"DEVELOPMENT OF TRANSITIONAL METHODS: PV expert meeting"
31st October at the JRC Ispra (VA), Italy

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PRESENTATIONS LIST:

- Opening of meeting and DG GROW presentation (D. Polverini DG GROW)
- Presentation of the conclusions of the report on standards for PV ECODESIGN (E. Dunlop JRC Ispra)
- Transitional method for determination of the Energy Yield of PV systems (A. Garcia JRC Ispra)
- Transitional method for definition of the Efficiency of PV Inverters (A. Garcia JRC Ispra)
- Transitional method for definition and evaluation of degradation of PV modules, Inverters, components and PV systems. (E. Salis JRC Ispra)
- Transitional methods effect on definition of Durability and Operational Functional Lifetime of PV modules, Inverters, components and Systems (E. Salis JRC Ispra)
- Horizontal standards for EcoDesign regarding Reparability of PV Systems, Disassemblability of PV modules and Systems, Dismantlability of PV Systems. (M. Cordella and F. Alfieri JRC Seville)
- Specific considerations for transitional methods for photovoltaics under the horizontal standards. (N. Espinosa JRC Seville)

Main discussion points and follow-up actions:

1. PV system energy yield

The presentation on the proposed transitional methods triggered several questions and suggestions from the experts' audience.

One of the general concerns was whether the options proposed are either sufficient or too detailed depending on the policy tool that will be applied. The reply to this was that the development of the PV preparatory study will consider the broadest possible scenario in order to have all the available information and scientific background necessary to subsequently develop and apply the policy tool(s), if any, that the policymakers will decide to adopt for one or more PV product categories.

There was general consensus on the approach with 3 climatic profiles for PV (*Subtropical arid, Temperate coastal, Temperate continental*) to describe the European continent and derived from the standard EN IEC 61853-4. Related to the climatic profiles, some questions and comments were made and considered:

a. Possibility of adjusting the climatic profiles to local conditions for actual installations. For example, soiling and shading cannot be modelled in general. It was clarified that the proposed method does not consider losses for shading or soiling, as both are too local and installation-specific.

b. Regarding the various factors considered in the method (annual/hourly climatic profile data, inverter efficiency) it was suggested to perform targeted sensitivity analyses to clarify the necessary level of detail. **Action JRC C2**

The approaches presented for the calculation of PV system energy yield are based on yearly values in one case and on hourly values in the other case considering the relevant inputs for each of the climatic profiles. Comments included:

- Simplicity should be favoured in the case of small installations (i.e. residential and small commercial) where less expert customers/investors might benefit from a single value on which to base their calculations. The observation was supported by some of the experts, who asked for differentiation of the applied approach on the basis of the PV system size and use. This was also supported by referring to the WEEE legislation that makes difference on the products on this basis.

- For the European Commission the preferred option is to avoid differentiation based on size or use of product and this approach will be kept for the moment.

JRC C2 introduced the possibility in the future of developing and making available an online tool for the calculation of the energy yield following the methodology, either based on the standard climate profiles or on a location basis (if this was required). This however is at present not ready and will require additional resources from the JRC.

Another point was raised on the definition of PV system and on the components that should be included in it. For several experts the PV system boundary should be set as close as possible to the grid interface, thus including for example AC cabling from the inverter to the transformer and/or the grid interface. In particular, Mr. Noels offered to provide data on cables to support calculation of system cabling losses and other relevant to the MEERP procedure. From the European Commission side, it was noted that transformers already have their Ecodesign regulation, and therefore cannot be included in this specific study. The same is valid for batteries, for which an Ecodesign preparatory study was launched few months after the PV preparatory study. However the possibility to include a parameter representing the associated energy loss would be maintained.

2. Transitional Method for Efficiency of PV Inverter

The proposed function parameter for inverter performance requires calculation of the annual energy yield for a nominal PV array, taking account of the inverter energy conversion efficiency.

The proposed simplified approach is to start from the standard EN 50530 to calculate the inverter's *European Efficiency*. An extension to this approach would be to derive inverter efficiency values specific to each of the three chosen climate profiles being considered for the system energy yield calculation.

A second approach involves a calculation specific to each of the three chosen climate profiles, as discussed for PV system yield above. In regard to the second approach, the availability inverter conversion efficiency values over the operating range was discussed.

This is usually provided by the manufacturers either as a table of discrete values at different operating conditions (% of nominal power) or as a graph curve of the same quantities. In this case selection of the efficiency value corresponding to the hourly climatic condition would be done on the curve, the approximation due to extraction of values from a printed curve is not considered appropriate to use in this case. For tabular data, the representatives of inverter manufacturers present considered linear interpolation between the tabulated values is adequate for use in this case. Mr. Heidl also offered to provide additional data to verify the appropriateness of linear interpolation at different operating conditions of the inverter. This offer was very welcomed by the Commission.

The standard draft IEC 62891 (overall efficiency of grid connected photovoltaic inverters) was mentioned as possible future supporting document for the PV study. We acknowledge this and indeed it is already included in the PV standards report prepared by JRC C2 (which was not available to the inverter companies' representatives at the time of the experts meeting).

The inverter companies' representatives also commented that including additional information on the datasheet of the inverters might be detrimental for the non-expert installer understanding, but that could be definitely useful for the modelling process. They also suggested a sensitivity analysis should be performed on the real need to differentiate the definition of one value inverter efficiency specific for each climatic profile, as one value (or set of values at different operating conditions) might be applicable to all 3 climatic profiles without negatively affecting the overall PV system calculation (**Action JRC**). Mr. Polverini (DG GROW) confirmed that inverter efficiency differentiation by climatic zones will not be considered if the mentioned sensitivity analysis on inverters will show no reasonable gain when differentiation is applied.

3. Degradation of PV modules, Inverters, components and PV systems

The presentation on degradation proposed as first approach to use prescribed values based on robust scientific literature and third-party independent reports (e.g. IEA PVPS Task 12) to set the acceptable maximum value for the degradation rate of PV modules and systems. For inverters the approach is to consider the product always working until a failure occurs, which usually corresponds to an average lifetime of 10 years. This specific approach for the inverters was confirmed by the sector representatives.

The second approach proposed for PV modules and systems was to define degradation rate values through extensive measured data sets (including under different climatic conditions and geographical locations) supported by robust scientific validation made by at least one competent laboratory, in order to allow PV manufacturers to claim better degradation rate values than those proposed as prescribed.

Clarification was given by the European Commission services present at the meeting on this latter point; in the absence of a transitional method or standard to show lower degradation rate any claimed value (by a manufacturer) better than the prescribed one must be justified by means of robust data, potentially with a third-party competent laboratory evaluation, and

cover diverse climate zones. JRC.C2 will propose some guideline specifically on this point (**Action JRC)**. This claim finally must be measurable and enforceable by market surveillance National Authorities. The proposal of two distinct values (one for c-Si and one for thin-film PV) was accepted as appropriate by the audience. Failure rates will be considered, too, especially due to their connection with other tasks of the PV preparatory study related on the sustainability aspects.

As the presentation was focused on degradation only, which is though strictly connected to operational service lifetime, and due to the fact that for inverters only failure rates were considered, the inverter companies arose the question on the use of such failure rate in the PV system calculation. At present it is not used for prediction as the substitution of the failed inverter is considered instantaneous, but some factor could be introduced to account for this, even though its weight on the total lifetime energy yield of the PV system this may not be significant.

4. Durability and Operational Functional Lifetime of PV modules, Inverters, components and PV systems

The proposed prescribed values for the expected lifetime of PV modules, Inverters, components and PV systems were generally accepted by all experts.

5. Horizontal standards for EcoDesign regarding PV sustainability and Specific considerations on them

The final two presentations opened debate on whether environmental footprint and sustainability should in fact be preferred to energy performance, together with effects from economic considerations. Aspects of the reparability and replacement of modules/inverters, or the focus on the modules burn-in phase and infant failures were deemed to be of relevance for this Preparatory study. These aspects are indeed subject of other tasks in the PV preparatory study, about which the experts were informed as many of them did not participate to the 1st stakeholder meeting. Relevant information on how to join the stakeholder group and access all the shared documents was sent afterwards to all the participants.

The general evaluation was that the standard series EN 61215 is appropriate to assess the infant mortality that can occur in PV modules within the first 5 years from installation, and that EN IEC 61730 is proper for safety issues. There was, though, some concern on the full consistency of the accelerated and quality-assurance test results with the long-term behaviour observed in the field for real installations. The JRC C2 highlighted that indeed this would need a more active contribution and information sharing by the whole PV community.

As final remark, from the inverter manufacturers a concern was raised on the availability of a standardisation procedure to assess derating factors for inverters, especially at high temperature. This is due to the fact the inverters efficiency is determined at 25 °C, while real conditions are known to be different. This lack of information and standard test procedure should be addressed and if required a transitional method should be defined.