are sensitive to the spectral distribution of the incident irradiance ("Spectral Sensitivity"). The conversion efficiency of the PV modules is dependent on the wavelengths of available sunlight. Depending on the module design and atomic structure of the photosensitive materials, the impact of Spectral Sensitivity will vary. PlantPredict includes three options to calculate the impact of Spectral Sensitivity: 1) precipitable water model, 2) air mass and precipitable water model, or 3) static monthly losses. Static monthly losses can be calculated outside of PlantPredict and entered by the user. First Solar's generation modeling guidance includes a Microsoft Excel based tool that allows users to estimate static monthly losses. PlantPredict also allows the option to ignore the impact of spectral sensitivity. The two models included in PlantPredict are accepted in the PV modeling industry. Additionally, First Solar and others have published multiple, peer reviewed studies demonstrating that the air mass and precipitable water model results in reduced generation modeling uncertainty.

Array Behavior

The array behavior characterizes the performance of the PV modules based on the effective irradiance on the cells, as well as the electrical performance of the system including module mismatch and degradation.

The electrical performance of PV cells is strongly influenced by cell temperature. PlantPredict includes two options for algorithms to estimate the temperature of the module cells: 1) Sandia module temperature model, and 2) heat balance temperature model. Both models consider the impact of incident irradiance, air temperature, and wind speed. The Sandia model calculates the cell temperature based on empirically-derived coefficients. The heat balance model relies on a thermodynamic heat balance model considering a theoretical absorption coefficient and the efficiency of the module. The two models included in PlantPredict are accepted in the PV modeling industry.

PlantPredict utilizes a single-diode model to simulate the current ("I') and voltage ("V") output of a PV module, and correct for module temperature. The IV curves are then aggregated based on the series and parallel connections of the modules to estimate the output of the array. PlantPredict assumes the IV curves of all modules are the same. However, in reality there will be mismatch between the IV characteristics of different modules. As a result, PlantPredict allows the user to enter a percent loss due to module mismatch. The mismatch is applied as a direct reduction to the maximum power point of the array for any given interval. The approach implemented for estimating PV module performance and power output aligns with current methods used in the PV industry.

PlantPredict allows the user to include the impact of module degradation. Three methods are offered for applying degradation: 1) linear application to DC power, 2) linear application to AC power, and 3) stepped application to AC power.

Electrical Subsystems

The elevation of the site, anticipated power factor, and the ambient temperature at any given interval are used to determine the available rating of the inverter based on provided specifications. Inverter efficiency and maximum power point losses are also calculated based on provided performance specification. PlantPredict uses standard electrical equations for calculating losses associated with DC wiring, AC wiring, and transformers. PlantPredict also allows the user to estimated anticipated auxiliary loads, and losses associated with limiting plant output with a controller.

Reporting & Integration

First Solar has developed the platform with features for reporting and to allow integration with other tools and data sources commonly used within the PV industry. Specifically, PlantPredict offers four different report formats for summarizing inputs and results of a particular prediction. There is a feature that allows easy comparison between predictions for a single project. It is also possible to export results, at a block or project level, into a tabular excel spreadsheet for further analysis or manipulation.

PlantPredict also has the capability to integrate weather files from various common industry providers and resources such as Clean Power Research, GeoModel, Meteonorm, Vaisala/3Tier, and NREL's Physical Solar Model. PlantPredict also provides a Microsoft Excel worksheet template (the "Weather Template"), to allow users to import

weather and irradiance data from other providers that have not been directly integrated into the PlantPredict platform. In addition, it is possible to import module and inverter files into the Module Library and Inverter Library, respectively. Finally, PlantPredict has an application programming interface ("API"), allowing third party applications to integrate with PlantPredict and run automatically. We have had successful results testing PlantPredict's ability to import proprietary module and inverter files and third party weather files, both through the Weather Template and the API.

Revision Management

Within the Resource Center, First Solar has included a history of the various releases of PlantPredict. They are categorized newest to oldest, and for each release include details of changes to the user interface or model algorithms, new features that have been implemented, any bugs that have been fixed, and information that has been added to the Resource Center. In our experience, it is often useful archive PV generation models to compare the actual performance of a facility to the expected performance. First Solar has indicated that new versions of the PlantPredict model are compared to previous versions to ensure that backwards compatibility is maintained. In other words, testing is performed to ensure that new versions of the software will produce the same results as previous versions. However, it is not clear how this testing applies to updates in the underlying algorithms. Additionally, we note that on many occasions, contracts associated with the construction and operation of PV facilities will reference specific generation models and software versions (with regard to capacity testing or performance guarantees, for example). Without the ability to archive and maintain specific versions of the software, such contractual structures may become less clear.

Platform Summary

Based on our review of the PlantPredict platform, the user interface is straightforward and well documented in the user manual provided by First Solar. It provides capabilities for ease of documenting and cataloging projects, and the various predictions that may be developed for each project. Further, the platform hierarchy for developing models is logical.

In addition, it appears First Solar has documented, in the Resource Center, the critical algorithms utilized by PlantPredict in calculating energy production estimates and cited sources where appropriate. The algorithms selected are appropriate and substantiated for the respective calculations, and collectively, for estimating the generation of a PV facility. Additionally, First Solar offers areas for further sophistication, which may be added in the future, but are not imperative for obtaining reasonable results.

The PlantPredict platform has been designed to allow integration with other tools and data sources commonly used within the PV industry. Also, First Solar has developed and appears to maintain a log of release versions for PlantPredict. We recommend that methods for archiving specific product versions are made available to the user for use as contractual mechanisms.

We would recommend in the future, First Solar consider adding a search function to the Resource Center to further enhance usability. As well, it may be necessary to update the short instructional videos within the user manual to ensure they are relevant to the current user interface.

TECHNICAL REVIEW

Appropriate validation with a statistically relevant population of PV systems is critical to the assessment of any PV performance modeling tool, which is referred to as "benchmarking". It must also be considered that the accuracy of any performance modeling tool is subject to the utilization of appropriate input assumptions. Therefore, a consistent set of guidelines must be applied for the modeling input assumptions throughout any validation study. Herein we describe various benchmarking studies performed by both ICF and First Solar.

We note that the benchmarking studies described below are limited to discussion of central inverters. We do not consider this to be a significant limitation of the studies, because from the perspective of performance modeling, the majority string- and micro-inverters can appropriately be modeled using similar algorithms to central inverters.

First Solar Assessment

First Solar has performed a validation campaign of PlantPredict using two separate approaches. First Solar has benchmarked 63 models developed in PlantPredict against models created in the industry-accepted "PVsyst" software. Additionally, generation models were developed for a fleet of 21 operational PV facilities using weather data recorded at the respective facility sites. Various model outputs were compared to the actual performance of the facilities. First Solar has described their findings and underlying methods in a peer-reviewed study, as well as providing us with relevant data.

We have performed a review of the methodologies employed by First Solar in the completion of their various validation studies. We note that it is possible to tune production models to more closely match the operational performance of a given facility. Our assessment of the results presented herein rely on an assumption that First Solar has accurately applied consistent modeling practices in their studies and has accurately represented their methods and findings in the documents they have provided for our review.

PVsyst Benchmarking

In order to establish a benchmark for PlantPredict, First Solar modeled estimated year-one energy generation for 65 utility-scale PV systems (the "Theoretical Projects") in PVsyst and published their findings in a paper titled *"Accuracy of Energy Assessments in Utility Scale PV Power Plan using PlantPredict"* (the "PVsyst Study"). PVsyst is a widely used modeling software, originally developed by the University of Geneva. PVsyst is an industry-accepted method for estimating the long-term average generation of a PV system, and we have found that it is an appropriate method for benchmarking the output of PlantPredict. The Theoretical Projects were also modeled in PlantPredict considering the same weather data and similar modeling assumptions. The resulting generation estimates from the two modeling platforms were compared for each of the Theoretical Projects.

The published results specifically discuss the benchmarking of Theoretical Projects featuring First Solar CdTe modules. Design details and description of the Theoretical Projects is limited in the published works; however, First Solar has provided, upon request, a list of the individual Theoretical Projects and high-level descriptions of each (the "Theoretical Project List"). The Theoretical Project List included 12 additional projects featuring CSi modules from various manufacturers, which were modeled using similar methods, according to First Solar. Our review of the Theoretical Project List confirmed that a wide variety of geographic locations and technologies were featured in the PVsyst Study. Additionally, both single-axis tracking systems and fixed tilt systems were considered for both the CdTe projects and the CSi projects. The size of the Theoretical Projects ranged from less than 1 MW-AC to over 100 MW-AC.

The following values vary slightly from First Solar's published data, as the data set we reviewed included additional facilities The mean relative difference between the estimates developed with PVsyst and PlantPredict (the "Delta") provided in the Theoretical Projects List is 0.01% (a positive value indicates over prediction of PlantPredict relative to PVsyst) with a standard deviation of 0.46%. The mean Delta for the sub population of only the CdTe projects in the Theoretical Project List was 0.08%, with a standard deviation of 0.45%. The mean Delta for the sub population of only the CSi projects in the Theoretical Project List was 0.08%, with a standard deviation of 0.45%. We note that with any reasonable level of statistical confidence, the two means (of the CdTe and CSi sub-populations) cannot be shown to be different, indicating that PlantPredict does not likely have any bias between CdTe and CSi modules that is not also present in PVsyst.

Figure 1 shows the relative distribution of the Delta considering the Theoretical Project List, as well as the sub-populations consisting of only First Solar modules and only CSi modules. Considering the population size, there is generally no significant bias in the distribution of the Delta, specific to project design or geography. We believe that the slight multi-modal nature could represent slight biases (relative to PVsyst) in fixed-tilt systems based on regional

weather; however, the sample size and level of available detail provided is not sufficient to strongly support or refute this hypothesis.

Figure 1

Relative Distribution of Generation Delta by Module Technology

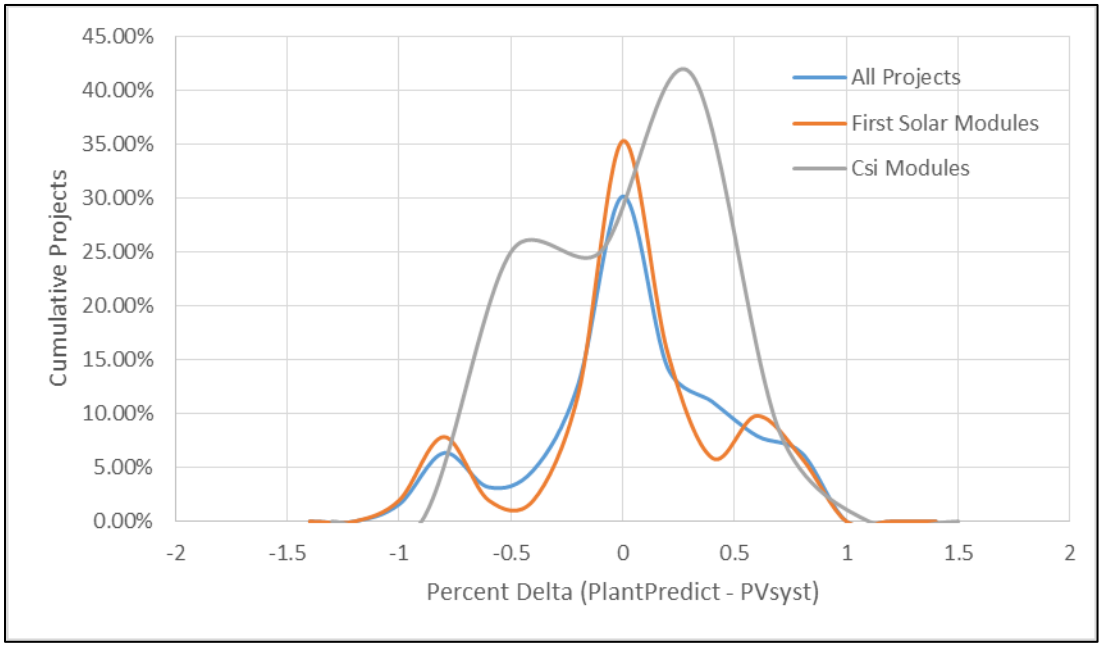
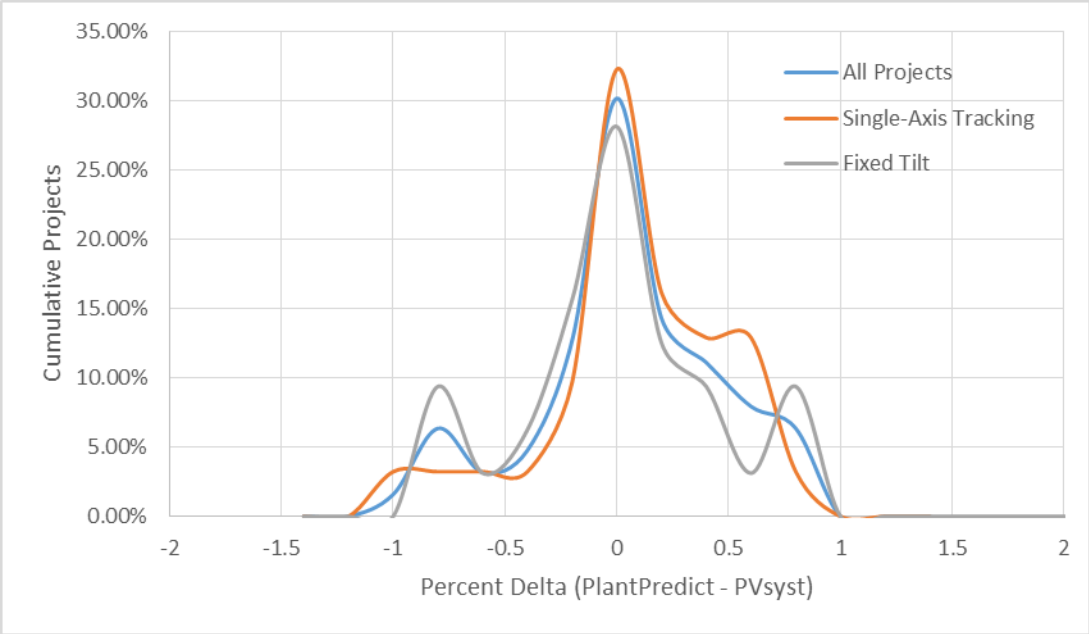


Figure 2 shows the relative distribution of the Delta considering the entire population studied as well as the sub-populations consisting of only single-axis tracking projects and only fixed-tilt projects. We found that PlantPredict generally under predicted generation (relative to PVsyst) on fixed tilt projects located in humid or tropical regions , while it seemed to over predict generation on fixed tilt projects located in semi-arid or arid regions. The cause of this pattern is not clear from the data available. No such pattern was identified for tracking projects.

Figure 2

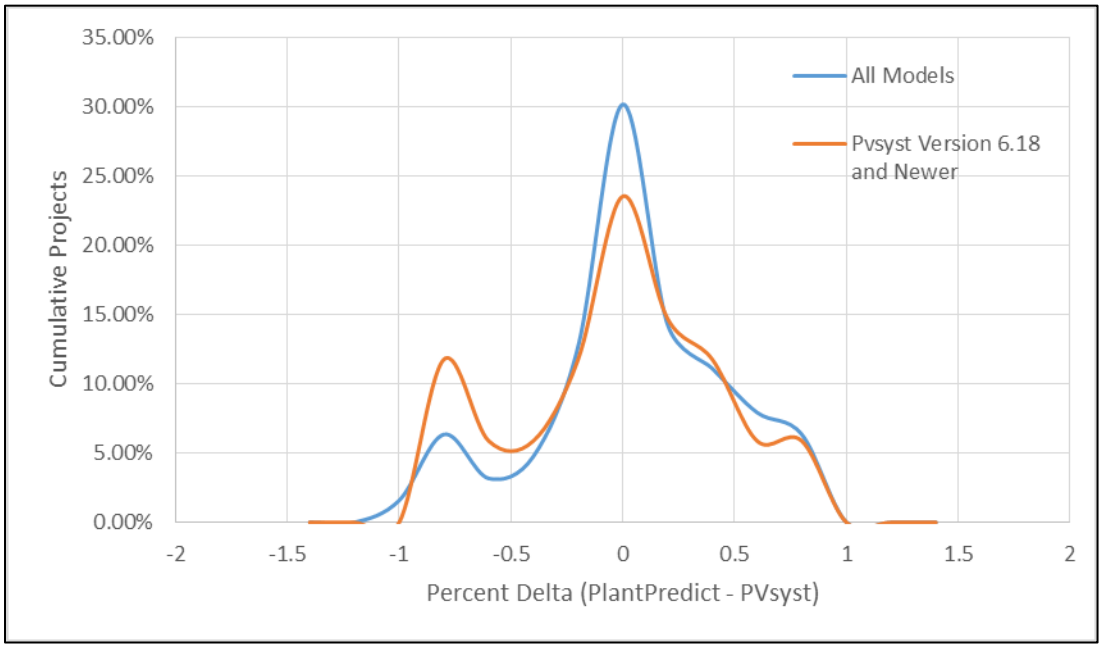
Relative Distribution of Generation Delta by Module Mounting Technology



We did note that multiple versions of PVsyst were used in the PVsyst Study, ranging from version 4.37 to version 6.22, which represents 96 revisions to PVsyst made over a period of greater than 3 years. We have reviewed the version release notes provided by PVsyst and find that changes made to modeling algorithms, may have influenced the overall distribution of the Delta. However, we reviewed the sub-population of only the projects modeled with version 6.18 to 6.22 of PVsyst (which represented only minimal or inconsequential updates to the PVsyst algorithms), and found the overall distribution of the Delta was minimally different from the full population of the Theoretical Projects List, as shown in Figure 3.

Figure 3

Relative Distribution of Generation Delta by PVsyst Version



While additional details regarding the modeling assumptions and design of the Theoretical Project List would be useful for additional analysis, the strong agreement shown in the PVsyst Study indicates that PlantPredict is a comparable to PVsyst as a means of modeling the annual generation of large-scale utility PV systems with limited external shading effects, utilizing central inverters.

Operational Facility Benchmarking

In addition to benchmarking PlantPredict generation estimates against estimates performed in PVsyst, through the PVsyst Study, First Solar has benchmarked PlantPredict against actual operational data from 21 utility-scale projects located in the United States, the Middle East, Australia and Canada ("Operational Projects"). The study compared weather-corrected model outputs to respective measured values representing the long-term operation of the Projects (the "Operational Study"). First Solar has summarized the findings of the Operational Study in a document titled *"PlantPredict Performance Model Fleet Benchmarking for 2013 Energy Prediction Guidance Parameters"*.

We have performed a review of the methodologies employed by First Solar in the completion of the benchmarking study. We note that the level of detail presented in the Operational Study was sufficient to describe the processes and analyses performed. Specifically, the Operational Study considered a wide array of centralized inverter manufacturers and considers both fixed-tilt and tracking systems. We noted the Operational Study considered only First Solar CdTe modules and did not consider CSi modules or any other technology, likely due to First Solar's access to operational project data. Further, the equipment used in the measurement of plant performance and weather conditions is of sufficient accuracy, and the period of record studied for each of the Operational Projects was in excess of 1-year.

First Solar performed both manual and automated filtration on the data for the Operational Projects. Detailed descriptions of the filtration criteria were provided, and the filtering criteria described in the Operational Study is appropriate and typical of similar studies. Because the use of a robust and consistent methodology for determining model inputs and settings is critical to the accuracy of such a benchmarking study, First Solar used their 2013 "Modeling Guidance" in the development of the Operational Study. The 2013 Modeling Guidance was detailed in the Operational Study, and sufficiently defines the model inputs, setting and methodologies to allow consist modeling of the various projects considered.

Overall, the diversity in the system designs considered in the Operational Study is appropriate; however only having access to facilities with CdTe modules somewhat limits the applicability of the results to facilities with CSi modules. First Solar has indicated that facilities were selected among their operational fleet to represent a diversity of geographies. However, we found that the diversity in geography was somewhat limited, as most projects studied were located in the Desert Southwest of the United States. The Operational Study did include one project in Australia, one project in the United Arab Emirate, and three projects in Canada. Even so, absent other studies, the Operational Study may not be sufficient to describe PlantPredict performance in tropical or humid climates. However, we note that the modeling performance of the Canadian facilities did not deviate from the rest of the population in a pronounced manner. Additionally, based on our review of the PVsyst Study and our review of the underlying PlantPredict algorithms, we expect that PlantPredict should result in comparable generation accuracy to similar commercially available software. We do not find the limited geography of the study to be of significant detriment to the study.

We did not review the individual data points filtered from the Operational Study or detailed statistics regarding the filtered, however, the methods of data filtration are described in First Solar's publications and appear to be appropriate for a .

On average, PlantPredict under predicted the generation of the 21 projects studied by 0.11% with a standard deviation in error of 1.97%, as reported in the Operational Study. This level of bias and associated variability is better than or aligned with other studies of modeling software validated against operational data that we have reviewed.

Independent Assessment

We have performed independent benchmarking of PlantPredict using a similar methodology to First Solar's efforts, by comparing PVsyst generation estimates to PlantPredict generation estimates ("Independent Study"). We chose the locations of the Theoretical Projects such that they represented a diversity of weather and geographic conditions. Similarly, the design specifications of the Theoretical Projects were chosen such that they represented a variety of technology and design while representing systems that are typical of the industry. Table 1 summarizes the projects modeled and the results.

For the Independent Study, model inputs and settings were selected to reflect our internal modeling guidance for developing long-term average production estimates for PV projects. We do not have specific modeling guidance specific to all of the various inputs available in PlantPredict, and the inputs do not necessarily translate directly to PVsyst model inputs. In such cases we have relied on our understanding of the underlying algorithms implemented by both software to choose the most appropriate PlantPredict inputs.

Table 1
Independent Benchmarking Summary

Project Location	Module Technology	Module Mounting	DC to AC Ratio	Delta (%)
Central North Carolina	CSi	Fixed-Tilt	1.31	-0.03
Northern Florida	CdTe	Fixed-Tilt	1.21	-0.01
Central Texas	CSi	Tracker	1.29	-0.01
Central Valley, California	CdTe	Tracker	1.21	0.91
Average	N/A	N/A	N/A	0.46
Standard Deviation	N/A	N/A	N/A	0.22

(1) Global Horizontal Irradiance ("GHI").
(2) kW-hours per meter squared ("kWh/m^2).
(3) Estimated relative uncertainty in P50 GHI at a 95% confidence interval.

The four projects we have studied does not represent a statistically significant sufficient population. However, we note that our findings provide independent support of the PVsyst Study performed by First Solar.

Summary of Technical Analysis

We find that the benchmarking studies performed by First Solar, supported by our independent benchmarking, demonstrate that the algorithms utilized in PlantPredict appear to be implemented appropriately.

For utility-scale PV systems with limited external shading effects, the benchmarking demonstrates that PlantPredict is capable of modeling PV generation estimates with a similar uncertainty to PVsyst, or other bankable PV generation modeling software platforms.

We believe that First Solar's studies would additionally be supported through additional study of PlantPredict estimated performance benchmarked against operational CSi projects. A similar benchmarking study for both CdTe and CSi modules comparing PVsyst (and other industry accepted software) to operational performance would also be beneficial.

SUMMARY OF REVIEW

As a result of our independent due diligence review, we have identified the following findings and conclusions regarding the use of PlantPredict for modeling utility-scale PV system performance. In order to have a full understanding of our findings and conclusions, the Report should be read in its entirety.

PlantPredict Platform

- Based on our review of the PlantPredict platform, the user interface is straightforward and well documented in the user manual provided by First Solar. It provides capabilities for ease of documenting and cataloging projects, and the various predictions that may be developed for each project. Further, the platform hierarchy for developing models is logical.
- In addition, it appears First Solar has documented, in the Resource Center, the critical algorithms utilized by PlantPredict in calculating energy production estimates and cited sources where appropriate. The algorithms selected are appropriate and substantiated for the respective calculations, and collectively, for estimating the generation of a PV facility. Additionally, First Solar offers areas for further sophistication, which may be added in the future, but are not imperative for obtaining reasonable results.
- The PlantPredict platform has been designed to allow integration with other tools and data sources commonly used within the PV industry. Also, First Solar has developed and appears to maintain a log of release versions for PlantPredict. We recommend that methods for archiving specific product versions are made available to the user for use as contractual mechanisms.
- We would recommend in the future, First Solar consider adding a search function to the Resource Center to further enhance usability. As well, it may be necessary to update the short instructional videos within the user manual to ensure they are relevant to the current user interface.

Technical Assessment

- We find that the benchmarking studies performed by First Solar, supported by our independent benchmarking, demonstrate that the algorithms utilized in PlantPredict appear to be implemented appropriately.
- For utility-scale PV systems with limited external shading effects, the benchmarking demonstrates that PlantPredict is capable of modeling PV generation estimates with a similar uncertainty to PVsyst, or other bankable PV generation modeling software platforms.
- We believe that First Solar's studies would additionally be supported through additional study of PlantPredict estimated performance benchmarked against operational CSi projects. A similar benchmarking study for both

CdTe and CSi modules comparing PVsyst (and other industry accepted software) to operational performance would also be beneficial.

Respectfully submitted,

ICF Resources, LLC

ATTACHMENT A – RELEVANT INDUSTRY LITERATURE

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