ncrease

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1. INTRODUCTION

The widespread adoption of Building-Integrated Photovoltaic (BIPV) and Infrastructure-Integrated Photovoltaic (IIPV) systems and technologies is crucial for achieving the European Union's ambitious long-term policies. These policies include the Renovation Wave, the European Green Deal, the climate-neutral and smart cities mission, and the New European Bauhaus initiative.

The INCREASE project aligns with these goals, setting forth a series of ambitious objectives. These include several module-level improvements aimed at enhancing safety, sustainability, reliability, and aesthetic aspects of BIPV and IIPV systems. The project focuses on innovations and improvements that boost reliability while minimizing degradation rates throughout the lifespan of modules integrated into buildings and infrastructure.

To demonstrate the efficacy of these advancements, the project will develop BIPV and IIPV systems for building envelopes and various infrastructures. Up to ten demonstrations – five BIPV and five IIPV – will be set up across nine locations for the duration of the project.

The process of bringing these innovations to real-world demonstrators involves several critical steps. These include design, validation testing, assessments, and approvals, all of which must comply with current standardization and regulatory frameworks.

This report provides a comprehensive analysis of the current standardization landscape. Beginning with a description of the demo site components and system designs, it will detail the specific applicable requirements, including any deviations from local regulations. This thorough examination will offer valuable insights into the practical implementation of BIPV and IIPV technologies within diverse regulatory environments.

1.1. Description of deliverable content and purpose

This document reports the outcome of an overall assessment of the general and regional requirements for PV integrated in buildings and infrastructure. Additional requirements given by local regulations in place for the demonstration sites by local authority have been collected and investigated. The present document reports the current European regulation and standards but is not limited to EN 50583-1 [1]and EN 50583-2[2].

Starting from these standards and its extended normative references (EN 14449[3], EN 13830[4], EN 13501[5], IEC 61730[6], etc.), a complete landscape analysis of the applicable standards has been performed during the assigned task. The regional requirements have been collected by the help of the pilot leaders and local representative following interaction with building institutes, DSO's, and regulators (1) (2) (3).

[1] EN 50583-1:2016 Photovoltaics in buildings - Part 1: BIPV modules

[2] EN 50583-2:2016 Photovoltaics in buildings - Part 2: BIPV systems

[3] EN 14449:2005 Glass in building — Laminated glass and laminated safety glass — Evaluation of conformity/ Product standard

[4] EN 13830:2015 Curtain walling — Product standard

[5] EN 13501-1:2018 Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests (series)

[6] EN IEC 61730-1:2016 Photovoltaic (PV) module safety qualification — Part 1: Requirements for construction (series)

Adopted Methodology

During the first part of the work related to task 6.3 the project team has performed the following activities:

- A structured overview of the current applicable standards and regulations
- A continuous monitoring and reporting of the standardization projects and activities ongoing in the international standardization
- Establishment of a direct and coordinated link between INCREASE project team and European CENELEC TC 82 and IEC TC 82 and JWG 11
- A collection of the description of technologies solutions and design data to be implemented in the demo sites relevant for the assessment, certification and approvals.
- Collection of BIPV local deviation requirements by relevant local authorities (i.e. construction local regulations, local fire requirements etc..)
- Identification of innovation introduced in demo sites

The above activities have been performing in close cooperation with WP4 for the coordinated development of the testing plan and WP5 in charge of the demos design and preparation.

This document is prepared to collect the local rules in force in the various countries of the demonstration sites. It is to complement the Standards Mapping. It refers to the rules that must be considered when installing BIPVs in buildings or infrastructure.

- Technical description of the technological solution will contain electrical and mechanical data (including components, category of installation, building installation fixture, etc..)
- Innovation included in technology solution impacting test plan and standards
- Assessment of test plan and possible impact on standardization
- Assessment of local deviation and possible impact on standardization

The above listed activities will be the basis for discussions which results in a gap analysis that will provide proposals and guidelines for possible simplification and harmonisation of testing and approval. Those results are no included in this initial deliverable but will be part of the activities of task 7.1.

Even new testing proposal beyond current standards will be reported in the final version of this report and the related impact or roadmap for proposals amending current normative framework will be delivered in task 7.1

1.2. Relation with other projects activities

The present deliverable is primarily related to the activity performed in Task 6.3 which is linked to other activities, tasks and deliverables within INCREASE project.

Those links are reported in the following table:

Project Activity	Relation with current deliverable
WP 1	Materials, processes and designs for advanced Integrated PV Modules. Introduces innovation to improve reliability of PV modules in the dedicated integrated PV applications with minimized. performance losses
WP 5	Demonstrations. This work package is in charge for design and optimal preparation of the on-site activities and technology implementations, on which the present deliverable shall tailor the basic requirements.
Task 4.1	Setting up the test programme and preparation of prototypes. Based on the works performed in task 6.2, 6.3 and the content of D6.3, this task will define the path to follow for performance evaluation and demo validation of the developed solutions.
Task 7.1	Active engagement in and effective contributions to standardization activities. This task coordinates the communication of evolutions in these standardisation committees towards the project, and the aspects identified in INCREASE that need to be addressed in identified committees. Mainly the outcome of tasks 6.3 and 4.3 will be considered for the definition of possible standardisation contribution. The standardisation contributions aim to lead to new standardisation work (expected e.g., for fire testing protocols for BIPV), as well amendments of current standards (e.g., to overcome the gap between CPR and IEC world).

TABLE 1: LINK WITH TASK 6.3

This document serves as a comprehensive repository of design data and outlines innovations that impact existing standards. It provides a foundation for in-depth analysis of current standardization gaps, challenges in the assessment and approval process, and inconsistencies in European regulations. The outcomes of this analysis may lead to:

1. Proposed amendments to existing standards
2. Recommendations for new standardization projects addressing innovative aspects of technologies adopted in this project
3. Dead ends to avoid for BIPV designs

These findings will directly inform Task 7.1, which focuses on standardization activities. Additionally, this task will deliver a structured overview to guide:

1. Testing procedures in Work Package 4 (WP4)
2. Design and preparation of demonstration projects

By systematically addressing these aspects, the project aims to streamline the integration of Building Integrated Photovoltaics (BIPV) and Infrastructure Integrated Photovoltaics (IIPV) technologies, ensuring compliance with evolving standards and regulations while fostering innovation in the field.

2. TERMS AND DEFINITIONS

In this section a list of terms and definition used in the current report and derived from standards and regulation is reported

Building-Integrated Photovoltaic modules
BIPV modules
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. Thus the BIPV module is a prerequisite for the integrity of the building's functionality. If the integrated PV module is dismounted (in the case of structurally bonded modules, dismounting includes the adjacent construction product), the PV module would have to be replaced by an appropriate construction product.

The building's functions in the context of BIPV are one or more of the following:

- mechanical rigidity or structural integrity
- primary weather impact protection: rain, snow, wind, hail
- energy economy, such as shading, daylighting, thermal insulation
- fire protection
- noise protection
- separation between indoor and outdoor environments
- security, shelter or safety

Inherent electro-technical properties of PV such as antenna function, power generation and electromagnetic shielding etc. alone do not qualify PV modules as to be building-integrated.
[Ref. EN 50583-1:2016]

Building-Attached Photovoltaic Modules
BAPV modules
Photovoltaic modules are considered to be building-attached, if the PV modules are mounted on a building envelope and do not fulfil the above criteria for building integration.

(Negation: The integrity of the building functionality is independent of the existence of a building-attached photovoltaic module.).

Note 1 to entry: Further important information on this type of photovoltaic system on roofs is provided by the Technical Report by CEN/TC 128/WG3 - Solar energy systems for roofs: Requirements for structural connections to solar panels.

[Ref. EN 50583-1:2016]

Building-Integrated Photovoltaic system
BIPV system
Photovoltaic systems are considered to be building-integrated, if the PV modules they utilize fulfill the criteria for BIPV modules as defined in EN 50583-1 and thus form a construction product providing a function as defined in the European Construction Product Regulation CPR 305/2011.

[Ref. EN 50583-2:2016]

Building Attached Photovoltaic system
BAPV system
Photovoltaic systems are considered to be building attached, if the PV modules they utilize do not fulfill the criteria for BIPV modules as defined in EN 50583-1.

Note 1 to entry: Further important information on this type of photovoltaic system on roofs is provided by the Technical Report by CEN/TC 128/WG3 - Solar energy systems for roofs: Requirements for structural connections to solar panels.

[Ref. EN 50583-2:2016]

Infrastructure Integrated Photovoltaic (IIPV) Modules

IIPV modules are photovoltaic modules designed to be integrated into infrastructure elements such as noise barriers, road surfaces, bridges, or other civil engineering structures. These modules serve a dual purpose of generating electricity while also fulfilling a specific infrastructural function.

IIPV System

An IIPV system is a photovoltaic system where the PV modules are integrated into infrastructure elements. It includes:

- The IIPV modules
- Electrical components for connecting modules to external circuits
- Mechanical systems for integrating modules into the infrastructure
- Any additional components necessary for the specific infrastructure application

IIPV systems must meet both electrical standards for PV systems and relevant infrastructure regulations and standards.

3. STANDARDIZATION ACTIVITIES AND OBJECTIVES

The main objective of European standardization is to create a link on common specifications and/or procedures responding to the needs of business and meet consumer expectations.

In particular, the standardization facilitate innovation and promote the adoption of new technologies being a key instrument for the consolidation of the Single Market and for strengthening the competitiveness of European companies, thereby creating the conditions for economic growth. Standards can be useful to improve safety and performance, increasing energy efficiency levels, and protect consumers, workers and the environment. They complement European and national policies in these areas and make it easier for companies and other actors to respect relevant legislation.

They facilitate communication, commerce, measurement and manufacturing. European Standards bring benefits to businesses and consumers in terms of reducing costs, enhancing performance and improving safety. They also help to ensure the compatibility of different components, products and services.

European Standards can be used to enhance safety and performance, improve energy efficiency, and protect consumers, workers and the environment consolidating Single Market and facilitating cross-border trade in Europe and with the rest of the world.

The stakeholders are directly involved in standardization activities at national level and also at European level. In particular, they can:

- gain detailed knowledge of standards and this way, anticipate requirements and trends;
- influence the contents of standards and ensure that their specific needs can be well-addressed;
- establish contacts with other stakeholders, experts and regulators at both national and European levels.
- Can give a contribution to the development of standards that will ensure increased safety, performance, efficiency and interoperability of products and/or services.

The main objective of standardization activities within INCREASE project is to evaluate the existing standardization framework in the field of Building-Integrated Photovoltaics (BIPV) and fill the gap by identifying the challenging aspect and the possible innovation.

In summary, the final goal of standardization activities within INCREASE project will be:

- To assess general and regional requirements for BIPV and IPV
- Give a complete landscape analysis of applicable standards and possible gaps identifications
- To provide a structured overview of standards
- To provide a Gap analysis for the innovation

A proposal to IEC/CLC TC 82 for a new standard (NP) or for revising of amending an existing one, derived from the innovations introduced by the INCREASE project would bring concrete industrial spin-off that fosters the diffusion and confidence in BIPV solutions, beyond projects outcome, providing advantages well after project timeline in the long term. The communication between INCRASE project team and European standardization bodies can be achieve via two possible ways, an informal one considering the member of INCREASE project TEAM participating as individual experts in standardization activities and a formal way by establishing a Liaison between INCREASE and IEC and CENELEC TC 82.

A direct link between INCREASE and TC 82 provides the following advantages:

- First-hand information to Increase on the current standardization project ongoing in the technical committees workprogramme
- Commenting on current standardization project draft
- Raising needs, pain point and proposals directly to the standardization bodies
- Providing standardization project proposal for new, revising, amending standards

The fact that BIPV systems are both building components and electrical components results in an additional complexity in the approvals phase for manufacturers who must refer to both ISO/CEN World Standards and IEC/CENELEC Area Standards. In addition to the international electro-technical photovoltaic standards such as IEC 61215, IEC 61646 and IEC 61730, some standards from the building sector are also included, such as: EN 13501 (Safety in case of fire); EN 13022 (Safety and accessibility in use); EN 12758 (Protection against noise). As the BIPV modules and systems are construction products and contain electrical components, they are subject to the European Construction Product Regulation CPR 305/2011, the Low Voltage Directive LVD 2014/35/EU and the Electromagnetic Compatibility Directive ECD 2014/30/EU) (4).

In particular, the following regulations must be taken in account:

International Electrotechnical Commission	- **IEC 61215:2021** parts 1 and 2, focused on the **requirements for design qualification** of terrestrial photovoltaic modules suitable for long-term operation in outdoor climates, - **IEC 61730:2021** parts 1 and 2, focused on description and specification of respectively the basic construction and testing requirements for photovoltaic (PV) modules to ensure **safe electrical and mechanical operation**. - **IEC 63092:2020** Part 1 and 2 focused on the **specification of requirements for BIPV** (building-integrated photovoltaics) modules and systems. Part 1 addresses requirements on BIPV modules in the specific ways in which they are intended to be mounted but not on the mounting structure itself, which falls under Part 2. It is important to note that this international standard is based on what is prescribed in EN 50583-1, which refers to the European CPR Regulation.
International Organization of Standardization	At the international level, for the building part, some ISO standards consider the behaviour of BIPV. For example, the **ISO/TS 18178:2018** technical specification is specifically developed for building-integrated photovoltaics. It specifies the appearance, durability, safety requirements, test methods, and designation for laminated solar photovoltaic (PV) glass for use in buildings.
Construction Products CPR	According to European legislation, a construction product is defined as "any product or kit manufactured and placed on the market for permanent incorporation in construction works or parts thereof and the performance of which has an effect on the execution of construction works with respect to the basic requirements for construction works." The BIPV as a construction product must comply with **Regulation (EU) No. 305/2011** on Construction Products CPR. Its performance shall be defined according to the relevant essential characteristics expressed in CPR 305/2011 established in Annex I of the Regulation and listed below: 1. Mechanical strength and stability 2. Safety in case of fire 3. Hygiene, health, and environment 4. Safety and accessibility in use 5. Protection from noise 6. Energy conservation and heat retention 7. Sustainable use of natural resources The aims of CPR 305/2011/EEC are to set the conditions for placing construction products on the market, to establish provisions for the description of performance in relation to characteristics, and finally, to define the use of CE marking.
Low Voltage Directive	BIPV has an electrical part that produces energy, so in Europe, it must comply with the low Voltage Directive **(LVD) (2014/35/EU)**. This directive ensures that electrical equipment within certain voltage limits provides a high level of protection for European citizens.

Some of the Technical Committees that develop Standards for the application in BIPV Components and Systems are:

- In the ISO/CEN area: ISO/TC 160 Glass in building; CEN/TC 127 -Fire safety in building
- In the IEC/CLC area: IEC/TC 82 Solar photovoltaic energy systems

On these topics was created a specific Working Group JWG 11 - Building-Integrated Photovoltaics (BIPV) linked to ISO/TC 160 and in CLC TC 82 - Solar photovoltaic energy systems the Working group: CLC/TC 82/WG 01 Wafers, cells and modules; CLC/TC 82/WG 02 Boss components and systems.

At international level the scope of committee *IEC TC 82 "Solar photovoltaic energy systems"* is the preparation of international standards for systems of photovoltaic conversion of solar energy into electrical energy and for all the elements in the entire photovoltaic energy system. The "photovoltaic energy system" includes the entire mechanism from light input to a photovoltaic cell to and including the interface with the electrical system(s) to which energy is supplied.

The regulatory liaisons between IEC TC 82 and other committee involved in the field of photovoltaic system are mapped in the following maps:

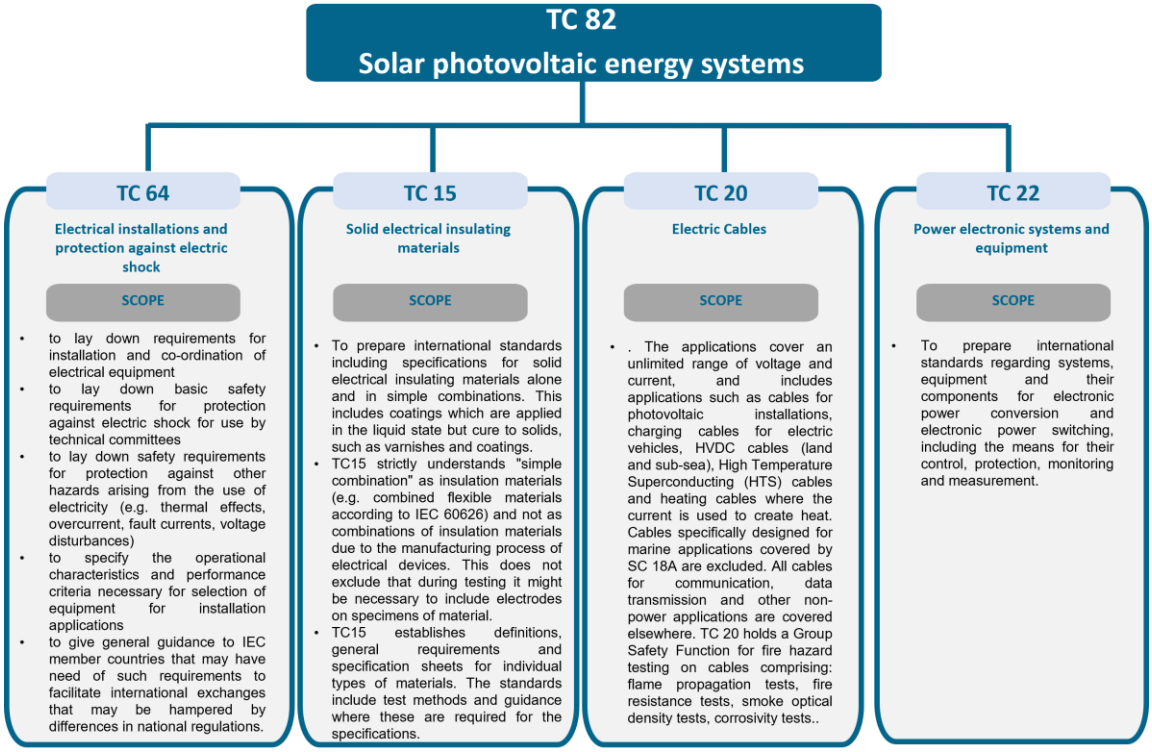

FIGURE 1:LIASON BETWEEN TC 82 AND OTHER TC INVOLVED IN PV PROJECTS

At European level CEN and CENELEC the *CLC /TC 82* 'Solar photovoltaic energy systems' develops standard from the conversion of light to the interfaces to the public grid or users.

3.1. Ongoing standardization projects

At the IEC level there are more than 70 ongoing projects. Of which 16 involve New Standards (NP), 9 concern updates to existing standards (Amendment), 26 relate to new editions of existing standards.

Specifically, for BIPV systems, is underway the projects:

- IEC 63549 ED1 "Building integrated photovoltaic (BIPV) - Identification code for building-integrated photovoltaic modules", resulting from a new proposal (82/2194/NP), and the first CD is expected to be released in 2024 from the JWG 11.

- IEC 63092-3 ED1 Photovoltaics in buildings - Part 3: Evaluation methodology of SHGC for Building integrated photovoltaic modules with various designs (82/1872/NP) by JWG 11

Regarding ongoing projects at the CLC level, in particular, we highlight updates to the two main BIPV-related Standards that CLC TC82/WG01 is working on:

prEN 50583-1(74287) Photovoltaics in buildings - Part 1: BIPV modules (Under Approval)

prEN 50583-2(74288) Photovoltaics in buildings - Part 2: BIPV systems (Under Drafting).

All other CLC/TC82 projects concern IEC source standards.

A proposal to IEC/CLC TC 82 for a new standard (NP) or for an update of an existing one derived from the innovations introduced by the INCREASE project would be the best demonstration that the results of the project can have a concrete industrial spin-off that fosters the diffusion and confidence in BIPV solutions.

The fact that BIPV systems are both building components and electrical components results in an additional complication for manufacturers who must refer to both ISO/CEN World Standards and IEC/CENELEC Area Standards.

Some of the Technical Committees that develop Standards that apply to BIPV Components and Systems are in fact, for instance:

In the ISO/CEN area: ISO/TC 160 Glass in building; CEN/TC 127 -Fire safety in buildings

In the IEC/CLC area: IEC/TC 82 Solar photovoltaic energy systems

Whit a specific Working Group: JWG 11 Building-Integrated Photovoltaics (BIPV) linked to ISO/TC 160

In CLC TC 82 Solar photovoltaic energy systems is active the Working group: CLC/TC 82/WG 01 Wafers, cells and modules; CLC/TC 82/WG 02 Boss components and systems.

At the following link are reported the work programs:

- IEC TC 82 WORK PROGRAM
- CENELEC TC 82 WORK PROGRAM

An extraction, as of the date of this document, of IEC's TC 82 Work Progam is given to show how much regulatory work is underway related to the entire PV sector.

For an up-to-date view it is recommended to use the Link to the relevant page on the IEC website, similarly for the CENELEC Work Program.

In the following table are reported the ongoing standardization projects (2024):

TC82 Work Programme generated on 2024-09-26			
Project Reference	**Title**	**Document Reference**	**Fcst. Publ. Date**
PNW TS 82-2304 ED1	Renewable energy and hybrid systems for rural electrification - Part 10: Silicon solar module visual inspection guide		2026-12
PNW TS 82-2305 ED1	High density polyethylene (HDPE) floating body used in floating photovoltaic system		2026-12
IEC TS 60904-1-2 ED2	Photovoltaic devices - Part 1-2: Measurement of current-voltage characteristics of bifacial photovoltaic (PV) devices	82/2278/DTS	2024-10
IEC TS 60904-1-3 ED1	Photovoltaic devices - Part 1-3: Measurement of current-voltage characteristics of curved photovoltaic (PV) devices	82/2222/NP	2026-03
IEC TS 60904-1-4 ED1	Photovoltaic devices- Part 1-4: Guidelines for current-voltage measurements of metastable photovoltaic devices	82/2216/NP	2025-12
IEC 60904-8 ED4	Photovoltaic devices - Part 8: Measurement of spectral responsivity of a photovoltaic (PV) device	82/2159/RR	2025-10
IEC 61215-1/AMD1 ED2	Amendment 1 - Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1: Test requirements	82/2084/RR	2025-09
IEC 61215-1-1/AMD1 ED2	Amendment 1 - Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1-1: Special requirements for testing of crystalline silicon photovoltaic (PV) modules	82/2126/RR	2025-12
IEC 61215-2/AMD1 ED2	Amendment 1 - Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 2: Test procedures	82/2085/RR	2025-09
IEC 61683 ED2	Photovoltaic systems - Power conditioners - Procedure for measuring efficiency	82/1966/RR	2025-10

IEC TS 61724-2 ED2	Photovoltaic system performance - Part 2: Capacity evaluation method	82/2210/CD	2025-09
IEC TS 61724-3 ED2	Photovoltaic system performance - Part 3: Energy evaluation method	82/1714/RR	2025-09
IEC 61829 ED3	Photovoltaic (PV) array - On-site measurement of current-voltage characteristics	82/2284/RR	2026-04
IEC TS 61836 ED4	Solar photovoltaic energy systems - Terms, definitions and symbols	82/2215/CD	2025-09
IEC 61853-1/AMD1 ED1	Amendment 1 - Photovoltaic (PV) module performance testing and energy rating - Part 1: Irradiance and temperature performance measurements and power rating	82/2025/RR	2025-09
IEC 61853-2 ED2	Photovoltaic (PV) module performance testing and energy rating - Part 2: Spectral responsivity, incidence angle and module operating temperature measurements	82/2298/CD	2025-10
IEC 61853-3/AMD1 ED1	Amendment 1 - Photovoltaic (PV) module performance testing and energy rating - Part 3: Energy rating of PV modules	82/2026/RR	2025-09
IEC 61853-4/AMD1 ED1	Amendment 1 - Photovoltaic (PV) module performance testing and energy rating - Part 4: Standard reference climatic profiles	82/2027/RR	2025-09
IEC 62109-1 ED2	Safety of power converters for use in photovoltaic power systems - Part 1: General requirements	82/2213/CD	2025-10
IEC 62109-2 ED2	Safety of power converters for use in photovoltaic power systems - Part 2: Particular requirements for inverters	82/2214/CD	2025-09
IEC 62109-3/AMD1 ED1	Amendment 1 - Safety of power converters for use in photovoltaic power systems - Part 3: Particular requirements for electronic devices in combination with photovoltaic elements	82/2285/RR	2026-06
IEC 62116 ED3	Utility-interconnected photovoltaic inverters - Test procedure of islanding prevention measures	82/1967/RR	2025-12
IEC 62253 ED2	Photovoltaic pumping systems - Design qualification and performance measurements	82/2097/RR	2025-10
IEC TS 62253-1 ED1	Photovoltaic pumping systems - Part 1: Performance, safety, and durability assessment for small-scale off-grid solar water pumps	82/2237/NP	2026-06
IEC TS 62257-9-5 ED5	Renewable energy and hybrid systems for rural electrification - Part 9-5: Integrated systems - Laboratory evaluation of stand-alone	82/2289/DTS	2024-11

	renewable energy products for rural electrification		
IEC TS 62257-9-8 ED2	Renewable energy and hybrid systems for rural electrification - Part 9-8: Integrated systems - Requirements for stand-alone renewable energy products with power ratings less than or equal to 350 W	82/2292/DTS	2024-11
IEC TS 62257-200 ED1	Renewable energy and hybrid systems for rural electrification - Part 200: System selection and design	82/2266/NP	2026-07
IEC TS 62257-301 ED1	Renewable energy off-grid systems - Part 301: Generators - Integration of solar with other forms of power generation within hybrid power systems	82/2177/CD	2025-09
IEC TS 62257-341 ED1	Renewable energy off-grid systems - Part 341: Selection of batteries and battery management systems for stand-alone electrification systems - Specific case of automotive flooded lead-acid batteries available in developing countries	82/2178/CD	2025-09
IEC TS 62257-350 ED1	Renewable energy off-grid systems - Part 350: Recommendations for selection of inverters	82/2179/CD	2025-09
IEC TS 62446-3 ED2	Photovoltaic (PV) systems - Requirements for testing, documentation and maintenance - Part 3: Photovoltaic modules and plants - Outdoor infrared thermography	82/1979/RR	2025-09
IEC TS 62446-4 ED1	Photovoltaic (PV) system - Requirements for testing, documentation and maintenance - Part 4: Photovoltaic modules and plants - Outdoor electroluminescence imaging	82/2219/CD	2025-01
IEC 62509 ED2	Battery charge controllers for photovoltaic systems - Performance and functioning	82/2145/RR	2025-11
IEC 62548-1/AMD1 ED1	Amendment 1 - Photovoltaic (PV) arrays - Part 1: Design requirements	82/2297/CD	2025-10
IEC TS 62548-2 ED1	Photovoltaic (PV) arrays - Part 2: Design guidelines and recommendations for ground-mounted photovoltaic power plants	82/2290/RR	2026-02
IEC 62688 ED2	Concentrator photovoltaic (CPV) modules and assemblies - Safety qualification	82/2005/CD	2025-09
IEC TS 62788-7-2/AMD1 ED1	Amendment 1 - Measurement procedures for materials used in photovoltaic modules - Part 7-2: Environmental exposures - Accelerated weathering tests of polymeric materials	82/1823/RR	2025-09

IEC TS 62804-1 ED2	Photovoltaic (PV) modules - Test methods for the detection of potential-induced degradation - Part 1: Crystalline silicon	82/2149/CD	2025-09
IEC 62817-1 ED1	Solar photovoltaic tracking systems - Part 1: Design qualification for horizontal one-axis solar tracking system	82/1722/NP	2025-11
IEC 62852 ED2	Connectors for DC-application in photovoltaic systems - Safety requirements and tests	82/2113/CD	2025-09
IEC 62894 ED2	Photovoltaic inverters - Data sheet and name plate	82/1970/RR	2025-11
IEC 62920 ED2	Photovoltaic power generating systems - EMC requirements and test methods for power conversion equipment	82/2231/CD	2025-10
IEC 62941 ED2	Terrestrial photovoltaic (PV) modules - Quality system for PV module manufacturing	82/2217/CDV	2025-07
IEC 63092-3 ED1	Photovoltaics in buildings - Part 3: Evaluation methodology of SHGC for Building integrated photovoltaic modules with various designs	82/1872/NP	2025-11
IEC 63112 ED2	Photovoltaic (PV) arrays - Earth fault protection equipment - Safety and safety-related functionality	82/2287/RR	2027-07
IEC TS 63126 ED2	Guidelines for qualifying PV modules, components and materials for operation at high temperatures	82/2182/CD	2025-09
IEC TS 63202-6 ED1	Photovoltaic cells - Part 6: Hot water soaking test for crystalline silicon solar cells	82/2302/CD	2025-09
IEC 63202-7 ED1	Photovoltaic cells - Part 7: Measurement of flexural strength of crystalline silicon photovoltaic cells	82/2282/NP	2026-07
IEC TS 63209-1 ED2	Photovoltaic modules - Extended-stress testing - Part 1: Modules	82/2288/RR	2025-12
IEC 63257 ED1	Power line communication for DC shutdown equipment - Communication signal, physical layer	82/2189/FDIS	2024-10
IEC TS 63348 ED1	Evaluation of Photovoltaic (PV) Module to Mounting Structure Interface	82/1740/NP	2025-09
IEC 63349-1 ED1	Photovoltaic direct-driven appliance controllers - Part 1: General requirement	82/2230/CD	2025-11
IEC TS 63371-1 ED1	Materials used in photovoltaic (PV) cells - Part 1: Specifications for electrical characteristics of crystalline silicon wafers	82/2131/CD	2025-09

IEC 63387-1 ED1	Hybrid CPV/PV modules: General characteristics and measurement procedures - Part 1: Performance measurements and power rating - Irradiance and temperature	82/2105/CD	2025-09
IEC TS 63392 ED1	Fire test for concentrator PV modules	82/2132/DTS	2024-10
IEC 63409-1 ED1	Photovoltaic power generating systems connection with the grid - Testing of power conversion equipment- Part 1: General requirements	82/2295/CD	2025-09
IEC 63409-2 ED1	Photovoltaic power generating systems connection with grid - Testing of power conversion equipment - Part 2: Testing environment	82/2033/NP	2025-09
IEC 63409-3 ED1	Photovoltaic power generating systems connection with grid - Testing of power conversion equipment - Part 3: Basic operations	82/2226/CDV	2025-07
IEC 63409-4 ED1	Photovoltaic power generating systems connection with grid - Conformity assessment for power conversion equipment - Part 4: Interface protection and fault ride through	82/1929/NP	2025-12
IEC 63409-5 ED1	Photovoltaic power generating systems connection with the grid - Testing for power conversion equipment - Part 5: Electromagnetic compatibility for low frequency conducted disturbances	82/2296/CD	2025-12
IEC 63409-6 ED1	Photovoltaic power generating systems connection with grid - Conformity assessment for power conversion equipment - Part 6: Power control functions and grid support	82/1930/NP	2025-12
IEC 63409-7 ED1	Photovoltaic power generating systems connection with grid - Testing of power conversion equipment - Part 7: Information exchange	82/2035/NP	2025-09
IEC TS 63451 ED1	Power conditioners efficiency with partially shaded photovoltaic generators	82/2032/NP	2025-09
IEC TS 63496 ED1	Floating photovoltaic power plants - Design guidelines and recommendations	82/2106/NP	2025-09
IEC 63513 ED1	Solar Trackers - Requirements for the protection of personnel	82/2154/NP	2025-11
IEC TR 63525 ED1	Reuse of PV modules and circular economy		2025-06
IEC TS 63543-1 ED1	Photovoltaic (PV) module safety qualification for DC system voltage up to 3 000 V DC - Part 1: Requirements for construction	82/2274/CD	2025-09

IEC TS 63543-2 ED1	Photovoltaic (PV) module safety qualification for DC system voltage up to 3 000 V DC - Part 2: Requirements for testing	82/2275/CD	2025-09
IEC 63549 ED1	Building integrated photovoltaic (BIPV) - Identification code for building-integrated photovoltaic modules	82/2194/NP	2025-11
IEC TS 63556 ED1	Coupled-stress acceleration test sequence for photovoltaic modules and materials	82/2212/NP	2026-12
IEC TS 63564 ED1	Electrical safety of Snow melting photovoltaic (Snow PV) module - Requirements for construction and testing	82/2208/NP	2026-10

TABLE 2: ONGOING STANDARDIZATION PROJECTS

4. LANDSCAPE ANALYSIS AND STANDARD MAPPING

Building-Integrated Photovoltaics (BIPV) represent one of the most promising solutions to reach the concept of nearly-Zero Energy Buildings (nZEB) to reduce the energy consumption from the building sector. However, the complexity of BIPV technologies presents significant challenges for standardization and widespread adoption in architectural sector (5). Key issues include:

1. Complex classification systems
2. Mismatching in standardized terminology in the two sectors
3. Difficulties in integrating building and electrical standards

The INCREASE project aims to analyze these obstacles, evaluate pain points, identify gaps, and propose solutions for harmonization between the construction and electrical sectors.

In the framework of European standardization system two fundamental product standards applies to BIPV technologies: EN 50583- 1 and EN 50583- 2 (6).

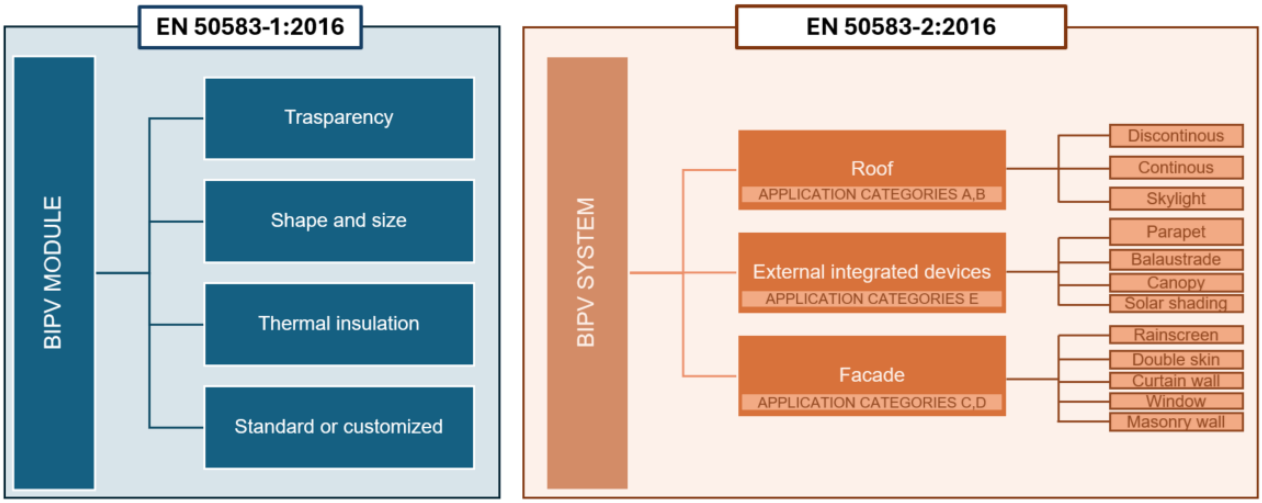

FIGURE 2: THE STANDARDS EN 50583- 1:2016 AND EN 50583- 2:2016

EN 50583:2016 applies to photovoltaic systems integrated into buildings with the photovoltaic modules used as construction products. Since the definition of BIPV addresses the photovoltaic modules and their mounting and electrical systems, EN 50583:2016 consists of Part 1 BIPV modules and Part 2 BIPV systems.

The two parts are focused on the following requirements for products and systems:

- General requirements
- Electrical requirements
- Building-related requirements
- Requirements for products with/without glass panes
- Labelling requirements
- System documentation, commissioning tests and inspection requirements

Other requirements on modules containing glass panes are categorised according to the module mounting position in the building.

In addition to referencing international electro-technical photovoltaic standards such as IEC 61215, IEC 61646 and IEC 61730, typical standards from the building sector are also included, such as: EN 13501 (Safety in case of fire); EN 13022 (Safety and accessibility in use); EN 12758 (Protection against noise) (7).

BIPV applications are categorized into roof, façade and externally integrated devices.

Under the roofing category, there are:

- Cold roof
- Flat & curved roof
- Skylight

For the façade application:

- rain-screen façade
- spandrel panel
- double-skin façade
- curtain wall

The significant difference between our proposed BIPV system typology and others is that our proposed structure distinguishes internal accessibility, as required by EN 50583. As the accessibility of the product would have a significant (or large) impact on the BIPV project at the installation stage, the designer should put it into consideration at the beginning of the system design.

In the following Figure 3 is reported a visual map of the classification of BIPV into five different categories introduced by the standard according to the installation:

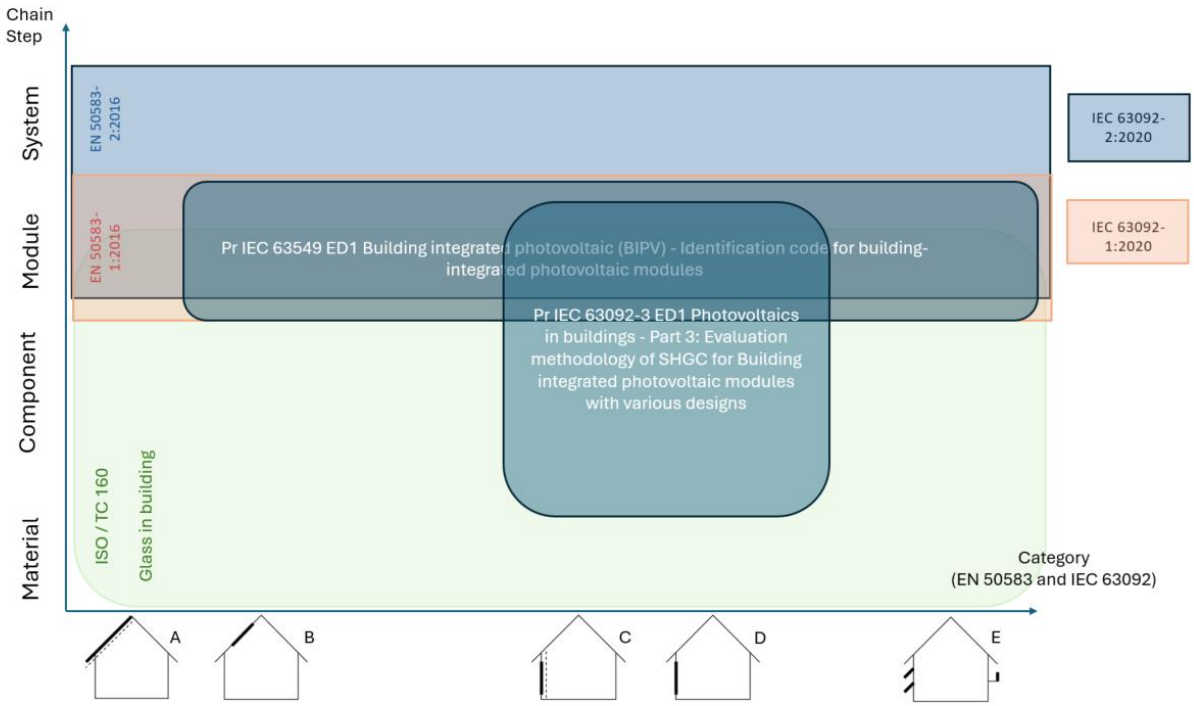

FIGURE 3: EXISTING BIPV PROJECTS/STANDARDS

Moreover, the picture shows the correlation between the European standards EN 50583- 1 and EN 50583-2 (Module and System) and the international IEC 63092-1 and IEC 63092-2. Figure 3 visualizes the link between current published standards and the projects Pr IEC 63549 related to the identification codes for BIPV and Pr IEC 63092-3 which intends to provide a versatile method to evaluate the solar heat gain coefficient (SHGC) of BIPV modules with a variety of designs. We can find a correlation with material and components chain steps (i.e type of mounting systems and materials like glass, encapsulant…). This standard applies to BIPV modules as defined in IEC 63092-1 and to different module designs but using identical components such as cells, interconnection, encapsulations and front/back sheets.

In particular, SHGC measurements for construction components employ a sample with a standard size, being different from IEC standards. Manufactures and users therefore ask for a simplified method applicable to variety of BIPV modules using identical components. The test method is focused on two successive steps, evaluation for BIPV modules with standard size and evaluation for small component samples. By combining these aspects, is

possible to obtain the g-values for each component and can calculate the g-value for modules with different sizes and cell configurations (8).

For which concern these two last step the existing standard is ISO/ TC 160.

Other standards of interest are the standard framework dealing with building codes (in addition to IEC) to integer CPR/CPD and/or EAD (formerly ETAG) (here an example guideline) : https://www.eota.eu/download?file=/2016/16-09-0062/ead%20for%20ojeu/ead%20090062-00-0404_ojeu2018.pdf. To integer requirement dealing with fire topic in construction probably also LVD and additional topics dealing with product safety (GPSR) (9).

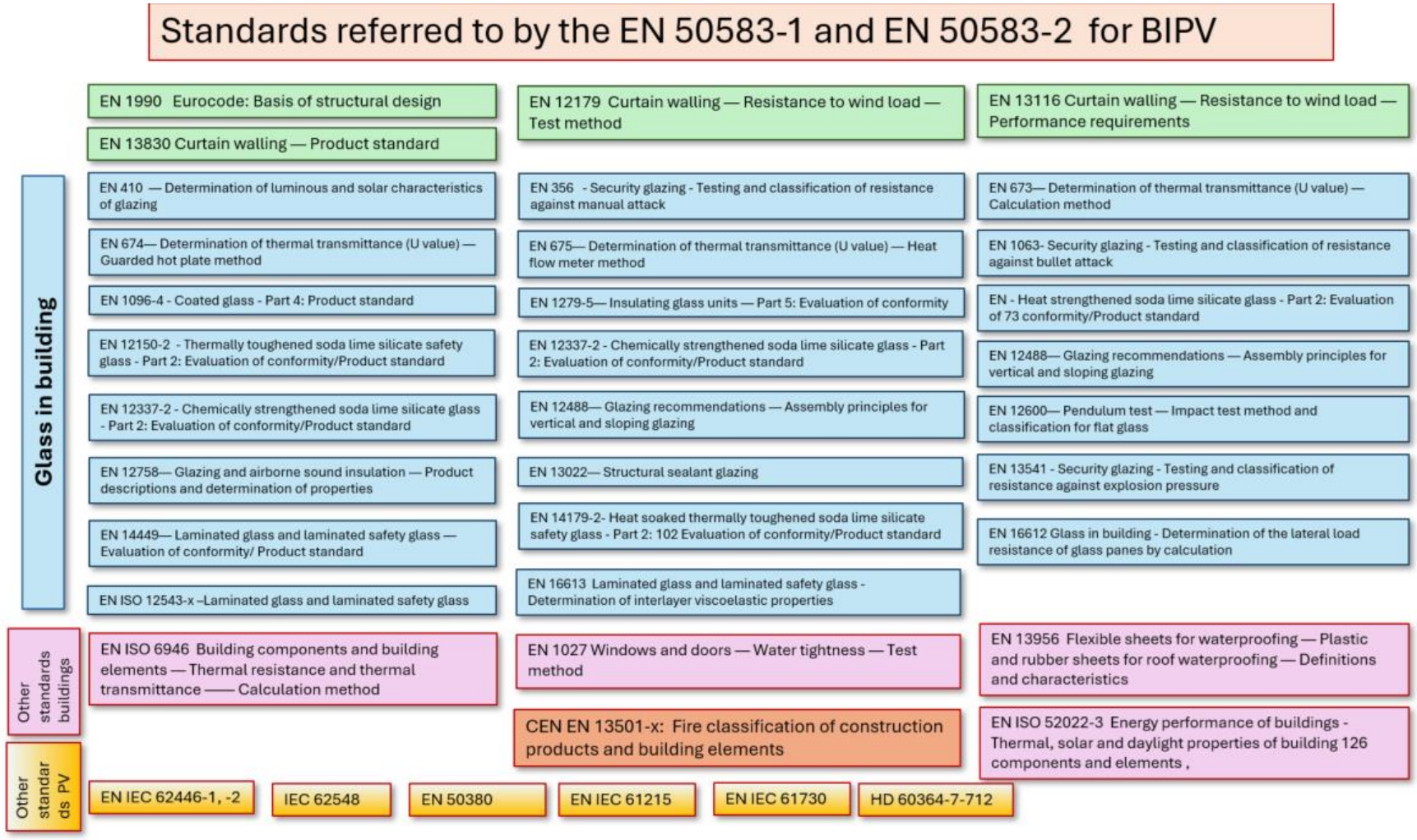

FIGURE 4 VIEW MAP OF STANDARDS ECOSYSTEM APPLICABLE TO BIPV

5. DEMO SITES

The objective of WP 5 within INCREASE project is to prepare the on-site activities and technology implementation, to promote the coordination of the innovation implementation and demonstration activities, to deliver impactful demonstrations with optimal interaction with all other work packages, to ensure effective operational demonstrations for at least 12 months *and* to deliver qualitative and quantitative performance and acceptance monitoring. In general, the technological innovations about the new encapsulants, colors, anti-glare solutions are still currently ongoing in WP1, so further updates will be needed in the future. WP5 is currently working on and will be engaged in defining in more detail the systems and components, including the implemented innovations, of each Demo.

For all demonstrations and interaction with WP4, this task ensures a close engagement with permitting and connection bodies relevant for the local realization.

For all demonstrations and interactions related to the testing work package (WP4), this task ensures close engagement with relevant permitting and connection authorities. This collaboration is crucial for the local implementation of BIPV systems, ensuring compliance with local regulations and standards.

Focus on Standardization Requirements

When proposing standardization for BIPV systems, it's essential to consider various types of requirements:

Mandatory European Regulations: These include regulations such as the Construction Products Regulation (CPR), which establishes harmonized rules for marketing construction products in the EU.
BIPV-Specific Requirements: These are technical specifications necessary for designing and characterizing BIPV systems effectively.
Local Requirements: These encompass location-specific factors such as:

- Fire safety standards
- Air permeability regulations
- Wind resistance requirements
- Other relevant local building codes

By focusing on these diverse requirements, we can develop comprehensive standardization proposals that address both international regulations and local needs. This approach ensures that BIPV systems are not only compliant with broad EU standards but also suitable for specific installation contexts, promoting safe and effective integration of photovoltaic technology into buildings (10).

In the following table are reported the different demosite located in different regions:

Demo	***Location***	***Reference***
1[1]	*Avila, Spain*	*Onyx*
2	*Entrance gate Terhills, Belgium*	*Soltech*
3[2]	*Echirolles, France*	*Bouygues Construction*

4	*Tartu, Estonia*	*Institute of Baltic Studies*
5-6	*Podgorica, Montenegro*	*Podgorica/Onyx*
7[2]	*La Toussuire, France*	*Sunstyle/CSTB*
8	*St-Sulpice, Switzerland*	*Climacy SA/CSEM*
9[1]	*Bizkaia, Spain*	*Euskal Trenbide Sarea/Onyx*

TABLE 3: INCREASE DEMOSITE

5.1. Demosite Characteristics and regulations

This section aims listing the demosites, and for each one collecting features, specific requirements and local regulation in an organic way, with a specific focus on local standardization and regulatory requirements.

1. *Demosite: Avila (Spain)*

General description: IIPV – The demosite PV system consists of urban furniture which comprises streetlights, canopies, tables and walkable floor.

Technical Innovation: The innovation to be implemented and tested in this demonstrator consists of the introduction of modules built of lightweight non flat composites, which should be compared to more common glass-glass solutions in term of durability and reliability. The possible presence of shadowing must be checked and evaluated.

Specific requirement: No specific requirements have been recorded so far. Further details will be recorded as soon as available.

Local deviation: No specific local deviation has been recorded so far. These requirements will be evaluated as soon as detail design description will be presented. The outcome will be reported in the final version of this document (M24)

2. *Demosite: Entrance gate Terhills, Belgium*

General description: IIPV - The demosite PV system consists of a walkway in a bike parking.

Technical Innovation: The innovation to be implemented and tested in this demonstrator consists of the introduction of glass-glass modules with new colour technologies, anti-glare coatings and easier separation of materials, furthermore light-weight modules with composites material will be installed. The solution will be tested with particular focus on hail test.

Specific requirement: No specific requirements have been recorded so far. Further details will be recorded as soon as available.

Local deviation: No specific local deviation has been recorded so far. These requirements will be evaluated as soon as detail design description will be presented. The outcome will be reported in the final version of this document (M24)

3. Demosite: Strasbourg, France

General description: IIPV - The demo site PV system consists of a prefabricated curtain wall integrated in a new parking silo.

Technical Innovation: The innovation to be implemented and tested in this demonstrator consists of the introduction of innovative anti-glare coatings and new technologies for colours which maintain high efficiency.

Specific requirement: Specific requirements are required for this demo site such as ATEX and seismic qualification. Approval is undergoing and the technical documentation for the approval to be submitted to the technical controller for the specific construction approval and permitting will be defined not before end of September.

Local deviation: LEPIR II (« Local Expérimental Pour Incendie Réel à 2 niveaux » is a full-scale test bench designed to evaluate the fire behaviour of façade construction solutions. It is governed by the French decree of 10 September 1970 relating to the classification of glazed facades in relation to the danger of fire, supplemented by a protocol validated in June 2013 by the French CECMI (Committee for the Study and Classification of Materials and Construction Elements in relation to the Danger of Fire).

4. Demosite: Tartu, Estonia

General description: IIPV - The demo site PV system consists of semi-transparent PV glass modules integrated in a Greenhouse curtain wall.

Technical Innovation: The innovation to be implemented and tested in this demonstrator consists of the introduction of new colors technologies.

Specific requirement: No specific requirements have been recorded so far. Further details will be recorded as soon as available.

Local deviation: The applicable regulations in Estonia are reported here below:

I. Fire regulation :

- Act: Fire Safety Act (https://www.riigiteataja.ee/en/eli/511012023006/consolide)
- Regulation: Fire safety requirements for the building (https://www.riigiteataja.ee/akt/123022021013)

II. Rules related to permits to construct/renovate buildings:

- Act: Building Code (https://www.riigiteataja.ee/en/eli/515122023008/consolide)

III. Technical rules for installations/system:

- Safety requirements for electrical equipment and electromagnetic compatibility requirements for electrical equipment and electrical installation and conformity assessment procedure (https://www.riigiteataja.ee/akt/119022019006)
- Requirements for operation and electrical work of the electrical installation (https://www.riigiteataja.ee/akt/105012024010)
- Safety requirements for electrical equipment and electromagnetic compatibility requirements for electrical equipment and electrical installation and conformity assessment procedure (https://www.riigiteataja.ee/akt/119022019006)

5. Demosite: Podgorica, Montenegro

In Podorica there will be installed two different demonstrators.

General description (Demo 1): IIPV - The demo site PV system consists of system integrated in a parking garage external vertical walls. Flat panels will be installed with metallic structure on external surfaces. The curved parts of the building are obtained a proper positioning and installation of flat modules finished with aesthetic fittings.

Technical Innovation: The innovation to be implemented and tested in this demonstrator consists of the introduction of new colors technologies.

Specific requirement: No specific requirements have been recorded so far because certified modules will be adapted. Further details will be recorded as soon as available.

General description (Demo 2): IIPV - This demo site PV system consists of system integrated in a ventilated façade of an administrative building.in Podorica.

Technical Innovation: The innovation to be implemented and tested in this demonstrator consists of the introduction of a new fire retardant encapsulants and anti-glare coatings.

Specific requirement: No specific requirements have been recorded so far. Further details will be recorded as soon as available.

Local deviation: The applicable regulations in Montenegro are reported here below:

I. Fire regulation:

- Law on Protection and Rescue ("Official Gazette of Montenegro", No. 13/07, 05/08, 86/09, 32/11, 054/16, 146/21 and 003/23)

II. Rules related to permits to construct/renovate buildings:

- The Law on Spatial Planning and Construction of Buildings ("Official Gazette of Montenegro", No. 64/17, 44/18, 63/18, 11/19, 82/20, 86/22, and 4/23
- Rulebook on the Method of Preparation and Content of Technical Documentation for Building Construction ("Official Gazette of Montenegro", No. 44/18 and 43/19)
- Current technical regulations Eurocodes (Montenegrin standards for design from MEST EN 1990 to MEST EN 1999) applicable to this type of structure, as well as according to data, existing conditions, and other requirements established for the location of the structure.

III. Technical rules for installations/system:

- The Energy Law "Official Gazette of Montenegro", No. 005/16, 051/17, 082/20, 029/22, and 152/22
- Rules for the Functioning of the Electricity Distribution System "Official Gazette of Montenegro", No. 72/22
- Rules of Measurement in the Electricity Distribution System "Official Gazette of Montenegro", No. 126/21, 131/21, 114/22

6. Demosite: La Toussuire, France

General description: BIPV – This demo site PV system consists of system already installed in a residential roof to which a warming system with advanced anti-vegetative system.

Technical Innovation: The innovation to be implemented and tested in this demonstrator consists of the introduction of antifouling and anti-soiling coatings. concerning snow melting solution. The project goal aims to minimize the energy required to dissolve the snow.

Specific requirement: No specific requirements have been recorded so far. Further details will be recorded as soon as available.

Local deviation: Since the system is already installed in a roof top of a private building no further local deviation are foreseen for approval and installation.

7. Demosite: St – Sulpice, Switzerland

General description: IIPV – This demo site PV system consists of system installed in a residential roof top.

Technical Innovation: The innovation to be implemented and tested in this demonstrator consists of the introduction of a composite light weight material.

Specific requirement: No specific requirements have been recorded so far. Further details will be recorded as soon as available.

Local deviation: No specific local deviation has been recorded so far. These requirements will be evaluated as soon as detail design description will be presented. The outcome will be reported in the final version of this document (M24)

8. Demosite: Bizkaia, Spain

General description: BIPV – This demo site PV system consists of system installed in a noise barrier.

Technical Innovation: The innovation to be implemented and tested in this demonstrator consists of the performances of BIPV installation as acoustic insulation material.

Specific requirement: No specific requirements have been recorded so far. Further details will be recorded as soon as available.

Local deviation: No specific local deviation has been recorded so far. These requirements will be evaluated as soon as detail design description will be presented. The outcome will be reported in the final version of this document (M24)

This part of the document is prepared to collect the local rules in force in the various countries of the demonstration sites. It is to complement the applicable Standards Mapping.

It refers to the rules that must be taken into account when installing BIPVs in buildings or infrastructure.

6. Final release

A final release of this work is expected in M24 after two years of the project. The final release will be issue when the design of the demo sites will be completed and the overall process of validation and approval will be defined. In this prospective the final release will present an overall view of the processes and an analysis to identify critical point and gaps and to address possible improvements and simplification proposals. A collection of the technical documentation will be carried out on the technical demo sites documentation to check their conformity with the current applicable set of requirements.

7. Conclusions

Based on the comprehensive analysis presented in this report, several key conclusions can be drawn regarding the standardization landscape for Building-Integrated Photovoltaics (BIPV) and Infrastructure-Integrated Photovoltaics (IIPV) systems.

The complexity of BIPV and IIPV technologies presents significant challenges for standardization and widespread adoption. The dual nature of these systems as both building components and electrical systems necessitates a multifaceted approach to standardization, involving both construction and electrical standards. This complexity is evident in the intricate network of applicable standards from various sectors, as illustrated in the visual mapping provided in this report.

The current standardization framework, primarily based on EN 50583-1 and EN 50583-2, provides a foundation for BIPV systems. A complete and comprehensive list of applicable standards is provided in the Annex to this report. However, the analysis reveals several areas where further development is needed. These include the need for more precise classification systems, simplification of the standard ecosystem complexity that bridges the gap between building and electrical sectors, and possible harmonization of requirements across different regions.

The ongoing standardization projects at both IEC and CENELEC levels, such as the development of IEC 63549 for BIPV identification codes and IEC 63092-3 for SHGC evaluation methodology, demonstrate the dynamic nature of the field and the continuous efforts to address emerging challenges.

The examination of the nine demonstration sites across Europe highlights the diversity of BIPV and IIPV applications and the varied local regulatory requirements. This underscores the need for flexible standards that can accommodate regional variations while ensuring overall safety and performance.

The innovations being implemented in the demonstration sites, including new encapsulants, colors, anti-glare solutions, and lightweight materials, point to the rapid technological advancements in the field. These innovations may necessitate updates to existing standards or the development of new ones to ensure they are adequately addressed in the regulatory framework.

Looking forward, the INCREASE project's ambitious on analyzing obstacles, evaluating pain points, and identifying gaps in current standards positions it to make significant contributions to the harmonization of construction and electrical sector requirements for BIPV and IIPV systems. **The project's engagement with standardization bodies** and its comprehensive approach to analyzing both technical and regulatory aspects of BIPV implementation provide a strong foundation for proposing improvements to the standardization landscape.

In conclusion, while significant progress has been made in developing standards for BIPV and IIPV systems, there remains substantial work to be done in refining, harmonizing, and expanding these standards to fully support the widespread adoption of these technologies. The insights gained from the INCREASE project's demonstration sites and its analysis of the current standardization framework will be invaluable in shaping the future of BIPV and IIPV standardization, ultimately contributing to the achievement of European Union's ambitious energy and climate goals.

DELIVERABLE INFORMATION

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Work Package Number	6
Work Package Title	Assessment of standards impacting/supporting innovations
Lead Organisation	CEI
Main author(s)	Giuseppina POLINO (CEI), Salvatore PUGLIESE (CEI).
Contributors	Simone GERMANI (CEI)
Reviewers	Simon BODDAERT (CSTB)
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Version history	1.0
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TABLE OF ABBREVIATIONS

Acronym	**Meaning of acronym**
IPV	Integrated Photovoltaic
IIPV	Infrastructure Integrated Photovoltaic
BIPV	Building Integrated Photovoltaic
ISO	International Standardization Organization
IEC	International Electrotechnical Commission
CENELEC	European Electrotechnical Committee for Standardization
CEN	European Committee for Standardization
TC	Technical Committee

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3	CSTB	Centre Scientifique et Technique du Batiment
4	KU Leuven	Katholieke Universiteit Leuven
5	VITO	Vlaamse Instelling voor Technologisch Onderzoek n.v.
6	IBS	Institute of Baltic Studies
7	ONYX	Onyx Solar Energy SL
8	Soltech	Soltech
9	Sunstyle	Sunstyle International
10	FOCCHI SPA	Focchi SPA
11	BECSA	Becsa Sociedad Anonima
12	BYCN	Bouygues Construction
13	METABUILD	Metabuild GMBH
14	CEI	Comitato Elettrotecnico Italiano C.E.I.
15	AIE/ EuropeOn	Association Européenne de l'Installation Electrique
16	EPIA	SolarPower Europe
17	EBC	European Builders Confederation
18	ETS	Euskal Trenbide Sarea
19	PODGORICA	Glavni Grad Podgorica
20	EPFL	Ecole Polytechnique Federale de Lausanne
21	CSEM	CSEM Centre Suisse d'Electronique et de Microtechnique SA
22	Climacy	Climacy SA

Reference

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PARTNERS

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