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Photovoltaic modules, inverters and systems
Position on the ecodesign & energy labelling options

ECOS, the EEB, the Coolproducts and the Right to Repair campaigns welcome the opportunity to discuss the different policy options for ecodesign and energy labelling for photovoltaic modules, inverters and systems. Solar energy has a crucial role to play to decarbonize electricity production, and ambitious ecodesign and energy labelling will be key to ensure that only efficient and durable products are placed on the market. We therefore regret that the current proposal focuses mostly on information requirements when mandatory thresholds for several criteria would be more effective.

The following comments relate to the policy options presented to stakeholders on November 19, 2020.

Potential measures for modules under Ecodesign

Requirements on lifetime electricity yield (2.1)

Module energy yield

The IEC 61853:2018 standard allows to measure the PV module energy output at maximum power under specific climatic conditions for a complete year, without considering any power loss or ageing process. The requirement should therefore not be named "*lifetime electricity yield*" but "*electricity yield in standard testing conditions*".

Manufacturers should declare the DC module energy yield for each of the 3 reference EU climate zones and report it in the product information sheet available to the end customer beside the life cycle Global Energy Requirement (GER).

Going beyond a simple information requirement, the Commission should consider setting a threshold ratio of energy pay-back time.

IEC 61853-3:2018 does not apply to bifacial PV modules, so a methodology to measure the energy yield of bifacial PV modules should be developed, and this needs to be included in the upcoming standardization request for PV panels.

Potential measures for inverters under Ecodesign

Performance requirements on efficiency (2.3)

Grid Services

A requirement on inverter grid services should be considered. Manufacturers shall provide information concerning ancillary services that can improve grid performance and reduce losses. These options can help to reduce the amount of material (copper, aluminum, plastics…) required to increase the grid's electrical generation capacity. Among these services, we can mention: AC power dynamic restriction, frequency or voltage support, reactive power management, etc.

Material efficiency requirements under Ecodesign

Performance requirements on quality, durability and circularity for PV Modules (2.2)

Durability product test sequency

We support the requirement of factory quality controls and auditing according to IEC 62941:2020 and relative to IEC 61215:2020 qualification. This quality approach can improve the whole manufacturing process and not only validate the performance of the 10 modules tested.

Moreover, as long as accelerated tests are not included in IEC 61215:2020, each model shall be certified to have passed the product test sequence required for the qualification under:

- IEC 62788-1-7:2020 on optical durability of encapsulants
- IEC 62788-5-1:2020 on edge seals materials
- IEC 62979 on bypass diode - Thermal runaway test
- IEC/TS 62916 on bypass diodes electrostatic discharge susceptibility testing
- EN 62790 on junction boxes if not completely included in 61215 testing sequence
- IEC/TS 62804-series on additional tests for PID

Manufacturers must ensure compliance to CEI 62759-1 on PV modules packaging from the factory doors to the module's installation site: they must ensure their distributors also are compliant to this standard.

Lifetime performance degradation

The lifetime performance degradation is the cornerstone of life cycle assessments in the case of photovoltaics, so this indicator should be accurately assessed and validated. The Commission's proposal to use "validated" and "unvalidated" measurements, as well as default values, is confusing for both the manufacturer and the final user.

→ *Develop a robust methodology before requiring field measurements to manufacturers*

Accelerated life testing method is the best way to allow a fair comparison between products, so developing a robust methodology for accelerated testing should be the priority.
Nevertheless, field measurements could be helpful to improve the understanding of PV modules ageing, as these would allow to gain more information on real-life degradation rates of PV modules. A methodology for field measurements performed by manufacturers should therefore be developed. The results obtained will not be used to determine durability or lifetime but to re-evaluate, if necessary, the default values of 0,7% and 1% of power loss per year, and to improve the accelerated life testing methods.

Paragraph 3.3.2 of the Transitional Methods describing the degradation rates measurements is too concise to be fully operational, and many of the testing parameters and performance metrics are not sufficiently defined. The document does not define which authority would check and validate the obtained values either. Manufacturers could be required to proceed to on-site measurements on years 5, 10, 15 and 20 after installation in order to gain knowledge on the actual degradation processes and improve the quality of their products. The values obtained from these field measurements could be made publicly available and could also be used in a second-hand market perspective.

→ *Revision of the default values*

Defaults values of 0,7% and 1% should be reviewed every 5 years based on the results from manufacturers field measurements.

→ *Accelerated life testing method*

An accelerated life testing method should be developed and therefore included in the upcoming standardization request. With this method, validated values could be defined, that would be accepted instead of the default values if they are lower, allowing a fair comparison of the products.

This should be made mandatory even before the next revision of the IEC 61215:2020 standard.

This aspect should be regularly reviewed based on the data obtained once the accelerated testing method is ready.

Repairability for modules

The manufacturer shall report on:

- the possibility and method to access and replace the connectors in the junction box
- the possibility and method to access and replace the cables connected to the junction box

The replacement of separate parts of the junction box (connectors, bypass diodes, cables) may enable to preserve the integrity and tightness of the junction box. Spare parts should be available for at least 30 years.

Dismantlability

→ *Declare the percentage of materials that could be dismantled and recycled or re-used*

The proposal made in 2.2.4 “Dismantlability of PV modules” does not go any further than what is required in article 15 of the Directive 2012/19/EU on WEEE.

To quantify the “potential to separate and recover the semi-conductors from the frame, glass, encapsulants and backsheet”, manufacturers should **declare the percentage of materials that could be dismantled separately**, in % weight per material.

→ *Declare a percentage of recycled materials*

Module frames should contain a minimum percentage of recycled aluminum. The requirement for recycled aluminum content could start at 30% (the average global level of recycled aluminum) and be increased up to 80% within 10 years. This objective is in line with the addition of bauxite (aluminum ore) on the Critical Raw Material (CRM) list of European Commission in September 2020.

There should also be a mandatory information requirement on the content of recycled material.

→ *Set recovery targets for metals in the WEEE directive related to photovoltaics*

The final objective of dismantlability is to improve the recovery rate of the different components. To date, the recovery target for photovoltaics is based on the weight. As glass and aluminum represent about 90% of the total weight of a PV module, effectively none of the metals are recovered. Increasing the recovery rates should be done by promoting complementary requirements in the ecodesign regulation and the WEEE Directive. Article 11 of the WEEE Directive allows to set targets related to individual materials from recycling processes: for photovoltaics we suggest they should be implemented for Si, Cu, Ag, In, Ga, Cd, Te.

Disclosure of information on materials

There should be an information requirement for all the materials and substances listed on the REACH SHVC list, the RoHS directive and the CRM list, based on the requirements set in IEC 62474.

The materials covered by the RoHS directive, as lead and cadmium, should be declared and their content should be expressed in weight percentage. Photovoltaic modules are currently excluded from the scope of RoHS directive, but the ecodesign regulation could set requirement thresholds for lead and cadmium that would be similar to the usual thresholds for these substances defined in RoHS (0,1% wt. for lead and 0,01% wt. for cadmium). Because of its toxicity, the Selenium content should also be declared.

Performance requirements on quality, durability and circularity for inverters (2.4)

Repairability requirements for inverters

On-site repairability measures should concern inverters up to 150 kW, or string inverters, given the fact that the power range of string inverters has been increasing in the past three years. For example, solar farms are increasingly equipped with string inverters ranging from 60 to 150 kW instead of central inverters of the MW range, because of their easier replacement and lower losses in case of failure. Instead of a power criterion, the threshold for repairability could be set based on the way the inverter is installed: if the inverter needs an external mounting system as a wall or a structure to be fixed on, it is considered as a string inverter that should be repairable on-site. If it stands alone, it is considered as a central inverter and maintenance and repairs can be supported by the manufacturer.

The manufacturer should identify and inform end-users consumers about the parts that can be replaced on site and provide a sequence of instructions to perform the operation. By default, all the components that carry the main power flow should be included on this list, as well as components managing active parts (as power system units or power line communication).

Spare parts must be available for at least 15 years.

Disclosure of information on materials

There should be an information requirement for all the materials and substances listed on the REACH SHVC list, the RoHS directive and the CRM list, based on the requirements set in IEC 62474.

Ecological footprint for PV Modules and inverters (2.5)

Life cycle GER and GWP product declaration

The calculation of GWP and GER should be performed according to PVPS12 Methodology Guidelines for LCA on PV. As an exception, the functional unit could be reconsidered as the **peak power unit** (kilo watt peak) and not the energy unit (kilo watt hour). This could help comparisons and setting maximum authorized levels.

→ *Define threshold values for the GWP indicator*

The Global Warming Potential indicator should be lower than:

- 50 g CO2-eq/kWh under 1000 kWh/m2. yr irradiation level
- 1200 kg CO2-eq/kWp

These values come from "Leccisi, Raugei and Fthenakis, The Energy and Environmental Performance of Ground-Mounted Photovoltaic Systems – A Timely Update, Energies 2016, 9, 622; doi:10.3390/en9080622" with a focus on PV European modules.

Some further environmental category impacts should also be considered in addition to the life cycle GER and GWP:

- Resource depletion has to be added to the product declaration, and especially mineral and metal resources depletion in mg Sb-eq/kWh. This information will be part of the Environmental Product Declaration.

  This requirement is linked to the material declaration one and is especially important for inverters including storage. IEA PVPS T12-17:2020 report on "environmental life cycle assessment of residential PV and battery storage systems" indicates that 1 kWh of electricity issued from storage of a residential solar system uses 80% more minerals and metal resources than a kWh of solar electricity without storage.

- Nuclear waste generation should be added to the product declaration, in line with the radiotoxicity index methodology developed in PEFCR (Product Environmental Footprint Category Rules for Photovoltaics), in order to promote truly renewable energy supply of manufacturing and not only low-CO_2 energy production processes.

Some additional impact categories should help to include requirements regarding chlorinated by-products and high GWP fluorinated gases abatement in manufacturing sites:

- Manufacturers shall give evidence of silicon tetrachloride by-products abatement in silicon and PV cells production sites at more than 90% level.
- Manufacturers shall give evidence of high GWP fluorinated gases such as SF_6, NF_3, CF_4, C_2F_6 and N_2O abatement in silicon and PV cells production sites, as required in NSF/ANSI 457 and in article 7 of the EU Regulation 517/2014 of 16 April 2014 on fluorinated greenhouse gases.

PV manufacturers should follow SEMI Standards of S-Series for PV manufacturing as soon as they are released, and in the meantime, operate their manufacturing sites following as closely as possible:

- SEMI S2 - Environmental, Health, and Safety Guideline for Semiconductor Manufacturing Equipment
- SEMI S8 - Safety Guidelines for Ergonomics Engineering of Semiconductor Manufacturing Equipment
- SEMI S26 - Environmental, Health, and Safety Guideline for Flat Panel Display Manufacturing System

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