

**Questions and Comments from Module Power Rating Stakeholder Meeting
March 3, 2011**

Solar ABCs' response is provided below each question.

Regan Arndt, TUV SUD America, rarndt@tuvam.com

Q: How will the new tolerances be enforced? At present, UL 1703 (safety std) is the only mandated standard for the US other than the CEC specs (for performance). Will there be an ANSI or UL standard to help enforce this as the EN 61853 std is a European norm document.

Solar ABCs: The performance tolerances cannot be enforced through regulatory agencies but they can be enforced by consumers including incentive providers, financial institutions and power purchasing companies. This question does not warrant any change to the draft policy document.

Q: Suggestion: How about implementing an ANSI 61215 or ANSI 61646 standard in the US to help with the performance requirements and tolerance enforcement with the assistance of SolarABCs?

Solar ABCs: This question is under review.

Q: Will the calibration test labs require spectral response for the Reference modules using a IQE/EQE system or will a calculated method suffice?

Solar ABCs: Yes, it is needed if solar simulator is used for reference module calibration. If natural sunlight is used, then spectral response may not be needed depending the irradiance, air mass and matched reference cell technology. The proposed Policy does not deal with measurement uncertainty and hence the spectral response question does not come in picture. This question does not warrant any change to the draft policy document.

Ben Bourne, SunPower, ben.bourne@sunpowercorp.com

Q: Question related to the first question regarding -0%/+3%: does the manufacturer account for LID in their modules in their tolerance rating? If not, then the installed tolerance could be significantly lower than -0/+3%.

Solar ABCs: Yes, according to the proposed Policy, they are required to account for the LID, This question does not warrant any change to the draft policy document.

Craig Burton, Motech Americas, craig_burton@motech-americas.com

Q: Even though the module nameplate power tolerances have been tightened, when taking into consideration the tolerance of the flash testing equipment available to manufacturers and the different calibration processes that are used by module

manufacturers, and the variability in tolerances found in the labs, is it feasible to consider a uniform nameplate value that is real?

Solar ABCs: It is difficult to match the nameplate value with tolerances found in different labs but the nameplate value shall have traceability with at least one calibration laboratory of manufacturer's choice to have a confidence in the nameplate rating. This is the reason the proposed Policy has the following sentence in the document: "***The measurement uncertainty of each test sample at STC along with calibration traceability chain for the measuring equipment and calibrated modules shall be reported.***" This question does not warrant any change to the draft policy document.

Steve Fortuna, LG Electronics - Solar Div, steve.fortuna@lge.com

Q: My company already has a positive only (0/+3%) power tolerance and makes flash data available for all panels. What can we gain by involvement in this organization?

Solar ABCs: Good! Your company already meets the draft Solar ABCs policy if your rating tolerance is always 0/+3%. The "-0%" is already consistent with the policy as it allows up to "-3%". The "-3%" limit was chosen because majority of the manufacturers use this limit. The "-0%" was proposed in the original policy document and was extensively discussed by the Review Committee of Solar ABCs. The "-0%" requirement is viewed as too stringent and practically difficult to maintain. This question does not warrant any change to the draft policy document.

David Gower, CeCeT / Intertek, david.gower@intertek.com

Q: Testing at all of the different conditions is a good idea, but what do you think the needed time for testing under these conditions would be? Is it only a flash test under that condition?

Solar ABCs: Yes, testing time for multi-conditions (multiple temperatures and irradiances) as compared to single-condition (single temperature and irradiance) will be longer but the modules, in real world conditions, operate at different temperatures and irradiances. The draft policy requires tolerance reporting only for the STC (standard test condition) condition, not for the other test conditions of IEC 61853. Both indoor flash test method and outdoor natural sunlight method can be applied to obtain test data at different temperatures and irradiances (see Solar ABCs recent report related to IEC 61853 testing). This question does not warrant any change to the draft policy document.

Glenn Harris, SunCentric, gharris@suncentricinc.com

Q: Each module should have the flash test data printed on the module label.

Solar ABCs: Nameplate rating could be a single-rating for all the modules of a Model/Type or individual flash test data but the stated tolerance shall comply with the policy in either case and the manufacturer shall maintain a flash tester

calibration traceability as delineated in the policy document. This question does not warrant any change to the draft policy document.

Jason Hevelone, Abound Solar, jhevelone@abound.com

Q: Many manufacturers sell multiple watt bins. Would this type of testing be required for each of these product bins?

Solar ABCs: This tolerance policy is applicable to the nameplate rating. If the nameplate rating is different based on binning, then tolerance policy shall be applied to each bin or nameplate rating. This question does not warrant any change to the draft policy document.

Q: Is this a one time effort or does this type of independent testing need to be repeated on some type of interval?

Solar ABCs: This is decided between the buyer and manufacturer, and the QA/traceability/calibration requirements maintained by the manufacturer. This question does not warrant any change to the draft policy document.

Bruce Karney, Skyline Solar, bkarney@skyline-solar.com

Q: How can including 5 different ratings not cause consumers to be confused?

Solar ABCs: It may be confusing but ratings at multiple-conditions better represent the reality. This question does not warrant any change to the draft policy document.

Q: I find it troubling that alternative policies were not generated and a process describing pros and cons of each was not used to identify the best policy. Similarly, I'm concerned that prototype labels have not been designed showing the 5 ratings. If you look at the analysis of the new 2011 US Lighting Label standards you'll see a much more thoughtful approach to a similar problem.

Solar ABCs: There is only published standard (EN 50380) deals with production tolerance. The issues with the tolerance requirements are clearly identified in the draft policy document as: "The EN standard allows benefit of doubt leniency on both sides of the equation: the production tolerance leniency on the right hand side of the equation and the measurement uncertainty leniency on the left side of the equation. Unfortunately, the measurement uncertainty varies from one lab to the other, and one technology to the other. Also, the EN standard does not impose any specific lower/upper limit for the production tolerance." The policy does not call for label or nameplate rating TOLERANCE for all test conditions but only one test condition (STC) which is already practiced by the industry. This question does not warrant any change to the draft policy document.

The reviewer is not familiar with 2011 US Lighting Label standards but a quick internet search indicated the following (<http://www.clubdoconline.com/news/press-release/new-regulations-on-lamp-labeling-for-lighting-products-in-united-states/>):

“U.S. Federal Trade Commission recently issued new regulations on lamp labeling for lighting products, saying that, sales of lighting products should affix a new label on the packaging. Products with labels which fail to meet the standard of new regulations will be banned on sale in the United States.

According to the regulations, the new label, unlike the original version which separates one lamp from another simply based on power wattage, is requested to have information related to energy efficiency and content of toxic and hazardous substances, such as flux, annual energy cost, life expectancy, color temperature, mercury content and etc.

The contents of the new label will allow consumers to clearly identify the energy efficiency and environmental standards of different lighting products, inspired by which, energy-efficient products like self-ballasted fluorescent lamps and LED lights will be widely used while incandescent light bulbs and other inefficient lighting products will eventually fade out the USA market.”

It seems the old lighting label requirement on the package called only for power wattage but the new lighting label requirement on the package calls for the energy efficiency and material info in addition to the old power wattage info. The reviewer is not sure, in the absence of understanding all the appropriate lighting standards, how this can be linked to the PV nameplate rating.

Q: Why did you not recommend -0% +5% like Manufacturer #5 uses?

Solar ABCs: Similar question was raised by another caller. The “-0%” is already consistent with the policy as it allows up to “-3%”. The “-3%” limit was chosen because majority of the manufacturers use this limit. The “-0%” was proposed in the original policy document and was extensively discussed by the Review Committee of Solar ABCs. The “-0%” requirement is viewed as too stringent and practically difficult to maintain. The “+5%” limit is considered to be too generous as “+3%” can be easily achieved these days by the manufacturers. This question does not warrant any change to the draft policy document .

Paul Parravicini, SunEdison Solar, pparravicini@sunedison.com

Q: How's the new standards will help the average customer in the purchase of a more effective module?

Solar ABCs: This policy tightens nameplate rating tolerance and requires rating the modules at more than one temperature and one irradiance condition. So, an average customer is expected to get picture on the performance effectiveness of the module. This question does not warrant any change to the draft policy document .

Chris Smith, Schuco, chris@waldenpower.com

Q: Did you consider a weighted average of the reference conditions, maybe specific to regions of the country? That would give a single performance number that would be relevant to a consumer.

Solar ABCs: Yes, this is considered in the IEC 61853 standard and that is why Solar ABCs recommends including the test conditions referred in IEC 61853 standard.

Q: A module may have a 3% power tolerance, but a +/-10% tolerance in current and voltage. Does your draft standard cover voltage and current also? This is important for mismatch and other design considerations.

Solar ABCs: It is an important point but the Solar ABCs policy focuses on the first order issue which is related to the power itself because most incentives and purchases are still based on \$/W. This question does not warrant any change to the draft policy document .

Michele Trancossi, Universita' di Midena e Reggio Emilia,

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Q: How testing system good to analyse problems such as gas bubbles in EVA can be produced in industrial quality evaluation?

Solar ABCs: The current policy is related to nameplate rating tolerance issue, not the construction/design issues of a PV module. This question does not warrant any change to the draft policy document .

Q: The very limited range of validity of flash test modules do not guarantee both teoretically and pratically a good system for performace certification, but in can also guarantee a comparison between modules of the some kind.

Solar ABCs: It seems to be comment rather tha a question. It is true STC rating alone is not sufficient though it is a good test to compare the performance of different manufacturers' modules for a cold sunny day condition (25°C module temperature and 1000 W/m²). This question does not warrant any change to the draft policy document .

Q: What to do in comparison of different modules both in terms of durability and effective performance?

Solar ABCs: In order to identify the effectiveness of performance, it is necessary to rate the modules at different sets of test conditions, not just STC condition. This is the reason why the Policy calls for rating the modules at different stes of test conditions as per IEC 61853 standard. Unfortunately, this policy does not deal with

durability of the modules as it is more related to design and construction materials of the modules. This question does not warrant any change to the draft policy document .

Lou Trippel, First Solar, Inc., ltrippel@firstsolar.com

Q: In experiences on multiple utility scale PV projects with lenders, advisors, and customers, there is a clear view that overall system performance is the primary mechanism for plant acceptance. Given that overall system performance is a driving force in economics and project acceptance, why should a project stakeholder be obligated to undertake individual module measurements if their plant is demonstrated to perform as expected as a whole?

Solar ABCs: It is that the overall system performance is the primary mechanism for PLANT acceptance; however, the power rating (and its tolerance limits) is the primary mechanism for the MODULES. This question does not warrant any change to the draft policy document .

Q: Follow-up/Rephrase: DC Performance as a whole is also typically measured and known in a utility scale system, and techniques exist to isolate influence of inverters. It is still not clear how individual module assessment, even within the DC side of a plant, is valuable to a project stakeholder if the DC side as a whole is performing at expectation.

Solar ABCs: Perhaps the previous answer applies here as well because this policy is related to module (not system) because the purchases are still done at \$/W of the module. This question does not warrant any change to the draft policy document .

Q: It was mentioned earlier Solar ABC's already has a +/-5% policy. Under what market or compliance mechanism is this currently enforced?

Solar ABCs: Solar ABCs is not familiar which market enforces the previous recommendation of +/-5% policy of Solar ABCs. However, it is to be pointed out that the previous policy was developed by Solar ABCs but not effectively marketed as it was a quick effort encouraging the industry just to move away from the acceptance of “+/-10% tolerance” palquing the US marketplace for more than a decade.

Overall Input: Unless this effort is firmly coordinated with IEC efforts on a global basis, the creation of unique requirements without substantive international adoption is believed to be contributing to industry fragmentation and localization which is a detriment to the overall industry as a whole, and especially to global manufacturers. Efforts might be better spent refocused to contribute to globally substantive debate and standardization under formal IEC auspices.

Solar ABCs: Yes, an IEC standard is preferred and that is why we have IEC 61853-1. Solar ABCs proposed Policy has a specific +/- production tolerance limit (+/-3%) but unfortunately IEC's rules do not permit to identify/impose any SPECIFIC production tolerance limit (it simply says that the manufacturer shall identify the tolerance but does not impose any limit) and is left open to the manufacturer to decide what tolerance limit they want to have (So, it is up to the consumer to purchase the low tolerance modules or high tolerance modules; if they are informed consumers, they purchase low tolerance modules). This is the reason why the industry needs to have this Policy which could potentially be converted into a national PERFORMANCE standard, such as IEEE or ASTM, in future.

Question/Comment:

If a 280W module has -2.999% tolerance, it underperforms nominal by 8.4W. If an 80W module has -2.999% tolerance, it underperforms by 2.4W. Both are very common in the market today. The customer is paying on a per watt basis. Both modules are compliant. So the same -3% recommended tolerance would allow a high wattage manufacturer to under-deliver by 6 more watts for than a low wattage module manufacturer and still remain compliant. How can it be ensured this proposal does not unfairly bias to allow higher wattage modules to take advantage of more watts under-delivery? Stated another way, a high-wattage module manufacturer could overcharge for a module by 6 more 'phantom' watts than a low wattage manufacturer and still be deemed fully compliant. This does not financially equitable.

Solar ABCs: Yes, it is true if a consumer purchases just one module of each! Taking the same example --- let's assume that a consumer purchases 2 modules of 280W for his total system power of 560W and 7 modules of 80W for his total system power of 560W. So, $2 \times 8.4W = 16.8W$ and $7 \times 2.4W = 16.8W$. So, both manufacturers are financially equitable if the total power of the purchaser exceeds 560W!

Uday Varde, United Solar Ovonix, uvarde@uni-solar.com

Q: How do you propose to address the higher measurement errors between labs concerning multi junction modules? In the table it looks like the error was double the 3% tolerance that you are suggesting.

Solar ABCs: Yes, the performance data repeatability error between the labs is more than double the 3% tolerance stated in the Policy. This is one of the primary reasons why the Policy does not get into the measurement uncertainty issues. However, the Policy requires the manufacturers to report the following: ***“The measurement uncertainty of each test sample at STC along with calibration traceability chain for the measuring equipment and calibrated modules shall be reported.”***

This comment does not warrant any change to the draft policy document.