APPLICATION NOTE PV*SOL SIMULATION: ENSURING ACCURATE SIMULATIONS WITH Q.SMART SOLAR MODULES DUE TO INCREASED EFFICIENCY ACCOUNTING

1. INTRODUCTION

Q.SMART modules typically perform better than their rated power as found in the data sheet. This means that, as a customer, you get more kWh per paid kWp. This Application Note shows you how to simulate system yields with Q.SMART solar modules in PV*Sol that more accurately predict module performance.

The PV*Sol software from Valentin Energiesoftware GmbH is a widely-used tool for simulating energy yields of PV systems. The simulation tool operates with standard settings that do not account for special features of Q.SMART solar modules on a system level. Evaluations from our extensive monitoring network show that simulations of Q.SMART systems using PV*Sol standard settings lie below the expected actual yield values we experience and should therefore be viewed as conservative.

This Application Note is valid until further notice for simulations of the modules Q.SMART, Q.SMART UF and Q.SMART UF L of product generation G1 in PV*Sol.
All images and links found herein refer to PV*Sol Expert 4.0 (R7).

2. BACKGROUND OF THE INCREASED EFFICIENCY OF Q.SMART SOLAR MODULES

The increased efficiency of Q.SMART modules is based on two factors:

1. Positive sorting +5 Wp / -0 Wp. This means that, for example, a Q.SMART UF 90 with 90 Wp rated power has a measured STC output between 90 Wp and 95 Wp. On average, the Q.SMART modules offer an increased efficiency of 2.5 Wp greater than the nominal value.
2. Light Soaking Effect (LSE). Exposure of the module to initial sunlight leads to a higher effective doping of the active layers in the first few hundred kW-hours of operation. This leads to a reduction of the charge-carrier recombination rate in the CIGS layer and increases the voltage*. To make the best possible use of the effect, the modules must be supplied with 215 kWh/m² or be exposed to the sun for several weeks. The LSE therefore has a positive effect on the yield output and can also be taken into account in the simulation with an added 2.5 % on the positively sorted output values.

SAMPLE CALCULATION
The increased efficiency of a Q.SMART UF 90 Wp module in the system can be calculated with:
90 Wp rated capacity
+ 2.5 Wp medium increased efficiency from positive sorting
+ 2.5 % medium increased efficiency from LSE
= 94.8 Wp medium efficiency of the 90 Wp module

This corresponds to an increased efficiency of 5.3 %.

* Please incorporate the relevant safety factors into the project planning due to the increased voltage in the system set-up (esp. for the number of modules connected in series).

3. LOADING MODULE DATA SETS IN THE DATABASE

1. Check whether the latest data sets are already integrated in your PV*Sol (Libraries / PV module / Load). You can identify the current data sets on the following designation:
   - Q.SMART XX (G1).mod for framed modules Q.SMART, generation 1,
   - Q.SMART UF XX (G1).mod for unframed modules Q.SMART UF, generation 1
   - Q.SMART UF L XX (G1).mod for unframed modules Q.SMART UF L, generation 1,

   where XX represents the power class.

2. If the data sets are not yet integrated, you have two options for downloading the new data sets:
   - Option 1: Update PV*Sol via the Internet update directly in the program. PV*Sol loads the data sets automatically.
   - Option 2: Contact the Technical Customer Service of the Q-Cells SE (service@q-cells.com). Unzip the zipped file (*.zip) in its own folder on your hard drive Load the data sets in PV*Sol via Libraries / PV module / Load /Import (Fig. 1).

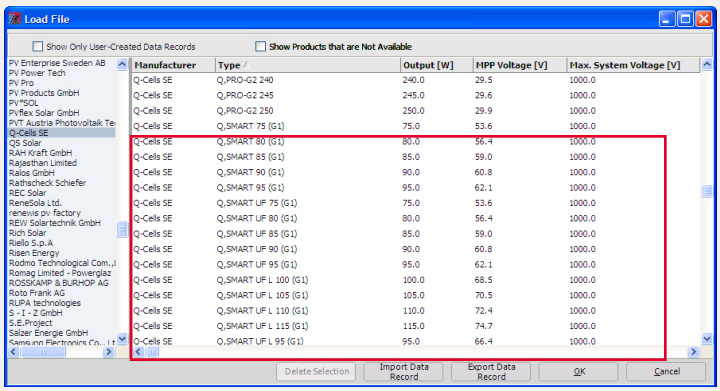

Fig. 1: Select data sets for Q.SMART solar modules

4. CREATE SIMULATION IN PV*SOL

Create a simulation of a Q.SMART installation in the usual way.
Always follow the basic instructions:

- from the installation and operating instructions for the Q.SMART modules
- from the inverter specifications.

5. ENTER THE CORRECTION FACTORS FOR POSITIVE SORTING AND LIGHT SOAKING EFFECT IN PV*SOL

1. Under System / Technical Data, open the window Losses (Fig. 2).

Fig. 2: Access to the Losses menu

2. Enter the correction factor for the relevant power classes under Losses in the field Deviation of the module output from the rated capacity (Fig. 3, marked in red) (shown here on the example Q.SMART UF 90).
   The correction factors for positive sorting and the positive "Light Soaking Effect" in the individual power classes can be found in Table 1.

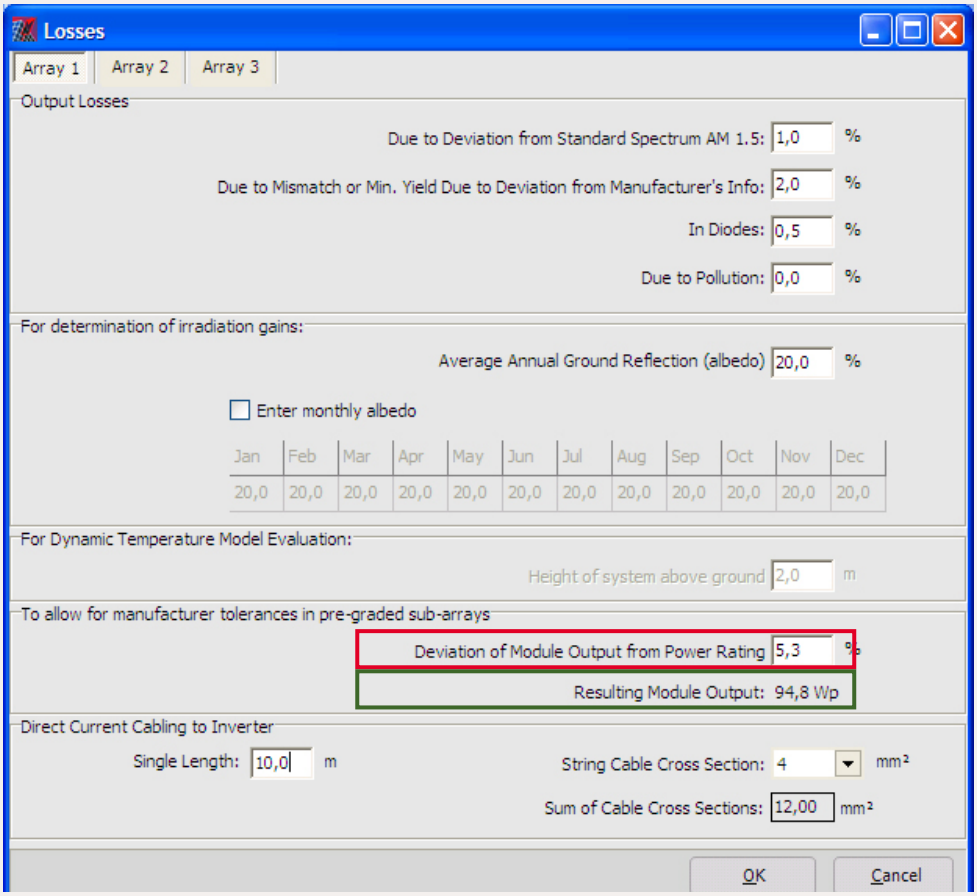

Fig. 3: Deviation of the module output from the rated capacity entry in the Losses menu

Q.SMART / Q.SMART UF					
Rated capacity according to the data sheet	Average effect for positive sorting	Average output taking into account the positive sorting	Average Light Soaking Effect (LSE) after 215 kWh/m²	Average output taking into account the positive sorting and the LSE	Correction factor
W	%	W	%	W	%
75	3.3	77.5	2.5	79.4	5.9
80	3.1	82.5	2.5	84.6	5.7
85	2.9	87.5	2.5	89.7	5.5
90	2.8	92.5	2.5	94.8	5.3
95	2.6	97.5	2.5	99.9	5.2
Q.SMART UF L					
Rated capacity according to the data sheet	Average effect for positive sorting	Average output taking into account the positive sorting	Average Light Soaking Effect (LSE) after 215 kWh/m²	Average output taking into account the positive sorting and the LSE	Correction factor
W	%	W	%	W	%
90	2.8	92.5	2.5	94.8	**5.3**
95	2.6	97.5	2.5	99.9	**5.2**
100	2.5	102.5	2.5	105.1	**5.1**
105	2.4	107.5	2.5	110.2	**4.9**
110	2.3	112.5	2.5	115.3	**4.8**
115	2.2	117.5	2.5	120.4	**4.7**

Tab. 1: Correction factors for Q.SMART modules

5. RESULT

The corrected module output taking into account positive sorting and LSE is shown in the input window under Resulting module output (Fig. 3, marked in green).

The simulated yield values are now based on the value of the resulting module output (in the example Fig. 3: 94.8 Wp).
The standardised values (e.g. spec. yield [kWh/kWp]) still refer to the nominal values, however (in the example, 90 Wp).
The correction factors are therefore increased accordingly in the simulation.

Q-CELLS SE
OT Thalheim, Sonnenallee 17–21
06766 Bitterfeld-Wolfen, Germany
TEL +49 (0)3494 66 99-23222
FAX +49 (0)3494 66 99-23002
E-MAIL service@q-cells.com
WEB www.q-cells.com