Photovoltaic modules, inverters and systems

Comments on potential Ecodesign requirements and Energy Labelling scheme(s)

Brussels, 4 June 2021

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 will be key to ensure that only efficient and durable products are placed on the market. It is therefore regrettable 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 April 29, 2021 and to the accompanying discussion paper.

Ecodesign requirements for PV modules

Requirements on electricity yield (2.1)

Module energy yield

- We support the proposal to set a **minimum threshold for module energy yield**. This way a minimum energy yield can be ensured for all modules sold in the EU. In order to avoid consumer confusion, it should be mentioned that this metric is the DC module energy yield, for example by expressing the value in **kWh-DC/kWp**.

- The discussion paper uses kWh/kWp while the slides presented during the meeting refer to kWh/m2 per module. To avoid confusion the **appropriate unit should be clarified**. Moreover, the customer may have difficulties understanding the metric when expressed in metric per square-meter of PV module because the surface of the module would need to be calculated, which is not clearly indicated on the product datasheet, while the peak-power is.
- We propose to include a metric related to the **energy pay-back time of the PV module**, to indicate the period required to generate the same amount of energy (in terms of primary energy equivalent) that was used to produce the module itself. This could be added either in this section or in the "ecological profile for PV modules" section. Providing this information has three benefits: it is easy to understand, it reflects one of the main environmental impacts of photovoltaics, namely energy consumption, and can counter the common belief that photovoltaic systems are "polluting", which is still widespread in the media today.

Requirements on durability (2.2)

Design qualification for long-term operation (2.2)

- The proposed Ecodesign requirement to withstand prolonged exposure to open-air climates reflects what is currently available on the market. This will not enhance the quality of PV modules. We therefore encourage the Commission to introduce a **stringent set of quality and durability tests** for PV modules. A first step could be the publication of the full test reports and of the values obtained for each test of the sequence. For example, for most of the EN IEC 61215 tests, the power of the PV module is measured before and after the test and is required not to drop by more than 5%. Knowledge of the percentage of power loss during each test could help to compare the quality of one module to another[1].
- To improve the quality of PV modules, the **warranty of the products should rely on an insurance contract** mentioned on the product warranty notice.
- Since UV radiation may cause lower power generation over time, **the ability of the PV modules to withstand UV exposure** should be added to the list of functional requirements in Annex A (Annex II Ecodesign requirements).

Design qualification for long-term operation (2.2.1)

- As rightly pointed out in the discussion paper, the specificities of the degradation of PV modules may not be revealed in standard product tests. Moreover, there is a risk of poor quality control of mass-produced modules leading to reduced durability. We therefore **strongly support the proposed enhanced conformity assessment requiring an internal production control system with third-party verified quality assurance** according to EN IEC 61215 qualification.
- The time during which the documentation should remain available to the relevant national authorities after the product has been placed on the market should be equal to the expected lifetime of the system – namely **30 years** instead of the proposed 10 years (see Annex A part 2 points 3, 7.2 and 8).
- A quality repository is missing for the selected conformity assessment procedure (module D1), but as mentioned in the disclaimer, we understand it will be specified further. We

[1] In France, PV modules have to comply with EN IEC 61215 in order to be connected to the grid and to be eligible for feed-in-tariffs and support schemes. The installer is responsible for compliance and is controlled by an accredited third-party (CONSUEL).

suggest that specifications are based on **international quality standards as well as industry standards** as developed within the SEMI association (www.semi.org) (see Annex A part 2 point 5).

- Regarding the quality system spelled out in Annex A Part 2 point 5, a **minimum frequency of on-site audits** by the notified body should be set to ensure continuity in quality procedures even if no changes occur in the manufacturing process.
- To ensure the homogeneity of manufacturing processes on all production sites, **the quality system should register all sites of the manufacturer**, including potential subcontractors.
- The **quality system assessment by the notified body should go beyond requiring modules to reach EN IEC 61215 conformity**. If the Ecodesign legislation requires to reach specific environmental targets in addition to EN IEC 61215, this should be included as part of the third-party assessment. Ecodesign requirements could include a target for the rate of recycled silicon for c-Si modules, the abatement rate of PFC gases such as C2F6 or NF3, or the carbon content of electricity used for manufacturing. If it is not possible to set mandatory targets today, the legislation should include them in the review clause to schedule them for the coming years.

Requirements on performance long-term degradation (2.3)

Lifetime performance degradation

- Since lifetime performance degradation is the cornerstone of life cycle assessments of photovoltaics, it is key that this indicator is accurately assessed and validated. Field measurements can gain more information on real-life degradation rates of PV modules, but it seems very difficult to develop a scientific method that is reproducible by different manufacturers. For this reason, an **accelerated ageing testing procedure** is urgently needed. If the difficulty is to calculate the linear degradation rate of the modules, at least the results of supplementary tests should be available to the end-customer, for instance power loss after extended thermal cycling tests.
- Lifetime performance degradation is proposed as an information requirement only. The review clause should state that **a threshold will be set as soon as the standard method to simulate long-term exposure is defined**. Similarly, it is essential to review the default values every 5 years as the quality of modules will increase.
- The continuously decreasing cost of PV modules makes them so affordable that replacing them before the end of their lifetime to repower the installation is now a viable economic option. PV recycling facilities such as PV Cycle France receive modules that have been dismantled as soon as defaults are detected such as cell cracks, hot-spots or dysfunction of the junction box. This practice is financially attractive even if defaults concern only one third of the total system as it is less costly to replace all modules at once. If it becomes current practice among big solar plants to replace modules earlier than the 30 years they are designed to last, the overall environmental impact of PV installations will increase and there is a risk of losing the environmental benefit of solar energy production. This development should be taken into account, for instance by
    - requiring **PV models that replace older models before the end of the supplier warranty to have a significantly lower environmental impact,**
    - requiring the **new generation of modules to be compatible with existing ones**. While attention should be paid not to prevent innovation, standardising the

physical dimensions of PV modules and their electrical characteristics could be a solution,
   - requiring **the assessment and disclosure of the 'state of health' of PV modules** when they are replaced, such as proposed in the draft ecodesign regulation on smartphones and tablets and in the battery regulation. If the module is in sufficiently good shape, it could then be prepared to be sold on a second-hand market. This would require a standard test method for repaired PV modules, mirroring EN IEC 61215 and informing whether a module can be sold on a second-hand market. The EN 45553:2020 standard setting a general method for the assessment of the ability to remanufacture energy-related products could provide guidance when developing such standard.

Requirements on repairability (2.4)

Repairability for modules

In line with the expected lifetime of PV modules, spare parts should be available for at least 30 years.

- To facilitate repair, it is essential that the manufacturer not only reports on the possibility to access and replace spare parts, but also informs on the **method to safely and effectively repair or replace** parts.
- The replacement of separate parts of the junction box may enable to preserve the integrity and tightness of the junction box. In addition to what is listed in the discussion document, the manufacturer shall report on the possibility and method to access and replace the **connectors** in the junction box and the **cables** connected to the junction box.

Requirements on recyclability (2.5)

Dismantlability

Some components of a PV module have a strong impact on climate change, such as solar silicon of the wafers or aluminium of the frame. Moreover, certain resources such as aluminium, silver, copper and tellurium could become scarce as solar energy production is growing. Therefore, it is key to encourage manufacturers to use recycled materials, which will reduce the overall environmental impact of the PV module and secure the wide deployment of this source of energy.

- Firstly, there should be a **mandatory information requirement on recycled content**. This information could be used in public support schemes to promote equipment with a high rate of recycled materials. As a second step, thresholds or recycling rates should be established for specific elements (aluminium, silicon, silver, tellurium and copper).
- The discussion document states that "manufacturers shall report on the potential to separate and recover the semi-conductors from the frame, glass, encapsulants and backsheet". To quantify this **manufacturers should declare the percentage of materials that could be dismantled for material recovery**, in percentage weight per material.
- Due to the growing shortage **critical raw materials should be recovered** from components that are not covered by the WEEE recycling objective, such as copper, electrical connections

(including lead soldering) and polymers including the backsheet that contains fluorinated chemicals.

- The final objective of dismantlability is to **improve the recovery rate** of the different components. To date, the WEEE recovery target for photovoltaics is based on the weight. As glass and aluminium represent about 90% of the total weight of a PV module, the target is reached without recovering the metals. Complementary requirements - in both the Ecodesign regulation and WEEE Directive - on individual materials can increase the recovery rates of metals such as silicon, silver, tellurium, indium, gallium, cadmium and copper.

Material disclosure

- It is key that **every raw material listed in section 2.5 of the discussion document is declared and localised**, regardless of the amount contained in the final product. Substances of which only a small amount is used should also be declared, such as the selenium and antimony content because of their toxicity.
- Due to the usefulness for recyclers, the **aluminium content should also be declared**.

Requirements on ecological profile (2.6)

Ecological profile

We strongly support the ecological profile initiative. A life-cycle assessment (LCA) approach is particularly relevant for PV modules, as the main impacts occur during the manufacturing phases. The indicators developed for this purpose could benefit the Member States' national support schemes, for instance to lower carbon emissions associated with new or repowered photovoltaic installations.

As a minimum, the ecological profile should include the following criteria:

- **GWP** as proposed, with a **minimum threshold**.
- **Energy payback time** calculated with the three climatic reference profiles for Europe and defined parameters as this metric is suited for consumer communication.
- **Nuclear waste generation** should be added to the product declaration, in line with the radiotoxicity index methodology developed in the Product Environmental Footprint Category Rules for Photovoltaics (PEFCR). This is needed to promote truly renewable energy supply of manufacturing and not only low-CO2 energy production.

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

- Manufacturers shall give evidence of an abatement level of more than 90% of silicon tetrachloride by-products in silicon and PV cells production sites.
- Manufacturers shall give evidence of high GWP fluorinated gases such as SF6, NF3, CF4, C2F6 and N2O abatement in silicon and PV cells production sites, as required in the NSF/ANSI 457 standard and in Article 7 of the EU F-gas regulation (EU Regulation 517/2014).

Due to the complexity of the production process the document proposes that operators may limit the use of company specific data to a predetermined list (see Annex B, part 1, point 5). However, this list is not presented in the document. We suggest that **data on carbon content and nuclear**

wastes content of energy used for manufacturing is included on this list. We support the proposal to have this specific data reviewed by a third-party notified body.

Ecodesign requirements for PV inverters

Requirements on smart readiness (3.3)

Smart readiness

Grid services, such as reactive power management or frequency support, are essential to enhance PV market penetration and to ensure that the grid can receive all solar energy - also the energy from rural areas with high production and low demand. Therefore, **inverters should be enabled to perform the following grid services**:

- the ability to remain connected to the grid for a defined period of time during frequency deviations.
- the ability to adjust the active power in case of under- or over-frequency.
- the ability of the communication interface to stop, reduce or adjust the power when receiving an instruction from the grid.
- the ability to absorb of inject reactive power.

The functionalities should be **compatible with the European network code Requirements** for Generators to be connected to the European Electricity Networks (RFG), applicable since April 2019, even if the national grid code is not ready yet. Furthermore, **inverters should use a common and open communication protocol** to connect to the grid.

Requirements on repairability (3.4)

Repairability requirements for all sizes of inverters

- To improve repairability of inverters, **spare parts that can be easily replaced need to be clearly identified and listed** in the technical documentation. These should include parts such as fans, electronic cards (for power management and communication), switches and contactors.
- The manufacturer should **identify and inform end-users about the parts that can be replaced on site and provide instructions**. By default, all components linked to the main power flow should be included on this list, as well as components managing active parts, such as power system units or power line communication.
- We support that all spare parts must be available for **at least 15 years**.

Repairability requirements for inverters < 30 kW

On-site repairability measures should concern inverters with a capacity of up to 250 kW, as well as string inverters, since the power range of string inverters has been increasing during the past three years. For example, solar farms are increasingly equipped with string inverters ranging from 60 to 250 kW instead of large central inverters, because they are easier to replace and have lower losses in case of failure. Instead of a power criterion, **the threshold for on-site repairability could be set based on the physical dimensions or the weight of the inverter**, reflecting its ability to be easily dismounted, packaged, transported and exchanged by the manufacturer.

Requirements on recyclability (3.5)

As for PV modules there should be a mandatory information requirement on recycled content for inverters.

Material disclosure

Similar to PV modules, it is key that **every raw material listed in section 3.5 of the discussion document is declared and localised**, regardless of its content in the final product.

Energy Labelling for PV modules and systems

We believe that in this specific case, the **EU Ecolabel seems a better fit to encourage the uptake of more efficient PV modules and systems** than Energy Labelling. It is important to inform consumers on the relative energy and environmental performance of PV systems. However, an Energy Label risks reinforcing the widespread idea that solar equipment consumes more energy than what it produces. Secondly, the D-class applied to a standard PV kit for a residential customer may discourage citizens to invest in clean energy. Thirdly, results for such D-class PV module are in line with the energy yield in standard test conditions. This is problematic since most of the parameters, such as location or shadow, cannot be optimised by the customer. Lastly, the value is not of direct use to the customer because a simulation on the PVGIS-tool[2] will be more accurate.

Should the Energy Label be chosen as the consumer information tool, we would recommend expressing the metric in Energy Pay-Back Time of the PV module or system, or in energy saved per year for an average household instead. This could improve the relevance for consumers, as it would demonstrate that any PV system saves energy.

By setting ambitious criteria that go beyond Ecodesign requirements - such as the selection of components of superior quality and improved environmental performance, optimised system design considering local conditions, quality service and proper protocols for handling and transporting modules, installation and monitoring or maintenance and aftercare services - an Ecolabel can inform consumers on environmental excellence, without giving certain products a bad rating due to suboptimal orientation or other local conditions. Given the importance of solar energy for the EU's decarbonisation objectives we urge the Commission to consider this as the preferable labelling option.

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[2] https://photovoltaic-software.com/pv-softwares-calculators/online-free-photovoltaic-software/pvgis#:~:text=PVgis%20is%20the%20ideal%20free,makes%20it%20easy%20to%20use.