1st Stakeholder meeting for the Preparatory Study on sustainable product policy instruments for SOLAR PHOTOVOLTAIC MODULES, INVERTERS AND SYSTEMS

Friday 29th June 2018, 9.00 – 16.00
Room 1D
Albert Borschette Conference Centre, Rue Froissart 36, 1040 BRUSSELS

Draft minutes v1.0

Agenda

09:00	Welcome and introduction	(GROW)
	Tour de table	
	Overview of the study (tasks, timing, etc.)	(GROW)
09:30	Task 1 – product scope	(JRC B5)
	Report on review of standards	(JRC C2)
	Task 1 – legislations +conclusions	(JRC B5)
10:30	Discussion	
11:00	Coffee break	
11:15	Task 2 - modules	(JRC B5)
	Task 2 - inverters	(JRC B5)
	Task 2 - PV systems	(JRC B5)
11:45	Discussion	
12:30	Lunch	
13:30	Task 3 – Use behaviour	(JRC B5)
	Task 3 – Direct and indirect impacts	(JRC B5)
	Task 3 – End of life	(JRC B5)
14:15	Discussion	
14:45	Task 4 and 5 Modelling aspects	(JRC B5)
	Transitional methods + October meeting	(JRC C2)
15:25	Discussion	
15:40	Next steps (10')	(GROW)
15:50	AOB and closing words	(GROW)

Participants list

AIE - EU electrical contractors association
Belgian Ministry of Environment
BEUC - ANEC
DSM Advanced Solar
Ecolabelling Denmark
Ecolabelling Finland
ECOS/ EEB
EDF ENR PWT
EU ProSun
European Copper Institute
First Solar GmbH
Fraunhofer Institute for Solar Energy Systems ISE
Fundación Corporación Tecnológica de Andalucía (CTA) - ES
German Federal Ministry for Environment [UBA]
German Federal Ministry for Material Research & Development, & Testing [BAM]
Imec
Innogy SE
Lisboa –Nova
Norwegian Water Resources and Energy Directorate (NVE)
Oeko-Institut (on behalf of BEUC)
SolarPower Europe
Solibro Hi-Tech
Solibro GmbH
TECNALIA
Total
University of Bergamo
VDMA e.V.
VITO/ Energyville
Volta
Wacker Chemie AG

Welcome and introduction

The meeting was opened by Fulvia Raffaelli, Head of Unit from DG GROW C1. She welcomed the participants and presented the agenda of the day, which was accepted by all present without comment. The Chair also explained the particular nature of this Preparatory Study for Solar PV, with regard to covering both mandatory Ecodesign and Energy Labelling regulatory instruments, together with its concurrent exploration of voluntary EU measures, such as potential Green Public Procurement (GPP) and the EU Ecolabel.

The Chair and the responsible Policy Officer, Davide Polverini (DP), DG GROW C1, also explained the role of the Product Bureau (JRC B5, based Seville) in the European Commission's JRC, in its supporting role to analyse the feasibility of the four product policies available to the European Commission. They are working in conjunction with JRC C2 (based Ispra) who are international experts in the field of performance calibration and testing for solar photovoltaics and related energy systems. They are active participants in European and international standardisation work on solar photovoltaic technology. Their role is to analyse existing standards and to identify needs for new standards and, if necessary, to develop transitional methods.

DG GROW also explained the overview of the aims of the Preparatory Study, and gave the timetable of the different phases. In particular he stressed the importance of providing feedback and/or to identify missing issues or misconstrued findings or information as early as possible in the process.

This was followed by a "tour de table" presentation by participants, who consisted of a balanced representation of experts from the business sector (industry, retailers and trade associations), academia and research institutes, government representatives, consumer and testing organisations, and environmental NGOs.

Task 1 Report: Product Scope, Relevant Standards, Legislation

The proposal and basis for a detailed scope of the preparatory study was presented by JRC B5. It includes specific proposals for PV modules, inverters and systems.

This was followed by a review of standards relevant for PV modules, inverters and systems, presented by JRC C2. Identification of transitional methods that are considered needed due to lack of existing standards was also highlighted.

Current Member State, EU and Third Country legislation that is of relevance to the Preparatory study was presented. Examples of requirements and standards for receiving subsidies in selected Member States were also presented.

Stakeholders were then invited to give their initial feedback, and also to contact the study team to share any relevant information.

The *geographical scope of the study*

The **Norwegian Water Resources and Energy Directorate (NVE)** made the point that with regard to the mapping of the countries covered, Norway to date seems to have been omitted. Since the product policies being considered form part of the EEA agreement, Norway requested to be included in the remit and scope.

The Commission replied that the main focus of the study is EU-28 with regard to data availability, etc, but that a practical approach would be to ensure thorough liaison with the Norwegian authorities and with stakeholders active in the Norwegian market. The Commission is currently seeking more precise information concerning on how to deal on this issue in general terms, in order to be able to confirm the practical approach outlined in the previous sentence.

The MEErP Methodology and the Pilot Study for PV in the Product Environmental Footprint (PEF)

Solar Power Europe sought information as to whether the MEErP (Methodology for Ecodesign of Energy-related Products) would be the principal method used.

Related to this **First Solar** asked about whether the Product Category Rules developed as part of the Solar PV Product Environmental Footprint pilot project would be used as a starting point.

The Commission confirmed that the latter was the case, with the following observations/ possible changes: firstly, the MEErP has to be amended slightly, as solar PV technologies are energy-producing, rather than energy-consuming products. Secondly, the most up-to-date version of the MEErP (2013) already took into account elements regarding recycling and material efficiency, etc. Where sufficient granularity of data may be lacking, the Commission encourages stakeholders to highlight this, and to submit data (more applicable to the next stages of the study, i.e., Tasks of the MEErP). The data gathered and the work conducted for the PEF Pilot PV Study would be taken into account where possible, although for Ecodesign and Energy Labelling the established method to be used was the MEErP. The MEErP could be supplemented by data from the PEF pilot project, and in the GPP and EU Ecolabel deliberations the PEF would form a key element, to be supplemented by other LCA per-

reviewed papers and evidence, via the thorough literature search of available Life Cycle Assessment (LCA) data which is conducted in any case.

Solar Power Europe asked whether the application of the MEErP would consider the LCA of the manufacturing and end of life stages, since these are the phases of high environmental significance. SPE agrees that Building Integrated PV (BIPV) should be in the scope and perhaps as a separate category since this type of product has specific functions and the functional unit must be selected in accordance to that.

Fraunhofer Institute (ISE) asked how would the modelling of the systems be done. While for the modules they are analysed with the bill of materials and there are standards for doing it, for the systems they are evaluated via limited material data, but for many new technologies there is limited or no measured data from the field.

Coverage of the standards review

Regarding cabling standards, the **European Copper Institute** noted that reference to EN standard 50618 was missing, relating to the DC electric cables used in the arrays of PV modules.

First Solar asked to know more regarding the recycling standards listed. How will end of life treatment be approached and will there be recycling/repairability standards? Recycling has been detected as a hotspot in PEF and as such it should be addressed in the present Preparatory Study.

University of Bergamo advised to cover apart from energy performance, other environmental parameters and aspects of circularity for cabling and power transformers. Current Ecodesign legislation for transformers only addresses their energy efficiency and not circular aspects. Cabling standards currently cover durability and quality, but not energy performance. In order to address the energy performance of cable use it is needed to look at system level.

The Commission responded that wherever stakeholders considered that a particular standard had not (yet) been referred to in the draft Preparatory Study documents, this should be highlighted when stakeholders submit their written comments. Secondly, the Preparatory Study would of course take into account the progress made with regard to the evolving horizontal standards on "material efficiency" aspects, but might draw conclusions that product-specific action could be needed in a shorter timeframe and in a more customised form regarding the issues to be addressed. It was also commented that with regard to BIPV, one issue that may need to be clarified with respect to standards is their role as both 'Construction Products' per se, and also Energy-producing products/elements.

With regard to PV products and systems being 'placed on the market' and being 'put into service', both are relevant in the context of this study, and the choice of how this will eventually be evaluated and monitored will be developed over time in close co-operation with stakeholders and in conjunction with Member States' Market Surveillance Authorities. Those responsible for placing the products on the market are the manufacturers, while in the case of PV systems the legal framework is more complicated. How to do the assessment of systems will have to be developed in conjunction with stakeholders and the market.

It was also clarified that Transitional Methods will be prepared where necessary to address any assessed gaps or needs, in order that Ecodesign/ Energy Labelling could go ahead, plus the preparation and issue of standardisation requests, where needed.

Product scope and definition

The Netherlands commented that any definitions for products and their properties and performance need to be fraud-proof and must not leave any scope for misuse, circumvention or loopholes, owing to the EU-wide mandatory nature of Ecodesign and Energy Labelling regulations, should these policy tools be chosen.

HESPUR (on behalf of ECOS) raised several points. The scope of the modules includes the frames, whereas there are laminated modules which are frameless. Aluminium frames can represent up to 5% of the total CO_2 embedded in the modules, making for an unfair comparison. The presence or not of the frame should be linked to the durability of the modules – without a frame the durability is lower. Another comment is that residential market is developing in the direction of self-consumption. AC modules should be considered in the scope of PV modules as well as micro-inverters and hybrid inverters (inverter + battery storage) in the inverters category. They agree to exclude 50 W PV modules from the scope, if they are not connected in series to the grid, because homes may use small power modules including BIPV tiles. They question the exclusion of transformers because central inverters are usually inside the same housing of transformers although they have different cabling.

Oeko-Institut (on behalf of BEUC) raised several points. There appears to be a certain bias to consider large systems while there is an increasing trend for residential self-consumption and smaller systems. Micro-inverters and inverters including battery chargers are also entering this market segment. The Commission should be careful on what to exclude from this group and on the right grounds, as this area may require further exploring even if it was to be in a future revision. It is important that even if some sub-products are excluded that there should be an indication as to how these products should be

treated in the future. Small power generating devices, as in consumer electronics or textiles, or in building integration, require explicit consideration. Innovation cycles may lead to overlaps.

First Solar asked whether storage at large scale or utility scale grid storage would be considered.

Functional Unit, Product Lifetime, etc

With regard to the functional unit for the modules **Fraunhofer Institute (ISE)** appreciated the idea of framing them in standard units, but they noted the difficulty to capture in standards new technologies such as bifacial and other technological improvements.

They, moreover, warned that the inclusion in the proposed functional unit of a fixed lifetime for all products does not allow for the strong differentiation that exists, which thus affects the yield. Having the same 25 year period as a "fixed lifetime" for all the products concerned was possibly a risky proposal, since it will lead to a difference between the calculated and actual yield of the solar PV systems chosen.

Solar Power Europe asked whether when 'one year' is mentioned in the Functional Unit, at what point in the life of the product is this 'one year'? Also, is degradation of the product per se *over* this defined one-year period actually included?

They moreover asked why the efficiency of Inverters is excluded in the inverter Functional Unit, and what period of design life for inverters was being taken into account: 10 years or 20 years (also relevant for End of Life (EoL) concerns and management)?

The Commission responded that the degradation of the system and sub-products per se was to be calculated over the defined 10 or 25 year time horizons and then an average for a representative year is to be calculated. The efficiency of inverters formed part of the 'PV system' approach, i.e., all the sub-products in their entirety. The definition will be reworded so that it better reflects that the inverter performance is modelled in the context of being installed in a system where all the other parameters are fixed but where the efficiency is not, since it is the efficiency of the specific inverter that is of interest.

First Solar noted that the Product Environmental Footprint (PEF) Category Rules for PV electricity generation are being finalised following a remodelling exercise and are going through a scientific review now and will be published in October. The LCA model used there is available in Open LCA software and they hope it is used and they encourage the JRC not to reinvent the wheel.

PV Systems approach

The Netherlands raised the issue of modelling and scope with regard to the potential 'systems' approach (i.e., of PV panels plus ancillaries [cables, panel frame, etc.] plus inverter plus possibly energy storage) posing a problem with the MEErP method, since MEErP works on the basis of an 'average model' (the base case). Allied to this, secondly a level playing field is needed for those products which are integrated and which come as a package, and those in which different parts were chosen separately to then subsequently be combined to form a complete PV system i.e., PV panel plus inverter plus other elements. Moreover, setting requirements on the materials used in products creates a problem for the verification process, especially when the production takes place outside EU.

The Commission responded that an approach would be taken whereby a matrix of possibilities would be included as the several representative "Base Cases" inherent to the MEErP method. In addition, as already mentioned previously with regard to Market Surveillance Authorities (MSAs), the issues of the 'product as a package', i.e., as placed on the market, could co-exist with the second approach of solar PV installers, or consumers, choosing to buy or assemble the different product components of a solar PV system from different suppliers, in which case it could be that the installer entity was responsible for either 'placing the PV system on the market', or 'putting the PV system into service', depending on how MSAs wished to carry out their surveillance and possible inspections (however, these legal aspects will be assessed more in detail at a later stage). It was also pointed out that whilst module standards focus on DC power generating products (which are the majority at present), a micro-inverter produces AC power and it may not be possible to separate the module and the inverter for the purpose of testing.

Legislation at Member State level; Interactions with National Programmes, Market Stimuli and Policies

Fraunhofer ISE raised the issue of whether Member States' national programmes (e.g., existing procurement standards, performance requirements, etc.) would be/are being taken into account regarding possible Member State legislative requirements, and also market stimuli, with their potential implications for the future market penetration of various types of technologies and EU stocks of PV modules, inverters and systems.

ECOS questioned the assumptions in the report which stated that going forward one-third of tenders regarding (renewable) electricity would be won by solar PV technologies, compared to two-thirds via wind electricity generation. Recent experience with some German tenders/auctions had shown that only the solar tenders had won.

The Commission confirmed that Member State policies and legislation are being taken into account, and also that, especially for Green Public Procurement (GPP), Member States will be explicitly invited to

contribute to and provide more information about policies, criteria and schemes, and to make suggestions for possible EU-wide GPP criteria and guidance. However, it is difficult to take into account the auction cited as this represents only one case. It may be indicative of a trend, but we cannot be certain yet.

Task 2: Market analysis

An overview of the preliminary findings from the market analysis was presented by the JRC B5, focussing in turn on modules, inverters and PV systems. For each technology the following topics were covered:

- The base assumptions and market data used as the basis for estimating the product stock,
- The major technology trends and market segments,
- Routes to market and pricing.

Stakeholders were invited to give their initial feedback, and also to contact the study team to share any relevant information.

Market Analyses and Trends

ECOS observed that a trend that had been noted was the increasing use of solar PV in "self-build" projects, together with some start-up enterprises working hand-in-hand to facilitate this more independent uptake of solar PV integration.

Wacker Chemie AG remarked that it appreciated the use of the ITRPV roadmap evidence, but that the forecasts in this report may be too conservative regarding forecasts of market penetration rates for certain technology.

The Commission noted this intervention and will cross-check the assumptions made with industry stakeholders now and going forward.

BEUC mentioned that a trend towards 'plug-in' PV systems should be included, e.g., so-called 'balcony systems', as these were opening up the market for tenants living in apartments. Such as the recent program in Germany 'Mieterstromgesetz' also called 'The Landlord-to-Tenant Electricity Act'.

Innogy noted that there are various PV cell trends and developments that may bring new technologies into the market, such as organic cells.

The Commission responded that the established procedure for conducting the Preparatory Study is as follows, in order to keep the project manageable but sufficiently flexible regarding newer technologies:

- establish which technologies are most important (in terms of market penetration)

- forecast trends over the following 5 -10 years. Beyond this period the forecasts start to become unreliable for the degree of granularity that Ecodesign regulations need
- cite solely mature Best Available Technologies (BAT) for detailed examination, i.e. those already "market ready" and on sale

With regard to the above approach, organic PV (OPV) still remains a relatively minor/immature technology, and for the purposes of this study may be classified as a Best Not-yet Available Technologies (BNAT) technology. As such it is not currently proposed as one of the Base Cases to be analysed in detail. The study will take into account the speed of take-up of technologies in this fast moving sector.

Warranties and Guarantees

Total raised the question as to which of the following would be preferential - a Performance Warranty, or a Product Warranty - and what is the difference between them as they are cited with different typical timespans in the report? Product warranty could be a preference, as a performance warranty might not be relevant if a module is not yet generating. Might one of these be incorporated into one of the measures (Ecodesign, Energy Labelling, GPP or EU Ecolabel)?

The Commission replied that there has been a prolonged discussion in the Ecodesign legislative and wider community regarding the potential role of warranties, and to date it has proved very difficult to incorporate references to these in the framework of Ecodesign regulations. This does not mean that the approach will not be examined again during this Preparatory Study. The content and type of warranties is an issue that is easier to examine and possibly to incorporate as potential GPP or Ecolabel parameters.

Lifetime of PV modules

BEUC commented on the issue of Feed-In Tariffs (FITs) and End of Life (EoL) management of PV panels and related equipment, especially considering that many of the PV panels that were initially put into service in early FIT schemes 20 years ago are now reaching their EoL. The following aspects should be further investigated:

- are those modules installed on buildings left until the buildings are demolished, or is decommissioning carried out, once needed (i.e., once they have reached the end of their useful life)?
- Are modules replaced and 'repowered' when a FIT contract runs out and what does this mean for the design of new modules just about to be placed on the market/put into service?

The Commission responded that it was aware of some of these issues, and that the alternative of using modules or other equipment for 'second service life use' as well as 'design for decommissioning' were also being examined within the framework of the study.

Task 3: Use behaviour, direct and indirect impacts, and end of life

JRC B5 presented an overview of the initial analysis of user interactions with the technology, the MEErP concepts of direct and indirect impacts on energy systems, and the end of life phase and currently available data and assumptions for PV equipment. Stakeholders were then invited to give their initial feedback, and also to contact the study team to share any relevant information.

The Commission emphasised that if stakeholders are aware of any technology that they consider meeting the above criteria with regard to Base Cases in the Preparatory Study, or BNAT, they should please inform the Study Team as soon as possible.

ECOS asked what the different policy tools will target, as a clear picture is needed along the chain of potential users. It is critical to identify gaps in terms of the added value that policies could provide. This is not fully clear yet, which may in part be due to the structure of the report. The conclusions from the testing undertaken by consumer NGOs need to be presented.

BEUC emphasised that residential scenarios need to be reflected in the modelling. For the domestic market, cost and performance are interrelated. From a life-cycle cost perspective the risk of product failure will have an influence on costs, so should be estimated. This is particularly the case for inverters, the failure of which will have an implication for a system as a whole. A lot will also depend on proper installation of a system. In regard to reference locations for yield modelling, more than one should be used in order to capture variations. In terms of indirect impacts a simplified approach to the marginal effect on emissions should be considered. Home versus grid storage are important options to consider.

Solar Power Europe supported the general approach but emphasised that any resulting measures should be proportionate and simple. Regarding inverters they stated that industry assumptions about their life time had shifted from 5-10 years to 15-20 years. The probability of downtime is generally lower for string inverters than for central inverters.

First Solar emphasised the need to look not just at CO_2 equivalent emissions but at other environmental impacts that may be related to the displacement of fuels such as coal and nuclear. The Product Environmental Footprint pilot for PV technology modelled a range of such impacts.

CEA/INES asked whether experience had been drawn from the solar thermal heaters product group? In terms of use behaviour the aim should be to improve performance whilst reducing the price. The repowering of PV modules is a trend to take into account as the environmental impact of early replacement may be greater. Will mobile storage (i.e. car batteries) be taken into account?

The Commission confirmed that car battery storage would not be analysed, as this would require comparing results from other vehicle fuel systems.

ECOS wonders if there is enough data to conclude on the low voltage grid impact that PV systems have. They asked whether the standby modes of inverters would be included in the horizontal regulation or would be dealt here in the frame of the Solar PV preparatory study.

BEUC supported ECOS on the low voltage grid issue raised. Care needs to be taken not to draw premature conclusions on grid congestion impacts.

The Commission notes the comments and welcomes the proposals and views on how to consider or calculate the mentioned parameters. Transmission losses won't be in principle accounted for, as the impacts of the PV systems on the local grids are completely different within the EU and within a single country. The approach is for now to make a sensitivity analysis on that issue, however other approaches are welcomed.

Task 4 and transitional methods

JRC B5 presented initial proposals for base cases, together with a categorisation of the main technologies identified in Task 2 into BAT and BNAT and the proposed use of the Levelised Cost of Electricity (LCOE) whole life costing method.

JRC C2 then presented on the development of transitional methods, being those that can be used temporarily in the absence of suitable existing international PV standards as long as harmonised standards are not available, and the next steps relating standardisation. Standards for the PV sector regarding modules are considered to be exhaustive and cover mainly all parameters except for degradation and durability of modules. For PV systems and at some extent for conditioning components, there is none standard that currently addresses the identified functional parameters, in particular the energy yield of PV systems, the durability of PV inverters and all the circular economy aspects. There is standardisation work to improve the available definition of efficiency of PV inverters both at European and international level.

Tecnalia supports the use of the LCOE in the analysis and emphasised the difficulties they have encountered in practice with some parameters when using the apparently simple formula. For example,

for PV plants the use of the land can be considered as an OPEX (when land is in rental) or CAPEX (when land is bought at the beginning of the project). The decommissioning process should be included and both the residual value and the cost of dismantling should be factored in. The latter sum may be positive. Another note is how the yield of bifacial modules will be calculated, since at the moment there is limited field data to cross-reference.

NEA noted that at least for Ecodesign and Energy label what is relevant is the difference between the base case and the improvements, and this may rule out of the equation the need to model decommissioning for example. The LCOE seems an appropriate formula equivalent to the life cycle cost analysis used in Ecodesign products. Regarding the Ecoreport tool and the bill of materials (BoM), this can be amended as long as there is data available, so if from the PEF study there is a solid base for the BoM and the environmental impact why not to use this in the preparatory study.

BEUC noted that for the purposes of LCOE the comparison should be made relative to grid electricity.

Next steps and conclusions

The Chair thanked all the participants of the meeting for their fruitful contributions, and reminded stakeholders that they are invited to send their written comments to the study team by 27th July 2018.

There will be a Technical Meeting on Standards and Transitional Methods on 31.10.2018, at the Commission's JRC premises in Ispra, to which invitations will be sent out to interested parties.

The second Preparatory Study Stakeholder Meeting will most probably be held in December (place, date and timing to be confirmed). This meeting will concentrate on draft findings in Tasks 4 and 5, as well as giving orientative elements regarding Task 6.

The meeting closed at 16.00.