November 6, 2017

Solar Industry Comments on EPRI Report *"Recommendations for Harmonizing Distributed Generation Interconnection Practices: Technical Review Processes in NY State"*

The solar industry supports the stated intention of the EPRI report to update SIR screens in order to make them a more accurate reflection of the impacts of DER and to allow systems with minimal impacts on the system to pass without requiring detailed study at the CESIR level.

However, the current recommendations (in particular #1 and #2 from the EPRI report) will not accomplish this, and will in fact likely have the opposite effect, with some of the redesigned screens adding unnecessary levels of currently inadequately supported conservatism that will have the effect of driving more systems rather than fewer to detailed study.

We have very significant concerns, in particular with the definition of aggregation for the redesigned screens C and E, the redesigned screen F in the preliminary review, Screen G in the supplemental review, and the proposed modifications to screen H in the supplemental review which would include consideration of rapid voltage change as opposed to more realistic consideration of the actual voltage impacts to be expected for solar PV. We have raised many of these issues previously in our comments and responses on April 28th and June 27th, 2017 and we will both recap and expand further on those concerns below.

In addition, the solar industry also has substantive issues with EPRI's recommendations #3 and #4. Specifically, for #3, while we strongly agree with the need for and goal of adopting more uniform criterion to scope and report CESIR studies, the current draft of the report does not, in our view, adequately accomplish this goal. Regarding recommendation #4, we are not aware of the existing issues referenced on page 12 and while we are open to a mechanism beyond what is currently in the SIR to address any such potential future scenarios, as we have previously commented, adequate forensic capabilities on the part of the JU would need to be demonstrated for this mechanism to be both fair and effective.

Finally, there are a number of places in the report where there are apparent errors in explaining how the current SIR process works today and we recommend that these be corrected, especially with respect to the use and interpretation of Section II – Interconnection Requirements.

Comments on Aggregation Definition Issue in Revised Screens C and E (p. 18-23)

As detailed initially in our April 28, 2017 comments, the solar industry requests that the definition of aggregation for Screens C and E be more specifically addressed. For both screens, aggregation should clearly and specifically state that it refers to

the existing DER and any DER approved before the project being reviewed in the queue, but not all approved generation as EPRI states. Thus, it is our recommendation that Screens C and E should be edited to say:

Revised Screen C: Is the Electric Power System (EPS) Rating Exceeded? Does the maximum aggregated (~~being considered,~~ existing and approved before the current application in the queue) Distributed Generation capacity connected to an EPS exceed any EPS ratings ~~(modified per established Distribution Provider practice)~~? If yes (fail), If no (pass), continue to Screen D.

Revised Screen E: Simplified Penetration Test. Is the aggregate DG capacity (existing and approved before the current application in the queue) on the Line Section less than 15% of the annual peak load for all Line Sections bounded by automatic sectionalizing devices? If yes (pass), continue to Screen F. If no (fail), Supplemental review or study is required, continue to Screen F.

Comments and Concerns on the Revised Screen F (p. 27-31)

The solar industry has significant concerns regarding the proposed redesign of Screen F. As we noted in our comments from June 27th following discussion of an earlier EPRI draft, the 15% penetration screen has been successfully relied on in the initial review process of jurisdictions like California, Massachusetts, and Hawaii and in the FERC SGIP to identify any potential concerns over voltage impacts from DER. The reliance of these jurisdictions on the peak load and other screening methodology currently embodied in the New York SIR is of particular note as they have achieved substantially higher penetrations of solar PV than New York without issues nor the need for this type of additional screening for voltage impacts.

In light of the stated goal of improving the efficacy of the screening process and better identifying systems that do not require detailed study, the solar industry has significant concerns with respect to the 40% of available power rating limit in the revised screen F for medium voltage systems. Specifically, we question the technical basis for the proposed screening limit of 40% as the specific quantitative limit is not given substantive underlying support in the EPRI report. The lack of detailed technical support for this newly proposed screening limit is of particular significance given the restrictive impact it will have on the ability of DER to pass preliminary review and the conservative nature of the current 15% of peak load and 5% $\Delta V/V$ screens.

For example, as detailed in Table 2 of the EPRI report itself, the use of the 40% of available power rating limit in the revised screen F will, in their illustrative examples, result in DER limits that are on average a factor of two (2) lower than the current $\Delta V/V$ limit of 5% in the existing screen F. These new limits would, in fact, even be 25% more conservative on average than the tighter limit of 3% voltage change considered in earlier EPRI drafts.

Given the highly conservative nature of the revised screen, and thus its significance in reducing the number of DER systems that would be able to pass preliminary review, as well as the lack of detailed technical justification for the selection of 40% as the screening limit, the solar industry would strongly oppose the adoption of this revision to the SIR. While we continue to question the need for an additional voltage impact analysis in addition to the 15% of peak load penetration screen, if such a voltage screen is to remain in the preliminary review, we would propose to clarify the language of Screen F as to its intent, but to retain the current $\Delta V/V$ limit of 5% to avoid unnecessary and, to date, unjustified levels of conservativeness at this level of review.

Comments on Revised Screen G (p. 31-32)

In the context of the minimum load screen in supplemental review, the solar industry would recommend that, consistent with its application in other jurisdictions, the minimum load to be used for stand-alone PV be specifically stated to be the minimum day-time load. In addition to the use of the phrase "minimum day-time load" for fixed tilt solar PV, the solar industry would recommend that specific hours of consideration be listed in the screen as is done in the FERC SGIP and in jurisdictions like California, Massachusetts, and Hawaii. Given the current DC to AC ratios in use at larger-scale facilities, we would propose that the hours specified for the minimum day-time load be 9am to 5pm which provides a one hour buffer over the current 10am to 4pm timeframe used in other jurisdictions for fixed tilt PV systems.

While we acknowledge that many circuits lack data currently to enable the full and complete application of the minimum day-time load screen, the importance of such clarification in the intent of this supplemental review screen will likely increase significantly given the growing focus on monitoring and control in the distribution system at the JU. The solar industry feels that 9am to 5 pm is a reasonable and conservative timeframe for the evaluation of minimum day-time load, particularly in light of the current anti-islanding screen's use of the Sandia screens 67% of minimum load to determine, in part, when supplemental anti-islanding protection or detailed risk of islanding studies are necessary.

Finally, when solar PV is combined with energy storage that can discharge into the grid at any time, we would purpose language that screen G include the absolute minimum load in order to retain an appropriate level of conservativeness for these system's operating characteristics.

Comments and Concerns on Revised Screen H (p. 32-34)

As with the revised screen F, the solar industry has significant concerns with the proposed revisions to the supplemental review's screen H. There are three distinct issues that are being raised in the proposed modification of screen H that should be

addressed separately – visible voltage flicker, the currently unsupported introduction of rapid voltage change considerations at the PCC, and the impact of voltage variation caused by cloud induced intermittency at voltage regulation devices.

Concerning visible voltage flicker, as noted in our earlier comments (June 27, 2017 p. 2-3 and April 28, 2017 p. 1 and 6), we support the conclusion of EPRI that visible flicker as defined by IEEE 1453 is unlikely to ever be a concern for solar PV and should not be a focus of a priori study. We continue to recommend that the most accurate and applicable means of addressing visible flicker concerns is with an a posteriori assessment using an in situ flickermeter in the unlikely event complaints ever arise, coupled with a specified method in the interconnection contract for identifying the underlying source of any power quality issues and a resulting contractual mechanism to address issues if they are traceable to the solar PV systems.

However, if voltage flicker is to be studied in an a priori manner, we support the use of the structure of Pterra's recommended screen from the July ITWG meeting and September workshop. Concerning the use of rapid voltage change as proposed by EPRI in the revised screen H, the solar industry has serious concerns. The use of such limits are only appropriate for rapid step voltage changes and take no account of the real-world ramp rates that would accompany realistic changes in solar PV output. As a result, the overly restrictive limits of 3% for an individual facility and 5% for the aggregate of all facilities is likely to be far too conservative for inverter based solar PV and is not representative in any way of the realistic impacts to be expected from this kind of DER resources. As such, this proposed modification of screen H runs counter to the intent of the current SIR update as it will act to drive more systems, not fewer, to detailed study as opposed to the existing screen H which is based on limiting visible flicker as defined by IEEE 1453 or equivalent utility practice.

As discussed at recent ITWG meetings, the Joint Utilities indicated that the running of power flow models in the supplemental review are an important element in determining the impact of DER on the system during supplemental review. As such, the actual $\Delta V/V$ impact of a full on-to-off transition of the solar system will be available as part of the supplemental review process. Having the actual voltage impact profile from the solar system is a significant improvement over the simplified approximations considered in the Pterra workshop and the use of the actual $\Delta V/V$ result from the power flow model is a significant element in the accuracy and intent of screen H.

With such data for $\Delta V/V$, the ability of the circuit including the solar facility to remain within ANSI limits can be determined with sufficient specificity to eliminate that issue as an area of potential concern. Coupled with the unique features of inverter based DER, such as the ability to incorporate ramp rates and soft-start capabilities after a trip, the use of the power flow model voltage profiles in supplemental review is more than sufficient protection, in our view, to ensure that the solar PV systems do not violate the ANSI static voltage limits.

Once the concerns regarding ANSI C84.1 voltage limits are addressed by the results of the power flow model, the solar industry sees no technical justification for the overly conservative restriction on $\Delta V/V$ being set to 3% as proposed by EPRI using the limits based on the rapid voltage change limits in IEEE 1453. This limit is substantially more conservative than that which would accompany a screening analysis of visible flicker using the more complete IEEE 1453 methodology. While a time series analysis is needed to determine the detailed impact of a solar PV system on the grid, a screening analysis is possible that would more closely meet the language of the current language of screen H that asks "[c]an it be determined within the Supplemental Review that the voltage fluctuation is within acceptable limits as defined by IEEE 1453 or utility practice similar to IEEE1453?".

For example, even applying the smallest emission level of 0.35, the equivalent voltage fluctuation limit at the PCC derived from the IEEE 1453 screening methodology (consistent with both the IEEE standard and the Pterra methodology) that incorporates a highly conservative ramp rate for solar PV output changes would be equivalent to a $\Delta V/V$ limit on single facility of 4.5%. Of note is the fact that this conservative application of the standard is stilll 50% higher than the 3% limit proposed by EPRI in their revised screen based on rapid voltage change. To derive the 4.5% limit, we applied a one second ramp rate to the limit for the $\Delta V/V$ that results in a Pst = 1 for two changes per minute as specified in Table 4 from IEEE 1453.

$(\Delta V/V / 2.568\%) \times 0.2 = 0.35$

$\Delta V/V = (0.35 / 0.2) \times 2.568\% = 4.494\%$

This application of the IEEE 1453 screening methodology is consistent with that proposed by Pterra in their interpretation of the existing supplemental review screen H as presented at the September 18th ITWG workshop while incorporating the more accurate measurement of $\Delta V/V$ resulting from the power flow model as opposed to the simplified approximations referenced in the Pterra workshop and the IEEE 1453 standard.

Given the extremely conservative nature of this type of visible flicker screening methodology which ignores both the significant body of real-world evidence concerning geographic distribution of ramp rates over the spatial extent of a MW scale solar facilities as discussed at the ITWG and considers both a 0 to 100% transition in the solar system output (which is unrealistic for actual cloud cover scenarios) and the use of just 1 second for the ramp rate (which is unrealistic for actual cloud speeds as detailed in the footnote below), the solar industry would strongly oppose the proposed change to screen H as included in the EPRI report and its application of the overly restrictive 3% limit on individual facilities derived from consideration of rapid voltage changes.[1]

[1] A typical 2 MW facility occupies approximately 10 acres of land (435,600 square feet). Assuming a square footprint for simplicity this is equivalent to an area 660 feet on a side.

As in our April and June 2017 comments, the solar industry continues to recommend that, following verification of compliance with the ANSI C84.1 voltage limits from the power flow model, that no additional screens for visible flicker be applied at the preliminary or supplemental review level. We continue to conclude that, based on the nature of cloud driven intermittency of solar PV and supported by extensive real-world experience as well as the results of detailed modeling and simulations, that visible flicker is unlikely to ever be a substantive concern for solar PV and that any exceptionally rare cases where it could in some remote possibility potentially appear are better addressed by a posteriori assessment using a flickermeter.

If, however, a screen for visible flicker is to be applied during supplemental review, the solar industry would strongly support the application of a version of the IEEE 1453 methodology in which a 4.5% limit on the $\Delta V/V$ predicted by a power flow model is applied. If such a limit is violated, an option for a more accurate time-series analysis should be included at the CESIR level analogous to the current option for a detailed risk of islanding study when the Sandia supplemental anti-islanding screens are failed. Any application of the rapid voltage change limits as proposed by EPRI would be strongly opposed by the solar industry for the reasons detailed above and supported by the evidence presented during the most recent ITWG meetings.

Finally concerning voltage variation (as opposed to visible flicker), the application of the 1.5% limit on $\Delta V/V$ at voltage regulation devices for a full on-to-off transition appears inconsistent with the standard proposed in Minnesota (the apparent source of the EPRI recommendation) and reduces the limit for voltage variation agreed to in that jurisdiction by fully a factor of 33%. With respect to voltage variation at regulation devices (as opposed to visible flicker), the solar industry recognizes the importance of including a screen for this potential impact and recommends the interim adoption of the Minnesota standard of 1.5% on a 100% to 25% transition in solar system output. This is equivalent to a 2% limit on a full on-to-off transition. As this appears to be the basis of the current EPRI recommendation, although there is no mention of the restricted range in solar output in the current document, the solar industry would recommend the interim adoption of this revised limit on voltage variation at regulation devices.

Specifically, given the substantive impact of such a screen on may circuits, the solar industry would recommend the retention of a simple full on-to-off transition as the basis for these voltage limits and thus the use of an equivalent 2% limit on a 0

Assuming a ramp rate of 1 second would imply a cloud moving at 660 feet per second to go from a fully clear sky to one in which 100% of the solar resource is blocked over the entire system. Thus, this ramp rate would require a fully opaque cloud traveling at a minimum of 660 fps (450 mph) which is highly unrealistic. Thus, the combination of the 0 to 100% transition and the 1 second ramp rate is extremely conservative and should not have additional layers of conservativeness applied as is done in the current EPRI report.

to 100% transition as the starting point for limiting the impact of voltage variation on regulation devices. As with the case of visible flicker (should it ultimately be retained as a supplemental screen), the solar industry would strongly recommend that the option for a more accurate time-series analysis be included at the CESIR level should a system fail this screen in order to more realistically assess the impact of the solar system on regulator tap changes over the course of the year should it fail this simplified screen. As noted in our June 2017 comments, such a recommendation is consistent with that of a 2013 report from Sandia National Laboaratory which concluded that

> QSTS [Quasi-Static Time Series] analysis is necessary to accurately quantify the effects of PV on voltage regulation device operations. The analysis should be an estimate of the long term, e.g. annual, difference in operations that can be expected due to PV. It is necessary to run both the base case and the PV case for comparison in order to quantify the impact due to PV.[2]

Comments on Recommendation #3 to Adopt More Uniform Criterion to Scope and Report *CESIR* Studies – Pg 34-41

The solar industry strongly agrees with EPRI's observation that "[m]ost of the direction to applicants and utilities provided in the NYSIR on when to do studies is administrative in nature. There is little established technical guidance for actually conducting and reporting CESIR studies.. [and that] reports ranged widely in length and the amount of technical justification presented to the applicant."

That being said, while we appreciate EPRI's suggestion that studies should have 3 key technical areas - voltage, thermal capacity, and operational protection/safety – they do not provide enough specific technical criteria in these areas to significantly standardize the reported results of utilities approach to CESIR studies. Instead they have provided a general initial scope of activities with caveats that acknowledge current utility software limitations. However, even in light of such limitations, there are specific problems in this guidance, such as the fact that their section on operation protection/safety does not directly and clearly reference existing NY ITWG technical guidance on anti-islanding.

In addition, the CESIR report template shared on pg 43 does not capture this existing guidance, but instead just lists under each topic, "address and make clear analytical approach, any requirements not met, and mitigation option". This type of open-ended narrative format for CESIR studies will not address the problem identified by EPRI of the need for standard technical guidance for conducting detailed studies and for standardizing the resulting information provided in the CESIR reports. In particular, the minimum technical justification presented to the applicant for the required upgrades should be more clearly identified and should be made explicit for all utility territories.

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[2] Robert J. Broderick, Jimmy E. Quiroz, Matthew J. Reno, Abraham Ellis, Jeff Smith, and Roger Dugan, *"Time Series Power Flow Analysis for Distribution Connected PV Generation"*, Sandia National Laboratories, January 2013 (SAND2013-0537) p. 18

Comments on Recommendation 4 to Reinforce the SIR mechanism to Address Unforeseen Site Incompatibilities, As Well As Changes in Performance After Installation – pg 12-13

As the Solar Industry has previously commented in our April 28th comments, we agree that current interconnection documents do not adequately include mechanisms to address post-interconnection issues beyond the fundamental powers given to the utility under the "Disconnection of the Unit" provisions in the current Interconnection Agreement (currently Appendix A of the SIR pg 38).

While we support taking up this issue at some point in the future, but we oppose doing so without more linkage to updating of the screens and a more thorough review than is currently given in the EPRI report for two reasons. First, we have not seen any evidence that additional mechanisms beyond the "Disconnection of the Unit" provisions are a matter of urgent need to address. We are not aware of any evidence of the issues referenced on pg 12 of the report occurring in New York given our current levels of penetration ("[w]ith increasing numbers of DG added into the power system there has been reported site incompatibilities and problems. The nature of these problems are often in the general category of electromagnetic compatibility (EMC).")

Secondly, as we mentioned in our April 28th comments and in previous discussion at the ITWG, should such issues arise in the future there would need to be some clearly defined process in any new Interconnection Agreement language by which the root cause of any power quality problems can be determined, as preexisting conditions or other changes on the distribution circuit may be to blame for a problem with power quality and not the DG facility. We recognize that troubleshooting power quality problems can be very challenging and that it is often hard to determine whether a particular facility is the cause of the problem or is itself creating a reaction to the problem. It is the strong view of the solar industry that such a process would need to be specifically outlined and confirmed by the JU, including the demonstration of the requisite forensic abilities, before such a provision in the interconnection agreement could be implemented.

Comments on EPRI Report's Description of SIR Process Today

Finally, the Solar Industry requests some minor corrections to the EPRI report's description of the current SIR's process so that there is no confusion going forward.

First, the solar industry would request that all preliminary review screens be evaluated and that the failure of any one screen not end preliminary review as implied by the proposed EPRI screens. The evaluation of all preliminary review screens provides substantive value to solar developers and helps guide them to the most efficient path for continuing development (i.e. supplemental review or CESIR).

Second on page 5 of the report, EPRI states that current NY SIR technical review process comprises: "an initial review that verifies the application's completeness and general feasibility, a series of technical screening for larger installations, and (if necessary) a Coordinated Electrical System Interconnection Review (CESIR) for large interconnection systems that may require system upgrades". We will return to the initial review in a moment, but as to the later two points, we suggest that they be modified as reflected in the SIR to state that the series of technical screening is not just for larger projects, but is in fact to be applied to all projects over 50kW and also that the study process is not just for large projects that may require upgrades, but specifically for projects that fail one or more of the technical screens. Another similar correction is on page 16 of the report, where EPRI states that when talking about the level of screening in the second paragraph, that currently the preliminary screening is apparently only for 50-300 kW projects. This is incorrect, as the preliminary screening is for all projects > 50kW as the EPRI report correctly states on page 17.

Third, on pages 6, 11, and 33 of the report, EPRI shows an initial review using "Section II – Interconnection Requirements" as the first step in the SIR process for projects over 50kW. The solar industry would not that, while this section of the SIR includes a set of non-screen design requirements like equipment certification and a disconnect switch for certain size projects that clearly are important to check, it also has other very broad topics like supplemental anti-islanding protection and minimum protective function requirements that are incorporated in existing screens. The use of Section II in this way by the EPRI report is not mentioned in the process for projects in Step 3 on pages 8-9 of the current SIR and thus we suggest that the use of Section II in the EPRI report be clarified and perhaps the relevant sections for initial review be specified as a series of yes and no questions that line up with confirming the information required upon application submittal in Appendix F

Fourth and finally, we suggest that the description of the preliminary and supplemental screens on page 15 of the report be clarified to make clear that the screens are not just important for fast-tracking but that they are important to provide standardization of the criteria for review and the justification for any upgrades that to be required for the interconnection of an inverter based DER.