



Project SOPHIA

PhotoVoltaic European Research Infrastructure

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D3.5 – Yearly report on contribution to standardization committees

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1. Executive summary

Description of the deliverable content and purpose

The contribution to the standardization committees is a deliverable due at M48, with preliminary reports due each year (M12, M24, M36).

The Sophia project will mainly develop harmonised practices for a better use of research infrastructures. It could end up with recommendations for improved characterisation procedures of some materials or devices, which could serve as proposals towards the ongoing standardisation processes.

These potential Sophia contributions fit mainly to the scope of IEC Technical Committee 82 (Solar photovoltaic energy systems) Working Group 2 (PV-modules, Non-concentrating) quite well which aims to develop international standards for non-concentrating, terrestrial photovoltaic modules.

Deviation from objectives, corrective action

Considering that the development of improved procedures takes a long time because of the necessary validation, no concrete input is planned especially for the first year. Therefore, no deviation is reported.

Technical progress

So far our contribution is prepared by the SOPHIA partners (FhG ISE, CREST, JRC, AIT, Tecnalia) participating to standardization committee meetings of IEC TC82 WG2, which are usually organised once a year.

In this way we are aware of the topics under discussion and will be able to find out how to optimise our input to the standardisation process.

Impact of the results

The initiated Back-sheet UV-Round Robin was taken can be seen an example for another Round Robin testing on encapsulant materials organised by our American colleagues. It is too early to see more impact.

Dissemination activities carried out, planned

The main dissemination activity will be targeted by definition towards the standardisation committees.

Nevertheless, several additional channels will be used for the further dissemination of activities in the field of standardisation. As a first step, two of them are identified :

- Japanese colleagues from AIST and American PV-experts from NREL initiated an International Quality Assurance Forum (QA-Forum) dealing with the preparation of the background and fundamentals of innovative standards on durability assessment of PV-modules.
- We organised a SOPHIA PV-module reliability workshop at SUPSI in Switzerland in 2012, prior to an IEC TC82 WG2 meeting which was structured according to the QA-Forum in order to facilitate European interaction with the standardisation committees.

2. Technical sections

2.1 *Standardisation committees in the field of photovoltaics*

The main standardisation organisation active in the field of photovoltaics is the International Electrotechnical Commission, through its Technical Committee 82 (IEC TC 82) on Solar photovoltaic energy systems.

In this context, the concept of "photovoltaic energy system" includes the entire field from light input to a photovoltaic cell and module and including the interface with the electrical system(s) to which energy is supplied.

The standards are in the general areas of photoelectric performance, environmental test, quality assurance and quality assessment criteria. The standards ultimately produced should be universal and non-restrictive in their application, taking into account different environments and manufacturing technologies.

In addition to the basic electrical and mechanical characteristics, standards will be written for other important factors such as module thermal performance, high voltage performance, fault resistance and fault-tolerant design.

Five working groups are currently in operation :

WG 1 - Glossary

WG 2 - Modules, non-concentrating

WG 3 - Systems

WG 6 - Balance-of-system components

WG 7 - Concentrator modules

Working Group 2 (PV-modules, Non-concentrating) is the one which will be the most related to some of the Sophia project activities. Working Group 7 on Concentrator modules will also be looked at later on.

2.2 *Activities of the first year*

The contribution to the standardization committees is a deliverable due at M48, with preliminary reports due each year (M12, M24, M36).

The development of improved procedures takes a long time because of the necessary cross-validations, with several technologies, procedures and actors. Therefore, the main inputs will happen during the last two years of the project.

Consequently, the activities of the first years of the project are more related to the preparation of the contributions.

For this first year, five SOPHIA partners, Michael Köhl (FhG ISE), Ralph Gottschalg (CREST), Tony Sample (JRC), Karl Berger (AIT), and Oihana Zubillaga (Tecnalia) participate to standardization committee meetings of IEC TC82 WG2, which are usually organised once a year.

In this way, we are aware of the topics under discussion and will be able to find out how to best optimise our inputs to the standardisation process.

Examples of Sophia topics which could result in some contributions:

- Sample preparation and pre-conditioning issues, especially in the case of Organic PV and thin film measurements
- Peak power measurement for new cSi technologies
- Recommendations for accelerated ageing tests of flat PV modules
- Defect detection in the PV modules
- Quantification of the impact of mistracking in the case of CPV modules

The participation to TC82 WG7 will be organised as a second priority, during the second year of the project.

2.3 Additional initiatives in relation to standardisation

2.3.1 Based on the discussions within the IEC we are looking at initiating a Round Robin test on accelerated UV-testing of PV-modules and components in the framework of Networking Activity 3 (Work-package 3) in order to evaluate the possibilities of accelerating UV-testing by increasing the sample temperatures and the UV-intensity without changing the dose-effect relation.

2.3.2 Japanese colleagues from AIST (Japan, Dr. Michio Kondo and Maasaki Yamamichi) and American PV-experts from NREL (USA, Sarah Kurtz and John Wohlgemuth) initiated an International Quality Assurance Forum (QA-Forum, www.nrel.gov/ce/ipvmqa_task_force/) dealing with the preparation of the background and fundamentals of innovative standards on durability assessment of PV-modules.

This QA-Forum is structured into five different Tasks:

Task1: PV QA Guideline for Manufacturing Consistency

The goal is to design a guideline that could be used as base document for a new IEC standard for PV or as a new iso standard. The guideline is focused on PV manufacturing processes and procedures aiming to insure manufacturing quality and the consistency of the produced photovoltaic modules to the warranties given by the producer.

Task 2: Thermal and mechanical fatigue including vibration

Failures of cell interconnects and solder bonds have been identified as a key cause of long-term failure of PV modules. The primary stresses affecting the failure rates have been shown to be thermal and mechanical. There is evidence that vibration during transportation and/or caused by wind can contribute.

Task 3: Humidity, temperature, and voltage

The ingress of moisture with or without electrical bias has been shown to cause corrosion and charge movement in PV modules. Temperature and humidity have been used as accelerated stress tests for PV modules for many years. However, the use of constant exposure tests, such as the existing Damp Heat Test of 85 C and 85% RH for 1000 hours, appears to result in relative humidity levels far above that which will ever be seen outdoors for breathable package designs and may overstress the module. On the other hand, for semi-hermetic designs, 1000 hours may not be long enough to simulate 20 years of moisture ingress through the moisture barriers. There are multiple humidity and humidity/electrical bias degradation modes with widely varying acceleration factors. The group's development of accelerated lifetime tests must take variation of environmental conditions into account.

Task 4: Diodes, shading and reverse bias

There is increasing evidence that shading or other non uniformities in modules puts localized stress that can lead to overheating, and, in some cases, to fires. Not only is this failure a serious safety issue, but there is some evidence that aging modules show increasing non uniformity, implying that this may turn out to be a significant wear out mechanism. Thermal cycling may also be important since thermal fatigue failures can cause stress on the diodes.

Task 5: UV, temperature and humidity

Light (especially UV light) can cause changes in modules including solarization of the glass, light-induced degradation in the cells, discoloration, and decrease in adhesion. Unfortunately, application of light in large area is expensive, so a strategy has often been to apply the stresses to a smaller version of a module.

The link between activities of Tasks 2 and 5 and the Sophia Joint Research Activity #1 is rather obvious and dissemination of some Sophia outcomes will be particularly relevant to this Quality Assurance forum.

2.3.3 A SOPHIA PV-module reliability workshop was organised at SUPSI in Lugano (Switzerland) in 2012, in the week prior to an IEC TC82 WG2 meeting at Stresa (Italy) which was structured according to the QA-Forum in order to facilitate European interactions with the standardisation committees.

2.4 Deviations from the Description of Work

No major deviations from the description of work can be mentioned.

3. Conclusions

These late actions taking place during the first 6 months in 2012 were the main reason why the M12 report was delayed.

Standardisation is a very slow process and it takes some time before you can see results. During the next reporting periods we will start cooperation with the Working Group 7 of TC82 (Concentrator modules) and can expect the results of the Module Reliability Workshop and the UV Round Robin.

4. References

N/A