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PERFORMANCE ASSESSMENT OF BIPV PRODUCTS:
COMBINED TEST PROCEDURES FOR ELECTICAL AND MECHANICAL SAFETY

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ABSTRACT

Building Integrated Photovoltaics (BIPV) sector is progressively achieving an advanced level of technical maturity and market transfer. In the last kilometer for considerable market implementation, major challenges are mostly related to cost-effectiveness and products quality. BIPV multifunctional products are still framed in uncertain certification processes in the EU, in the grey area between electrotechnical and construction sectors, impacting commercialization and market confidence. The standards in force for product certification, such as EN50583, in most national and local contexts are not yet harmonized and imply wide margins of interpretation for product and project requirements. The product's qualification is therefore mainly based on electrical standards for PV (IEC 61215, IEC 61730) and, on the other hand, on procedures for "non-active" traditional construction products in accordance with the prevision of the EU Regulation 305/2011 or by National and Local regulations specific to each country. The H2020 EU project "BIPVBOOST" (www.bipvboost.eu) is focused on obtaining a reduction in costs along the entire production chain by pursuing product and process innovation. New test procedures, which will aim at combining both PV and construction requirements in a harmonized assessment, are being developed and expected to provide a valuable starting point for BIPV manufacturers to ease the assessment of the technical requirements for BIPV products/systems development, as well as for reducing costs of the current testing approach.

STATE OF ART OF CERTIFICATION FRAMEWORK

PV NORMATIVE

IEC 61730-1:2016 *"This international standard defines the basic requirements for various applications of PV modules, but it cannot be considered to en- compass all national or regional codes.*
Specific requirements, e.g. for building, marine and vehicle applications, are not covered"

BUILDING NORMATIVE

EN 50583: 2016 *"Photovoltaic modules are considered to be building-integrated if the PV modules form a construction product providing a function as defined in the European Construction Product Regulation CPR 305/2011 "*

BIPV: DOUBLE CERTIFICATION?

- The CE mark already applied to PV modules is in accordance with the 2014/35/UE (LVD) -EN 61730: the performances are not relat- ed to building application.
- The CE mark for BIPV, according to the CPR 305/2011, has to be released also in accordance with building product harmonized standards or harmonized technical specification (EAD)

TOWARDS A CONSTRUCTION-BASED APPROACH FOR BIPV PRODUCTS

■ **Performance-based approach: the concept beyond a pass/fail test-based approach**

The *prescriptive codes* require that each element has a minimum acceptable standard. (PASS/FAIL). It may be hard to define the exact performance levels in BIPV, since the scenarios in the built environment cannot be standardized. The *performance-based* approach does not prescribe the value of the characteristics, nor the criteria for deciding on the suitability of a particular product, but provides the means to assess them for the Limit States. Engineering approach is usually adopted (e.g. in Eurocodes for structural design)

■ **Limit states: towards a construction engineering-based approach**

A limit state is a condition of a system (a structure in case of structural engineering where the method was introduced) beyond which it no longer fulfills the relevant pre-defined design criteria. The proposed methodology introduces combined electrical and construction LS considering the product's multifunctionality.

■ **Combined stress approach: to consider (non-standard) scenario relevant for BIPV**

The procedures to qualify a BIPV product family will have to deal with composite units for building skin claddings including a functional construction element of the building skin with an external PV active layer for energy production.

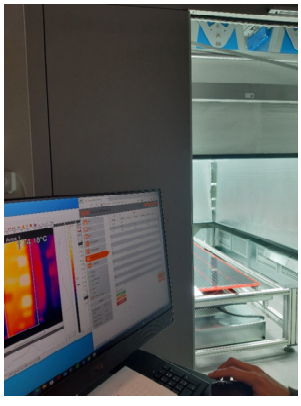
EXAMPLES OF NEW TEST PROCEDURES FOR BIPV ELECTRICAL AND MECHANICAL SAFETY

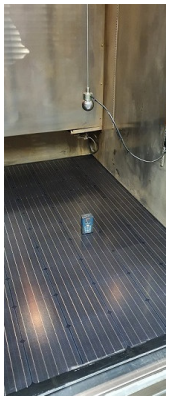
■ **BIPV maximum temperatures in non-conventional scenarios of serviceability LS**

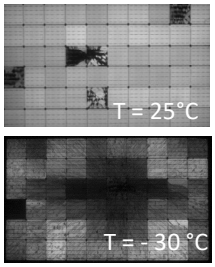
Problem:
The integration of passive and active parts and BIPV shading scenarios in operation can introduce additional overheating which can affect max serviceability temperature
Proposal:
Combination of the temp. test (MST21) with non- conventional shading scenarios (IEC TS 63140 "Partial shade endurance testing)
Result:
accurate determination of the maximum temp. in non-conventional operative scenarios

■ **BIPV impact resistance for Safeguard and Ultimate LS**

Problem:
the standard test methods (PV and building) don't consider temperatures effects. Moreover, the consequence of impact on electrical parts is not considered
Proposal:
Combination of the impact test (e.g. hard body according to EADs) with temperature by considering both glass and electrical limit states (LS)
Result:
Combination of CPR (impact resistance) and LVD (breakage) tin a combined test







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CONCLUSIONS

The construction of multifunctional BIPV products involves more and more the use of several materials in the same component. These elements, electrically active and non-active, assembled together, mutually induce and influence changes both in the energy performance and in the construction requirements. These performance relations have been only partially investigated at the state of art of BIPV quality assessment: it is required to go further than the application of the test methodologies provided separately by the PV or the building regulations. To make tangible innovation, unified and effective procedures ensuring reliable, safe and efficient products for the market in a cost-effective way will have to be developed and transferred in normative, to create a supporting impact on the real market.

Consortium

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