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Public Summary

Building-integrated photovoltaics (BIPV) are increasingly seen as an important solution for combining renewable energy production with sustainable buildings. Unlike conventional photovoltaic systems installed on top of buildings, Integrated photovoltaics (IPV) systems are integrated directly into roofs, façades, glazing systems, or shading elements while also fulfilling architectural and construction functions.

This report investigates the main social barriers currently limiting the wider adoption of IPV systems in Europe. The work combines literature review, public and professional surveys, and stakeholder interviews carried out with architects, engineers, manufacturers, consultants, researchers, and industry representatives involved in photovoltaic and construction projects across several European countries.

The results show that the main barriers affecting IPV deployment are no longer mainly technical. Although the technology itself is increasingly mature, important challenges remain linked to regulations, market conditions, stakeholder coordination, and public awareness.

One of the strongest findings is the fragmentation between the construction and photovoltaic sectors. IPV projects require collaboration between many actors, including architects, engineers, façade specialists, photovoltaic manufacturers, installers, investors, and public authorities. However, these actors often work separately and become involved at different stages of project development, making integration more difficult and increasing costs or technical compromises.

The study also highlights the importance of awareness and education. Many professionals in the construction sector still have limited knowledge of available IPV solutions and their integration possibilities. Public awareness of integrated photovoltaic systems also remains relatively low compared to conventional rooftop photovoltaic systems. Stakeholders repeatedly identified education, demonstration projects, and practical examples as important tools for improving understanding and confidence in IPV technologies.

Economic uncertainty remains another major challenge. IPV systems are still often perceived as more expensive and more complex than standard rooftop photovoltaic installations. At the same time, stakeholders highlighted that IPV systems should not only be evaluated as energy technologies, since they also replace conventional construction materials and contribute to architectural quality and building performance.

Regulations and fire safety requirements were also frequently identified as barriers, particularly for façade applications. Stakeholders highlighted the need for clearer and more harmonised standards, certification procedures, and insurance frameworks adapted to integrated photovoltaic systems.

Overall, the report concludes that wider deployment of IPV systems will depend not only on technological progress, but also on improving collaboration between sectors, increasing stakeholder awareness, developing clearer regulations, and integrating IPV more effectively into standard construction practices.

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Abbreviations

Abbreviation	*Explanation*
BAPV	Building-Applied Photovoltaics
BIPV	Building-Integrated Photovoltaics
EPBD	Energy Performance of Buildings Directive
IPV	Integrated Photovoltaics
NZEB	Nearly Zero-Energy Buildings
PV	Photovoltaics
ROI	Return On Investment

1 Introduction

Building-integrated photovoltaics (BIPV) combine energy production and building functions within the same element. Unlike conventional photovoltaic systems added onto existing buildings, BIPV systems replace conventional construction materials such as façades, roofs, glazing systems, or shading devices while also generating electricity. BIPV therefore connects the construction and energy sectors through a single technology.

The development of BIPV is closely linked to European climate and energy objectives. Buildings account for around 40% of energy consumption and 36% of greenhouse gas emissions in Europe, making the building sector a major priority for decarbonisation policies. In this context, on-site renewable electricity generation integrated directly into buildings is increasingly encouraged through European initiatives such as the Energy Performance of Buildings Directive (EPBD) and the EU Solar Energy Strategy. [1] [2]

Over the past years, BIPV technologies have developed significantly. New products now allow a wider range of architectural applications, including coloured modules, solar façades, transparent glazing systems, roofing products, and lightweight photovoltaic elements. [3]

Despite this progress, BIPV deployment remains limited compared to conventional building-applied photovoltaics (BAPV). Several studies show that the barriers are no longer only technical. Current challenges are also linked to costs, regulations, coordination between stakeholders, market structure, and public perception. The construction sector and the photovoltaic sector often operate separately, with different practices, regulations, and decision-making processes. This creates difficulties for project development and slows down adoption.

Research on renewable energy acceptance also shows that social factors strongly influence deployment. Because BIPV systems directly affect the appearance and function of buildings, acceptance depends not only on energy performance but also on architectural integration, aesthetics, reliability, maintenance concerns, and trust in the technology. Studies on BIPV acceptance show that visual integration and architectural quality can both support and limit adoption depending on the context and stakeholder group.

The literature generally distinguishes three dimensions of social acceptance:

- socio-political acceptance, related to policies, regulations, and institutional support;
- market acceptance, related to economic actors and business conditions;
- community acceptance, related to public perception and local attitudes toward IPV integration.

Within this context, Task 6.3 “Overcoming Social Barriers to IPV” aims to identify and analyse the main barriers affecting the deployment and acceptance of IPV systems. The work combines literature review, questionnaires, and stakeholder interviews to better understand how different actors perceive IPV and which factors currently limit wider adoption.

The objective of this report is to identify the main social barriers affecting IPV deployment and to propose possible actions that could support wider integration within the construction sector and the general public. Particular attention is given to stakeholder awareness, architectural integration, market conditions, regulations, and collaboration between actors across the IPV value chain.

2 Methodology

This study combines literature review, questionnaires, and stakeholder interviews to analyse the social acceptance of Integrated Photovoltaics and identify the main barriers affecting deployment in the building sector.

The methodology combines quantitative and qualitative approaches in order to compare perceptions from different stakeholder groups and complement existing research with practical feedback from actors directly involved in IPV projects.

2.1 Literature review

The first phase of the study consisted of a review of existing literature related to:

- IPV and BIPV systems,
- renewable energy acceptance,
- architectural integration of photovoltaics,
- market and regulatory barriers,
- public perception of photovoltaic technologies.

The objective was to identify the main barriers and drivers already discussed in previous research and compare them with stakeholder feedback collected during the study.

The review included scientific articles, technical reports, market studies, and European project publications related to BIPV development and social acceptance. The focus was on studies addressing architectural integration, regulations, stakeholder coordination, aesthetics, and public perception.

2.2 Surveys and Stakeholder interviews

To complement the literature review, two online questionnaires were developed:

- one targeting the general public;
- one targeting professionals from the photovoltaic and construction sectors.

The surveys aimed to collect information on awareness and perception of IPV systems, perceived barriers and drivers, aesthetic acceptance, economic concerns and expectations regarding regulations and future development. The professional survey focused more specifically on technical integration, market conditions, stakeholder coordination, and regulatory issues.

In parallel, semi-structured interviews were conducted with stakeholders involved in the IPV sector across different European countries. Interviewees included:

- architects,
- engineers,
- manufacturers,
- consultants,
- researchers,
- project developers,
- industry representatives.

The interviews explored practical experiences related to project development, stakeholder collaboration, regulations, costs, public perception, fire safety, maintenance, and architectural integration. The interviews also helped identify differences between countries and market conditions.

Table 1: Overview of stakeholder engagement

Activity	*Target group*	*Purpose*	*Type of data collected*
Public survey	General public	Understand awareness and perception of IPV	Quantitative
Professional survey	PV and construction professionals	Identify professional barriers and expectations	Quantitative
Stakeholder interviews	Architects, engineers, manufacturers, consultants, researchers	Collect practical feedback and project experience	Qualitative

2.3 Data analysis Framework

The collected data were analysed using thematic and comparative approaches. Thematic analysis was used to identify recurring barriers, acceptance drivers, concerns, and expectations emerging from questionnaires and interviews. The analysis was structured according to the three dimensions of social acceptance: socio-political acceptance, market acceptance, and community acceptance.

Comparative analysis was then conducted to identify similarities and differences between public participants, professional stakeholders, and interviewed experts. This approach made possible to compare general public perception with implementation-related perspectives from industry and professional actors.

The analysis aimed to identify recurring implementation barriers, stakeholder expectations, and potential measures for improving the integration and acceptance of IPV systems.

2.4 Limitations

The study acknowledges several limitations. First, the number of interviewees remains limited and does not represent the entire European IPV sector. The results therefore reflect the perspectives of selected stakeholders rather than a complete market analysis.

Second, the maturity of IPV markets differs strongly between countries. Some findings are therefore influenced by local regulatory frameworks, market conditions, and construction practices, which might not be representative of markets with different frameworks.

Finally, the perception of IPV systems is evolving rapidly due to changes in energy prices, photovoltaic technologies, and climate policies. The results presented in this report should therefore be understood within the current context of the European energy transition.

3 Literature Review findings

3.1 Social acceptance of IPV: Concepts and state of the art

The development of IPV systems depends not only on technical performance and economic viability, but also on social acceptance. Because IPV systems directly affect the appearance and function of buildings, their acceptance involves a wider range of actors than conventional photovoltaic systems, including architects, developers, public authorities, construction companies, building owners, and local communities.

Research on renewable energy acceptance generally distinguishes three complementary dimensions:

- socio-political acceptance;
- market acceptance;
- community acceptance. [4]

Socio-political acceptance concerns public policies, regulations, institutional support, and long-term political commitment. Market acceptance relates to the adoption of technologies by economic actors such as manufacturers, investors, developers, and construction professionals. Community acceptance concerns public perception, local acceptance, aesthetics, and trust in technologies.

Several studies show that BIPV systems are often viewed more positively than conventional rooftop photovoltaic systems because they can be better integrated into buildings and urban environments. However, acceptance strongly depends on architectural quality, visibility, design choices, and local context. A recent study on apartment buildings showed that rooftop PV systems generally receive higher acceptance than façade-integrated systems, while visible façade applications generate more disagreement depending on demographic and professional backgrounds. [5]

The literature also shows that the IPV sector remains relatively fragmented. Construction and photovoltaic industries often operate separately, with different technical standards, professional cultures, and decision-making processes. This fragmentation is regularly identified as a major barrier to wider deployment. [6]

Although IPV technologies have progressed significantly in recent years, most studies agree that the market remains limited and highly dependent on specific projects, public support, and specialised stakeholders. Technical guidance and integration practices have improved considerably, but adoption remains uneven across countries and market segments. [3]

3.2 Key barriers identified in literature

3.2.1 Socio-political barriers

One of the most frequently identified barriers concerns the complexity of regulations and administrative procedures. IPV systems must comply with both photovoltaic and construction regulations, which creates additional constraints compared to conventional PV systems or conventional construction materials.

Similarly, the absence of clear and harmonised regulatory frameworks specifically dedicated to IPV systems is frequently discussed as a key concern. In many countries, existing legislation was initially developed either for standard photovoltaic installations or for conventional building materials, without considering the multifunctional nature of integrated photovoltaic systems. IPV components simultaneously fulfil architectural and energy-related functions, yet regulatory frameworks often treat these systems separately, leading to uncertainty during project approval and implementation. [3]

This regulatory fragmentation becomes particularly visible in urban and heritage contexts. In historical environments, photovoltaic integration frequently requires additional authorisations linked to cultural heritage preservation, landscape protection, or façade conservation. Bottino-Leone et al. show that heritage-related administrative requirements remain among the most significant obstacles to photovoltaic deployment in protected Italian contexts. Their survey highlights that approval procedures and conservation constraints are often perceived as restrictive even when integrated photovoltaic solutions are visually compatible with the surrounding environment. [7]

The complexity of administrative procedures is reinforced by the multiplicity of institutional actors involved in project validation. Depending on the local context, IPV projects may require approval from municipalities, planning authorities, electrical safety agencies, architectural review boards, and heritage conservation institutions. Several studies report that this fragmented governance structure increases implementation time, project uncertainty, and administrative costs. [6]

The literature also identifies the lack of standardisation as a major institutional barrier. While conventional photovoltaic systems benefit from established certification procedures and technical standards, IPV systems still face difficulties regarding testing methods, classification, and performance evaluation. The multifunctional nature of integrated systems complicates the development of unified standards because photovoltaic components must simultaneously satisfy construction requirements and energy-generation requirements. [8]

Policy support mechanisms strongly influence socio-political acceptance. Financial incentives, feed-in tariffs, renovation subsidies, and renewable energy policies have accelerated photovoltaic deployment across Europe. However, several studies underline that these support schemes are not always adapted to integrated photovoltaic systems. In many cases, policies mainly reward electricity production efficiency while insufficiently considering architectural integration, multifunctionality, or urban quality. This can place IPV systems at a disadvantage compared with conventional rooftop installations.

Another important issue identified in the literature concerns the contradiction between renewable energy policies and heritage preservation policies. European climate strategies increasingly encourage photovoltaic deployment through instruments such as the Energy Performance of Buildings Directive and the Renovation Wave Strategy. At the same time, local planning regulations may restrict visible modifications to façades, roofs, and protected urban environments. Several authors underline that this institutional inconsistency creates uncertainty for local authorities and developers attempting to integrate photovoltaics into historical or architecturally sensitive areas. [1] [9]

Research on renewable energy governance also demonstrates that socio-political acceptance depends strongly on institutional trust and policy stability. Wüstenhagen et al. explain that stable regulatory environments and coherent long-term policies improve stakeholder confidence and facilitate technology adoption, while inconsistent regulations and rapidly changing subsidy schemes increase perceived investment risk and reduce adoption rates. [4]

Communication gaps between policymakers, urban planners, architects, and energy stakeholders are also identified as structural barriers. Several studies note that energy policies are often developed independently from architectural and urban planning practices, limiting the integration of photovoltaic systems during early building design phases. This separation reinforces the perception of photovoltaics as external technical additions rather than architectural components integrated into the conception of buildings and urban environments. [10]

Recent literature therefore recommends more integrated governance approaches combining energy policy, urban planning, construction standards, and heritage management. Several studies suggest that simplified approval procedures, harmonised certification frameworks, dedicated IPV guidelines, and interdisciplinary planning approaches could significantly improve socio-political acceptance and facilitate implementation. [11]

Overall, socio-political barriers demonstrate that IPV deployment depends not only on technological readiness but also on the capacity of institutional systems to adapt regulatory, administrative, and planning frameworks to the multifunctional nature of integrated photovoltaic technologies.

3.2.2 Market barriers

Market barriers refer to the economic, industrial, organizational, and commercial factors that limit the diffusion of IPV systems within the construction and energy sectors. The literature consistently identifies market-related issues as one of the main obstacles preventing the transition of IPV technologies from niche applications toward large-scale implementation. Although photovoltaic technologies have experienced significant cost reductions during the last decade, integrated photovoltaic systems continue to face additional constraints linked to their multifunctional nature and their integration into construction processes. [6] [12]

One of the most frequently identified market barriers concerns the high perceived investment cost of IPV systems. Compared with conventional photovoltaic installations, integrated systems generally require customized design, specific mounting solutions, architectural adaptation, and coordination between multiple stakeholders during project development. These additional requirements often increase upfront costs, particularly for façade-integrated systems and retrofit projects involving existing buildings.

Economic uncertainty is reinforced by the difficulty of evaluating the multifunctional value of IPV systems. Unlike standard photovoltaic panels, IPV components simultaneously fulfil architectural and construction functions while producing electricity. However, market evaluations often focus primarily on energy generation performance without fully accounting for the replacement value of conventional building materials or the architectural added value provided by integrated systems. This fragmented evaluation approach can make IPV systems appear less economically attractive compared with conventional construction solutions or rooftop photovoltaics. Several studies and European BIPV initiatives have therefore highlighted the importance of assessing IPV systems through an "extra-cost approach", where the economic evaluation focuses on the additional cost associated with the photovoltaic functionality after subtracting the cost of the conventional building component that the IPV system replaces. This approach allows IPV systems to be evaluated more fairly as multifunctional building elements rather than only as electricity-generating technologies. Recent studies show that considering avoided façade or roofing material costs can significantly improve the perceived economic attractiveness of BIPV solutions, particularly in renovation projects and façade applications. [13] [14] [15] [16]

An additional challenge concerns the development of viable business models for IPV systems. Because IPV combines energy generation with building functions, its value cannot be assessed through electricity production alone. Several studies note that existing business models often fail to capture the full benefits of architectural integration and material replacement, making it more difficult for investors and project developers to evaluate projects and justify investments. Developing business models that better reflect the multifunctional nature of IPV systems is therefore considered an important condition for wider market adoption. [13]

The literature also highlights the limited maturity and fragmentation of the IPV market. Compared with conventional photovoltaic systems, the IPV sector remains relatively small and highly specialized. Supply chains are often fragmented, involving a large number of actors from different professional sectors, including architects, façade manufacturers, photovoltaic producers, engineers, developers, and installers. Coordination between these actors is frequently identified as difficult due to differing technical priorities, communication practices, and project timelines. [17]

Several studies underline that the construction sector itself constitutes an important structural barrier to IPV adoption. Construction markets are generally characterized by conservative decision-making processes, low tolerance for technical risk, and strong reliance on conventional building practices. Stakeholders often prefer proven and standardized materials rather than innovative integrated systems perceived as technically or financially uncertain. This resistance is particularly strong in renovation projects where time constraints, budget limitations, and technical compatibility issues reduce willingness to experiment with new technologies. [18]

The absence of standardization also affects market development. IPV systems still lack fully harmonized technical specifications, certification procedures, and design guidelines adapted to large-scale implementation. This creates uncertainty regarding long-term reliability, maintenance procedures, and product comparability. Several authors point out that developers and investors are often reluctant to adopt technologies when long-term operational data and standardized performance benchmarks remain limited. [3]

Another recurring issue concerns the limited visibility of successful reference projects. The literature shows that market confidence tends to increase when technologies are supported by demonstration buildings, monitored case studies, and publicly accessible performance data. However, many IPV projects remain isolated or experimental, limiting knowledge transfer and reducing market familiarity. Potential adopters may therefore perceive integrated photovoltaic systems as uncommon or insufficiently tested technologies. [4]

Recent research increasingly emphasizes that market acceptance of IPV depends not only on reducing costs but also on improving integration processes, simplifying supply chains, increasing product standardization, and strengthening stakeholder confidence. The transition from niche demonstration projects toward broader market deployment therefore requires coordinated efforts involving manufacturers, policymakers, architects, engineers, and financial actors. [12]

3.2.3 Community and user-related barriers

Community barriers refer to the social, cultural, perceptual, and behavioral factors influencing the acceptance of IPV systems at the local level. In the literature, community acceptance is considered one of the central dimensions of renewable energy deployment because it directly affects the willingness of users, residents, and local stakeholders to support or oppose the integration of photovoltaic technologies into buildings and urban environments. In the case of IPV, these barriers are particularly important because photovoltaic systems become visible components of façades, roofs, balconies, or urban landscapes, interacting directly with everyday living environments.

One of the most frequently identified community barriers concerns aesthetic perception. Unlike conventional rooftop photovoltaic systems, many IPV applications are directly integrated into visible building surfaces and therefore modify the visual appearance of buildings. Acceptance levels are strongly influenced by how well photovoltaic elements are integrated into architectural composition, materiality, color, and façade continuity. Several studies show that public acceptance generally decreases when photovoltaic systems are perceived as visually intrusive or incompatible with local architectural identity. [5]

Research also demonstrates that façade-integrated systems tend to generate stronger visual reactions than rooftop systems because façades are more directly associated with urban identity and daily visual experience. Reflective surfaces, strong color contrast, irregular module patterns, or disruption of façade rhythm are among the most cited negative factors affecting perception. In contrast, systems perceived as coherent with the architectural language of the building generally receive higher acceptance. [5]

Cultural identity and heritage preservation are also major factors influencing community acceptance. In historical urban environments, respondents often perceive photovoltaic systems as potential threats to architectural authenticity and landscape character. Studies conducted in Italian heritage contexts show that even respondents who strongly support renewable energy objectives may reject photovoltaic integration when installations are considered incompatible with historical identity or cultural value. Concerns regarding the transformation of traditional urban landscapes remain particularly significant in protected areas and architecturally sensitive environments. [19]

Recent literature therefore recommends more participatory and context-sensitive approaches to IPV deployment. Public communication, demonstration projects, architectural quality, stakeholder involvement, and transparent information are consistently identified as important conditions for improving community acceptance. Several studies conclude that successful IPV integration depends not only on technical optimization but also on the capacity to align renewable energy objectives with local identity, visual expectations, and social values. [4]

Table 2: Main barriers identified in the literature

Barrier category	***Main issues identified***	***Examples from literature***
Socio-political	Complex regulations, lack of harmonised standards	Difficult certification procedures, insurance constraints
Market	High costs, competition with BAPV, limited standardisation	Difficult business models, uncertain ROI
Community and user-related	Lack of awareness, aesthetic concerns, maintenance fears	Limited public knowledge, concerns in heritage areas

3.3 Conclusions from the literature review and research gaps

The literature review confirms that **social acceptance is a key condition for the deployment of IPV systems**. Existing studies show that IPV adoption depends not only on technical performance and economic feasibility, but also on regulatory frameworks, market conditions, architectural integration, and public perception. The literature consistently refers to the three dimensions of social acceptance defined by Wüstenhagen et al.: **socio-political acceptance, market acceptance, and community acceptance**. These dimensions are interconnected and jointly influence the implementation of IPV technologies. [4]

The review highlights several recurring barriers. **Socio-political barriers** are mainly related to regulatory fragmentation, administrative complexity, and inconsistencies between renewable energy objectives and urban or heritage regulations. Existing frameworks are often not adapted to the multifunctional nature of IPV systems, creating uncertainty for project developers and public authorities. [3]

Market barriers are associated with high perceived investment costs, fragmented value chains, limited standardization, and lack of professional expertise. The literature also shows that the architectural and construction value of IPV systems is often underestimated in economic evaluations, which continue to focus mainly on energy production. As a result, the multifunctional benefits of IPV systems, including material replacement and architectural integration, are not always adequately reflected in investment decisions. Several studies further highlight the difficulty of developing viable business models capable of capturing these combined benefits and distributing value across the different actors involved in IPV projects. Together with market fragmentation and limited stakeholder coordination, these factors contribute to slowing the transition of IPV systems from niche applications to broader market adoption. [16] [13] [14]

At the community level, the literature demonstrates that **aesthetic integration and cultural compatibility strongly influence acceptance**. Public support decreases when photovoltaic systems are perceived as visually intrusive or incompatible with local architectural identity, particularly in historical or heritage contexts. [19]

Another consistent conclusion is that **information, communication, and stakeholder involvement improve acceptance**. Demonstration projects, transparent communication, and participatory approaches are repeatedly identified as important mechanisms for increasing familiarity and reducing resistance toward IPV systems. [19]

Despite these findings, several research gaps remain. Existing studies often focus on isolated aspects of IPV integration and rarely combine technical, architectural, regulatory, economic, and social dimensions within the same analysis. There is also **limited comparative analysis between stakeholder groups.**

In this context, the present study complements existing literature through questionnaires and stakeholder interviews involving both public participants and professional actors. The following section presents the results collected in order to identify current perceptions, recurring barriers, and stakeholder expectations regarding IPV integration.

4 Stakeholder Insights

4.1 Overview of stakeholder engagement

To complement the literature review, this study collected feedback from both the general public and professionals involved in the photovoltaic and construction sectors. The objective was to better understand how IPV systems are perceived in practice and identify the barriers currently affecting adoption across different stakeholder groups.

Two differentiated surveys were developed for two specific target groups:

- **A public survey**, aimed at collecting opinions from citizens and building users regarding IPV aesthetics, acceptance, awareness, perceived barriers, and expectations toward photovoltaic integration in buildings.
- **A professional survey**, addressed to stakeholders from the photovoltaic and construction sectors, including architects, engineers, researchers, consultants, manufacturers, and installers. This survey focused on market conditions, technical challenges, regulations, collaboration between actors, and deployment barriers.

In addition to the surveys, **semi-structured interviews** were conducted with professionals involved in BIPV-related activities across different European countries. The interviews provided more detailed feedback on practical project experience, stakeholder coordination, regulatory issues, fire safety concerns, business models, and long-term perspectives for IPV development.

The engagement process involved participants with diverse backgrounds and levels of experience. Public participants represented different age groups and professional profiles, while professional participants covered several parts of the BIPV value chain, including architecture, engineering, manufacturing, consultancy, research, and project development. This diversity helped capture both technical and non-technical aspects influencing IPV acceptance and implementation.

4.2 Profile of respondents and stakeholders

4.2.1 Public respondents

The public survey gathered responses from participants living in France and other European countries. The respondents represented different housing situations and building types, giving a broad overview of how the public perceives Building Integrated Photovoltaics.

Demographic overview

Most respondents were either homeowners or tenants, with homeowners representing the largest group. A smaller number of participants identified themselves as occupants of public or commercial buildings. This distribution is relevant because ownership status strongly influences the decision-making capacity related to building renovation and energy investments.

The survey also showed that IPV interest was not limited to one specific housing profile. Respondents came from both detached houses and apartment buildings, although apartment buildings represented a particularly important share of the sample. This reflects the growing relevance of IPV solutions for dense urban environments where roof availability is limited and façade integration becomes more important.

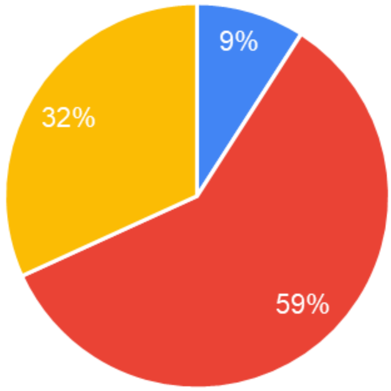

Figure 1: Demographic overview of public respondents

Geographic distribution

Most responses originated from French regions, especially Occitanie and other southern territories where solar energy is already relatively visible in the built environment. A smaller number of responses came from other European countries and regions.

Figure 2: Geographic distribution of public respondents

Although the survey does not aim to provide a statistically representative territorial sample, it reflects opinions from areas already exposed to discussions around energy transition and photovoltaic deployment.

The regional diversity of the responses is useful for understanding how IPV is perceived across different urban and residential contexts. However, the results mainly reflect perceptions from participants already familiar with sustainability and renewable energy topics.

Familiarity with photovoltaics and IPV

The survey indicates a relatively high level of prior awareness regarding photovoltaics and building-integrated solutions. Many respondents declared that they were either familiar or very familiar with IPV before completing the survey. Only a limited share of participants indicated that they had never heard about IPV.

Professional experience appears to influence awareness levels. Many respondents said they discovered IPV through work-related activities, discussions about sustainability, or technical environments. This suggests that IPV is still more familiar to people already connected to energy or environmental topics than to the wider public.

At the same time, several respondents indicated that they only had partial knowledge of IPV technologies. This highlights the persistence of information gaps regarding technical performance, installation processes, durability, and economic return.

4.2.2 Professional respondents

The professional survey gathered responses from stakeholders working in sectors directly connected to construction, energy, urban planning, sustainability, and photovoltaic technologies. The results provide an overview of the professional profiles represented in the survey and their level of familiarity with IPV systems.

Professional sectors represented

The respondents came from a range of professional sectors linked to the built environment and renewable energy. The main sectors represented included:

- architecture and building design;
- engineering and technical consulting;
- renewable energy and photovoltaics;
- construction and project management;
- urban planning and public authorities;
- research and academic activities.

This diversity reflects the multidisciplinary nature of IPV projects, which involve coordination between technical, architectural, regulatory, and energy stakeholders.

Geographic distribution

Most responses came from France, particularly from regions already involved in sustainability and energy transition initiatives. A smaller number of responses originated from other European countries and international contexts.

The survey reflects perspectives from professionals working in both urban and regional environments, including areas where building renovation and photovoltaic deployment are already active topics.

Although the sample does not aim to represent the full European construction sector, it provides useful insight into the perceptions of stakeholders already exposed to renewable energy and sustainable building practices.

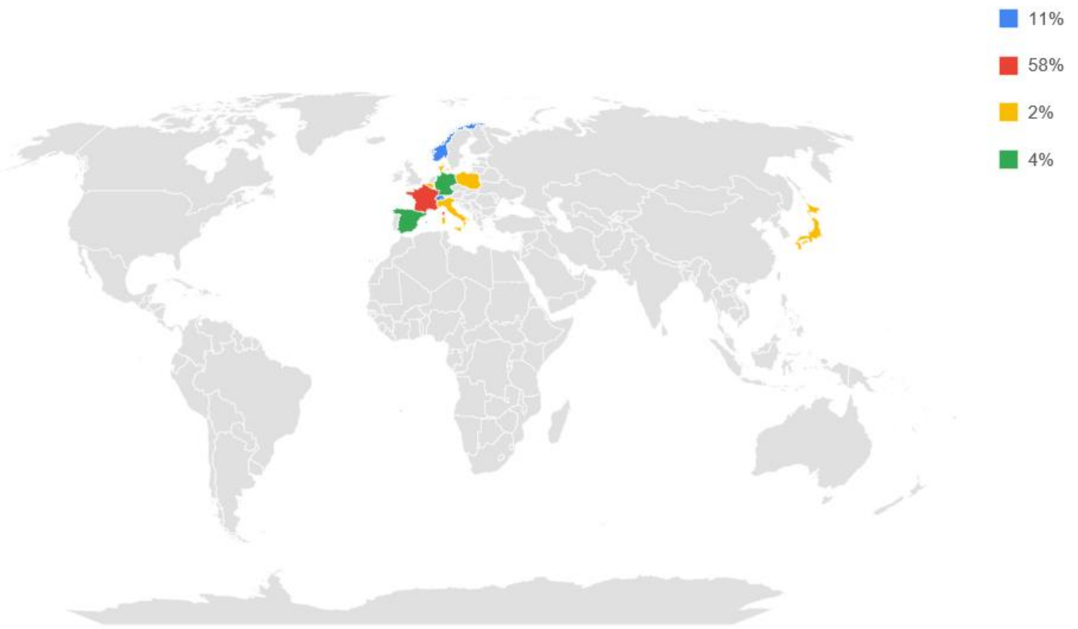

Figure 3: Geographic distribution of professional respondents (world)

Figure 4: Geographic distribution of professional respondents (Europe)

Experience with PV/BIPV/IPV

Most respondents were already familiar with conventional photovoltaic systems through their professional activities. However, the level of experience with integrated photovoltaics was more variable.

Several professionals indicated direct experience with:

- rooftop photovoltaic systems;
- façade integration;
- building renovation projects;
- energy performance and sustainability strategies.

IPV was generally perceived as an innovative and promising technology, but still less common than standard photovoltaic systems. The responses also show that practical experience with IPV remains relatively limited compared to conventional PV deployment.

Role in construction, energy, or urban planning sectors

The survey included professionals involved at different stages of the building and energy process, including architects and designers, engineers and technical experts, energy consultants, public authorities and urban planners and researchers and innovation stakeholders.

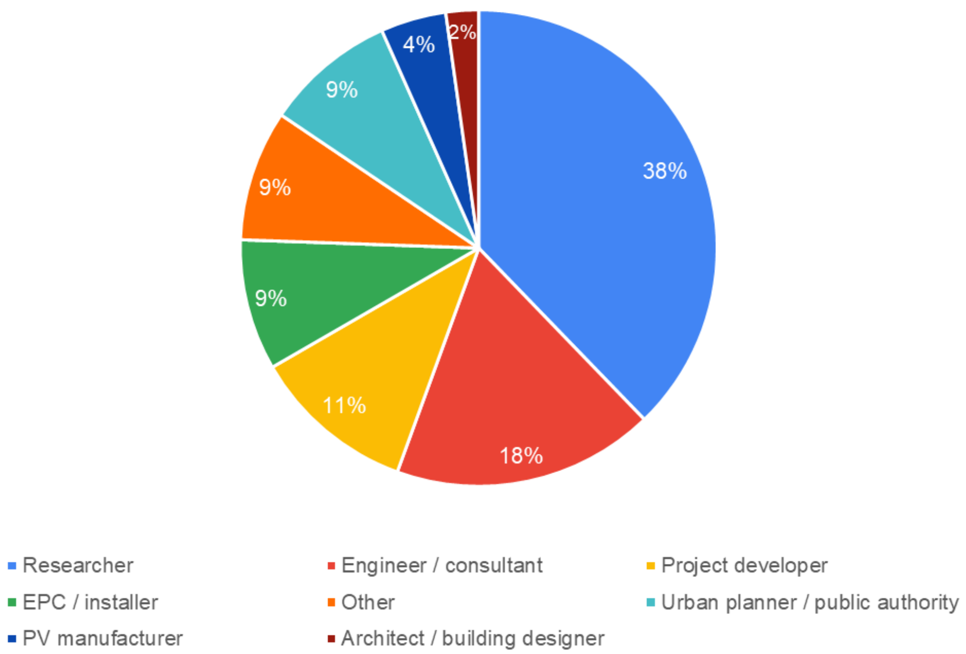

Figure 4: Distribution of professional respondents by sector and professional role

The responses highlight that IPV is often approached not only as an energy technology, but also as part of broader discussions on building performance, renovation, urban integration, and sustainable development.

Several respondents also referred to the importance of collaboration between architects, engineers, manufacturers, and local authorities in the successful implementation of IPV projects.

4.2.3 Interviewed stakeholders

The stakeholder interviews brought together a diverse group of professionals involved in the development, design, manufacturing, research, consultancy, and implementation of building-integrated photovoltaics. The participants represented different parts of the value chain and provided perspectives from several European countries, including Switzerland, France, Austria, the Netherlands, and Norway.

The interviewed stakeholders included architects, engineers, researchers, BIPV consultants, technology developers, project managers, manufacturers, and representatives from non-profit or advisory organizations active in the photovoltaic and construction sectors. Their experience ranged from technical research and product development to real-world implementation of BIPV systems in residential, commercial, and public buildings.

Table 3: Overview of interviewed stakeholder profiles

Stakeholder type	*Main expertise / role*
Architects	Building integration, sustainable design
Manufacturers	BIPV products and systems
Consultants	Project development and coordination
Researchers	Technical and market analysis
Engineers	Integration, façade systems, energy performance
Industry representatives	Market development and implementation

Several interviewees had more than 15 to 20 years of experience in photovoltaics and sustainable building design, with direct involvement in early BIPV pilot projects and market development. Others were more recently involved through specialized consultancy, engineering support, façade integration, or market analysis activities.

The stakeholders also reflected different organizational contexts. Some worked in small specialized companies focused exclusively on BIPV design or consulting, while others were active in universities, research centers, public-interest organizations, or industrial manufacturing. Several participants highlighted their role as intermediaries between architects, building owners, engineers, and technology providers, helping projects move from concept to implementation.

The interviews therefore provided complementary viewpoints covering technical, regulatory, economic, architectural, and social dimensions of BIPV adoption. Together, they offer a practical overview of the current opportunities and barriers affecting the wider deployment of integrated photovoltaic solutions in the built environment.

4.3 Public perception of IPV

General perception of IPV

The survey shows that IPV is generally viewed positively by respondents.

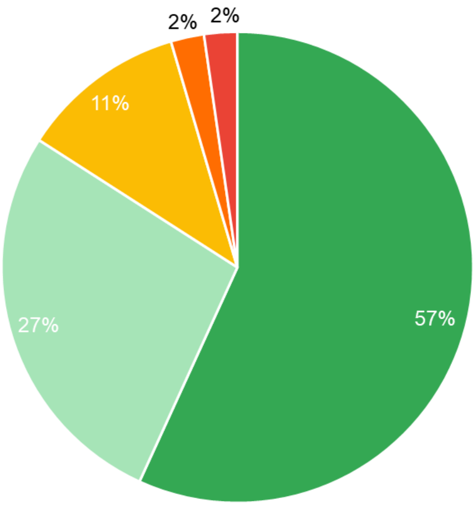

Figure 5: Public acceptance of Integrated Photovoltaic systems

Most participants considered the integration of photovoltaics into buildings to be an attractive solution for more sustainable and energy-efficient buildings. Several respondents also appreciated the architectural integration of IPV compared to conventional photovoltaic systems. However, some participants indicated that they still lacked information about practical aspects such as installation, maintenance, durability, and long-term performance.

Perceived benefits of IPV

The main advantages identified by respondents were:

- reduction of electricity costs;
- contribution to the energy transition;
- improved energy independence;
- better integration into buildings compared to conventional photovoltaic systems.

Many respondents also appreciated the architectural aspect of IPV, especially when integrated into façades or modern building designs. Overall, the survey shows that IPV is mainly perceived as a solution combining energy production with building integration.

Perceived concerns and barriers

Despite the positive perception, respondents identified several important barriers. The main concern was the high initial investment cost. Financial uncertainty and unclear economic returns were also frequently mentioned. Other common concerns included lack of awareness, installation complexity, maintenance and durability concerns and administrative procedures.

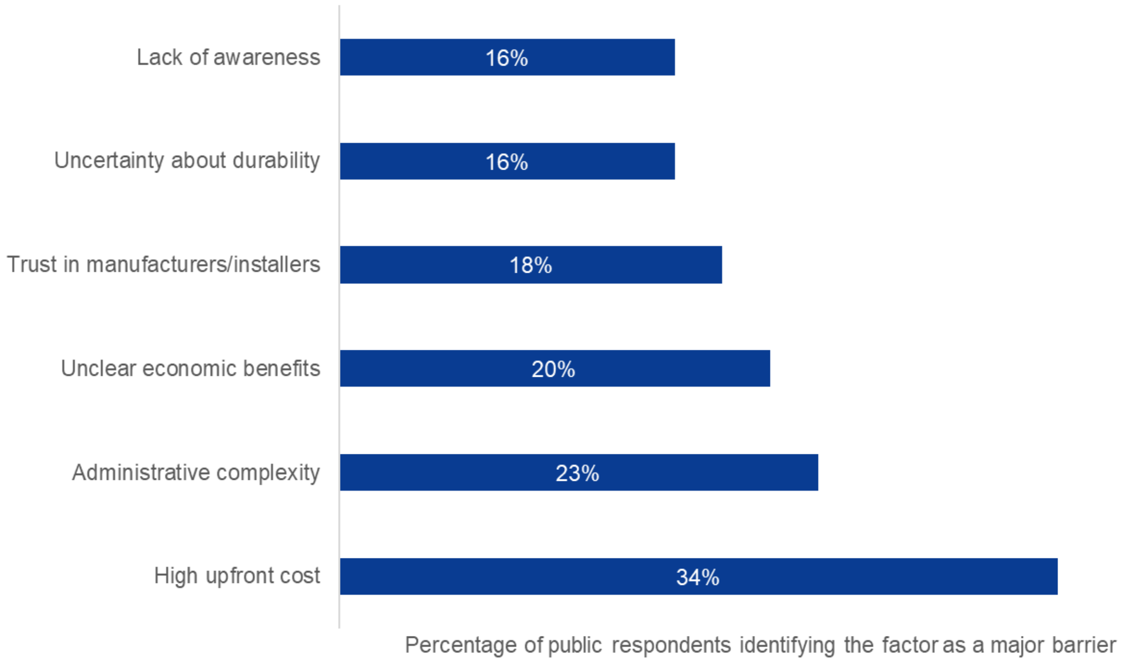

Figure 6: Factors perceived by the public as major barriers to BIPV adoption

Aesthetic concerns were generally less important than financial and technical aspects. The importance of visibility and incentives were also mentioned. Many respondents stated that seeing IPV installations nearby or benefiting from financial support would increase their willingness to adopt the technology.

Influence of social and demographic factors

The results suggest that housing situation and previous exposure to photovoltaics influence perception.

Homeowners were generally more focused on financial return and long-term investment, while tenants were more concerned about accessibility and feasibility in collective housing. Respondents living in apartment buildings showed stronger interest in façade integration and collective solutions. People already familiar with photovoltaics or sustainability-related topics generally expressed higher confidence in IPV technologies.

4.4 Professional perspectives on IPV

The professional survey highlights a generally positive perception of Integrated Photovoltaics, particularly regarding its role in sustainable construction and urban energy transition. However, the responses also show that several economic, technical, and regulatory barriers continue to limit wider deployment.

Perception and interest in IPV

The survey responses show that professionals generally perceive IPV positively and consider it a relevant solution for the future of sustainable buildings.

Most respondents associated IPV with:

- renewable energy production directly on buildings;
- reduction of building energy consumption;
- contribution to climate and decarbonization objectives;
- integration of energy systems into architecture.

Several professionals also highlighted the importance of IPV for renovation projects and urban environments where available roof space may be limited. At the same time, the responses show that IPV is still perceived as a developing market, less common and less standardized than conventional photovoltaic systems.

Main barriers identified by professionals

According to the professional respondents, economic barriers are the strongest factors limiting wider IPV adoption.

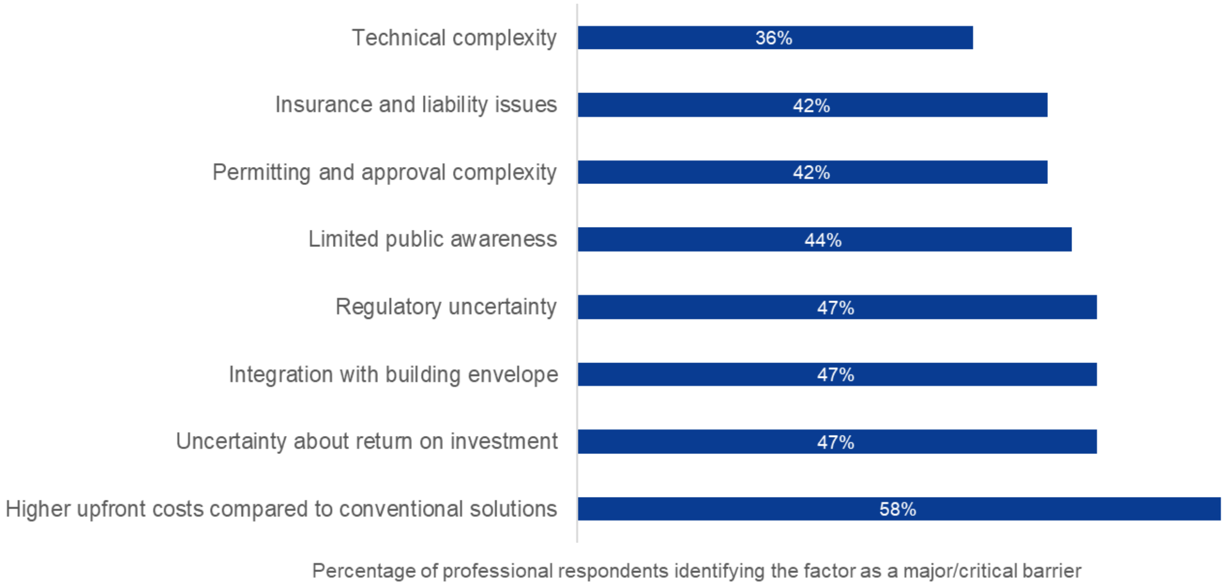

Figure 7: Main barriers to the acceptance and adoption of IPV systems among professional respondents

Several respondents also highlighted the lack of visibility and market maturity of IPV solutions compared to conventional rooftop photovoltaics.

Regulatory and administrative challenges

Administrative procedures and regulatory frameworks were repeatedly identified as important limitations.

Professionals referred to difficulties linked to:

- building permit procedures;
- urban planning regulations;
- approval processes for innovative systems;
- lack of harmonized standards for integrated photovoltaics;
- unclear responsibilities between construction and energy stakeholders.

Several respondents indicated that current regulations are often better adapted to standard rooftop photovoltaics than to multifunctional building-integrated systems.
The survey responses suggest that clearer procedures and regulatory simplification could significantly improve project feasibility and acceptance.

Architectural integration and building design

Architectural integration was considered a key aspect of IPV acceptance.
Many professionals viewed the integration of photovoltaics directly into the building envelope as one of the main advantages of IPV compared to conventional PV installations. Respondents particularly highlighted the importance of:

- façade integration;
- visual quality;
- compatibility with renovation projects;
- integration into dense urban environments.

However, some respondents also identified concerns regarding design flexibility, compatibility with existing architecture, and the visual integration of photovoltaic elements into certain building types.
The results show that the quality of architectural integration strongly influences both professional and public acceptance of IPV projects.

Conditions for wider adoption

The survey responses identified several measures that could support wider IPV deployment.
The most frequently mentioned priorities were:

- stronger financial incentives;
- reduction of installation costs;
- clearer technical standards and guidance;
- simplified administrative procedures;
- improved communication and awareness;
- more demonstration projects and visible case studies.

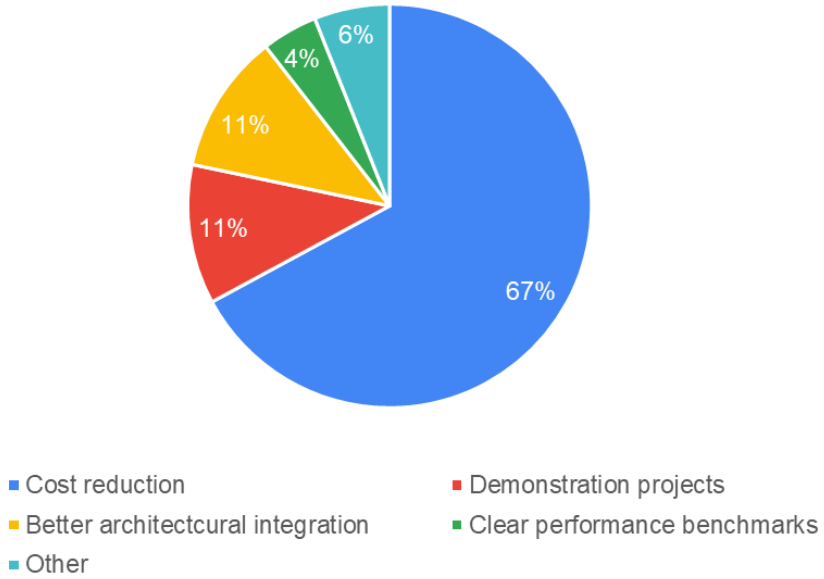

Figure 8: Conditions identified by professional respondents as necessary to support wider IPV deployment

Several respondents also noted the importance of integrating IPV more systematically into renovation strategies, public projects, and urban development policies.

Overall, the survey results suggest that professionals consider IPV to be a promising technology with strong long-term potential, but one that still requires economic support, regulatory clarification, and stronger market structuring before becoming more widely adopted.

4.5 Stakeholder interview insights

<u>Main topics Emerging from Interviews</u>

Across all interviews, stakeholders consistently described BIPV as a **promising but still niche market**. While the technology itself was generally considered mature enough for implementation, many participants explained that market uptake remains slow because of a combination of economic, regulatory, organizational, and knowledge-related barriers.

A recurring theme was the **gap between the photovoltaic sector and the construction sector**. Stakeholders frequently noted that BIPV projects require collaboration between actors who do not usually work closely together, including architects, engineers, installers, façade specialists, investors, public authorities, and building owners. Several interviewees considered this fragmentation one of the **main reasons why projects become complex or are abandoned** during development stages.

Another strong theme concerned the **lack of awareness and education around BIPV**. Many participants observed that architects, decision-makers, and clients often do not fully understand the technical possibilities, economic value, or architectural flexibility of integrated photovoltaics. As a result, BIPV is frequently excluded from projects very early in the design process.

Stakeholders also highlighted the importance of aesthetics. Unlike conventional photovoltaic systems, BIPV was often viewed positively because it can become part of the architectural identity of a building through colors, textures, transparency, or façade integration. However, this architectural value usually comes with **higher costs and more technical complexity**.

Finally, interviewees repeatedly underlined that BIPV projects require **long-term thinking**. Economic profitability alone was not always considered sufficient to justify implementation. Instead, projects were more likely to succeed when energy production, architectural quality, environmental targets, image value, and building renovation needs were considered together.

Socio-Political Perspectives

Regulatory complexity was identified as one of the most significant barriers to BIPV deployment. Several stakeholders explained that construction regulations, fire safety requirements, insurance systems, and certification procedures are often difficult to navigate and poorly adapted to integrated photovoltaic products.

Fire safety was mentioned repeatedly as a major concern, especially for façade applications and high-rise buildings. Interviewees noted that existing regulations are not always clear for BIPV systems, and many professionals struggle to understand which standards should be applied, as BIPV-specific adaptations are not yet in force.

Insurance and liability frameworks were also seen as important obstacles in some countries. Stakeholders explained that integrated systems are often treated differently from standard photovoltaic installations because they become part of the building envelope. This creates uncertainty for insurers, contractors, and project developers.

Several interviewees highlighted the **lack of harmonization between countries and regions**. While some areas actively support BIPV through subsidies, urban planning rules, or demonstration programs, others still lack clear guidance or stable support mechanisms.

At the same time, many stakeholders considered **public policies and demonstration projects essential** for market development. Public buildings, pilot projects, and architectural showcases were viewed as important tools to increase visibility, trust, and professional experience with BIPV systems.

Market Perspectives

Cost remains one of the strongest barriers to adoption. Most stakeholders agreed that BIPV systems are still significantly more expensive than standard building-applied photovoltaics (BAPV), particularly for customized façade products or architecturally integrated systems.

Interviewees explained that the market currently depends heavily on projects where aesthetics, sustainability targets, or façade renovation needs justify the additional investment. In many cases, BIPV is considered viable mainly for flagship buildings, public projects, premium architecture, or renovation projects where building materials would need replacement anyway.

Competition with low-cost conventional photovoltaic systems and imported products was another common concern. Several stakeholders noted that **European manufacturers struggle to compete with cheaper international suppliers**, especially when projects prioritize short-term costs over architectural integration or local production.

Despite these challenges, stakeholders also identified positive market drivers. Increasing pressure for low-carbon construction, energy-efficient buildings, urban decarbonization, and self-consumption were all considered factors that could strengthen the role of BIPV in the coming years. Electrification of mobility and stricter energy requirements for buildings were also mentioned as additional drivers.
Several interviewees stressed that BIPV should not be evaluated only through electricity production or financial return. They argued that the technology should also be valued as a **multifunctional building material** contributing to aesthetics, energy generation, façade renovation, and sustainability objectives at the same time.

Community and User Perspectives

Most stakeholders considered public perception of BIPV generally positive, especially when compared to conventional photovoltaic systems. Integrated solutions were often seen as more visually acceptable because they can blend into the architecture instead of appearing as an external technical addition.
Aesthetic integration was therefore viewed more as a driver than a barrier. Interviewees highlighted the growing demand for colored modules, façade integration, transparent solutions, and systems adapted to heritage or urban environments.
However, stakeholders also identified persistent concerns among building owners and the general public. These concerns included fears related to fire safety, maintenance complexity, durability, long-term reliability, and uncertainty about repair or replacement of integrated components.
Several participants explained that **awareness of BIPV remains low outside specialized professional circles**. In many cases, end-users and even construction professionals are not familiar with the technology or still perceive it as experimental, expensive, or difficult to implement.
The interviews also showed that user acceptance tends to improve when projects are clearly explained and when the architectural and environmental benefits are visible. Stakeholders noted that successful demonstration projects can help normalize the technology and reduce uncertainty.

Table 4: Main barriers identified from stakeholder interviews

Topic	*Main stakeholder observations*
Stakeholder coordination	Construction and PV sectors rarely collaborate early enough
Awareness and education	Architects and public authorities lack knowledge of IPV
Economic barriers	High costs and uncertain business models remain major issues
Regulations	Fire safety and insurance requirements create uncertainty
Aesthetics	Architectural integration is both a driver and a technical challenge

Stakeholder Recommendations

The interviews revealed several recurring recommendations for improving the adoption of BIPV systems.
The most common recommendation was to **strengthen education and training across the construction sector**. Stakeholders repeatedly stressed the need to introduce BIPV concepts earlier in architecture, engineering, and construction education programs.
Participants also recommended **improving collaboration between stakeholders from the earliest design phases**. Bringing together architects, engineers, manufacturers, contractors, investors, and

building owners at the beginning of projects was considered essential to reduce misunderstandings, technical conflicts, and redesign costs. If BIPV is proposed in late project phases, chances of the project implementing BIPV are significantly reduced due to higher costs, technical compatibility with the current design and complexity overall.

Another major recommendation was the development of **clearer and more harmonized regulations**, particularly concerning fire safety, certification, and insurance requirements. Stakeholders believed that stable and transparent rules would reduce uncertainty and increase confidence among investors and construction professionals.

Financial support mechanisms were also considered important, especially for early-stage market development. Several interviewees argued that subsidies, pilot programs, and public procurement policies remain necessary until BIPV becomes more cost-competitive and widely understood in unmature markets.

Finally, stakeholders emphasized the importance of **demonstrating practical success stories**. Public demonstration projects, renovation examples, and visible urban applications were seen as effective ways to increase trust, improve awareness, and encourage broader adoption of BIPV technologies.

5 Cross-analysis and discussion

The comparison between the literature review, surveys, and stakeholder interviews shows a strong consistency across the different sources. Most barriers identified in previous studies were also confirmed by professionals and public respondents involved in this study. However, the interviews also provided a more detailed understanding of how these barriers affect projects in practice and how they interact with each other.

One of the clearest findings is that the main barriers affecting IPV deployment are no longer only technical. Most stakeholders considered the technology itself sufficiently mature for many applications, especially for roofs and some façade systems. Instead, the main challenges are now linked to:

- stakeholder coordination;
- economic conditions;
- regulations;
- awareness and education;
- and integration into existing construction practices.

This confirms the conclusions already identified in previous BIPV studies. [6]

Fragmentation between sectors remains a major barrier

The interviews strongly confirmed that the separation between the construction and photovoltaic sectors remains one of the main obstacles to wider IPV deployment.

Many stakeholders explained that architects, engineers, manufacturers, installers, façade companies, and investors often work independently and become involved at different moments of the project. As a result, photovoltaic integration is frequently considered too late in the design process, leading to additional costs, technical compromises, reduced architectural quality or abandonment of the IPV solution entirely.

This issue appeared consistently across countries and professional profiles. The literature already identifies this fragmentation as a structural characteristic of the IPV sector, but the interviews showed how strongly it affects projects in practice.

Several stakeholders also highlighted the importance of intermediary actors capable of connecting technical, architectural, and economic aspects throughout the project process. This role currently remains limited in many markets.

The results therefore suggest that improving collaboration between sectors may be as important as improving the technology itself.

Awareness and education strongly influence adoption

The study showed that awareness and education strongly influence adoption. This issue appeared repeatedly in the literature, professional surveys, and nearly all interviews. Architects and construction professionals were frequently identified as key actors because they influence decisions during the early design stages. However, several interviewees explained that IPV systems are still rarely included in architecture or engineering education. Many professionals therefore remain unfamiliar with available products, integration possibilities, technical requirements, and long-term performance.

The public survey revealed similar trends. While many respondents were already familiar with standard photovoltaic systems, fewer knew about integrated photovoltaic façades, glazing systems, or architectural photovoltaic applications.

The results therefore suggest that increasing awareness is not only a communication issue but also a necessary condition for wider market adoption. Several stakeholders mentioned that demonstration projects, technical guidelines, and practical training could significantly improve understanding and confidence in IPV systems.

Economic uncertainty remains central

Economic uncertainty remains one of the strongest barriers identified throughout the study. Although stakeholders recognized the architectural and environmental value of IPV systems, many still considered them difficult to justify financially compared to conventional rooftop PV systems. The interviews showed that this issue is linked to higher product costs, project-specific engineering, limited standardization, and uncertain return-on-investment calculations.

At the same time, several stakeholders stressed that IPV systems should not be evaluated only as energy systems. Because they replace conventional construction materials, part of their value also comes from architectural integration, façade or roof functions, environmental image, and building quality. This point appeared particularly important for façade systems and renovation projects where building envelope replacement is already planned.

The study also highlighted strong differences between countries. Switzerland was frequently described as one of the most advanced markets due to financial incentives, greater acceptance of customized building solutions, and stronger architectural interest in BIPV applications. The Swiss market has a set of features that are aligned with BIPV, including land scarcity, a favourable regulatory framework and a strong research and industrial ecosystem, facilitating its market acceptance and technological adoption from the construction sector. In contrast, stakeholders from other countries described markets as more uncertain or more constrained by regulations and insurance requirements.

Regulations and fire safety remain important sources of uncertainty

The study confirmed the important role of regulations and standards in shaping IPV deployment. Several stakeholders explained that IPV systems must comply with both photovoltaic and construction regulations, making the regulatory framework more complex than for conventional photovoltaic systems. Fire safety requirements were particularly discussed for façade systems and high-rise buildings.

In some countries, interviewees also highlighted difficulties linked to certification procedures, insurance systems, administrative complexity, and long-term liability rules. The French context was often mentioned as an example where construction insurance requirements strongly affect IPV adoption. Other countries showed different challenges, including changing regulations or uncertainty regarding technical approvals.

However, most stakeholders did not consider regulations themselves to be the problem. The main issue was rather the lack of clarity, harmonization, and stability regarding how rules apply to IPV systems. Several professionals explained that rapidly changing regulations can discourage investment because project developers and building owners struggle to anticipate future conditions.

Aesthetics are both a strength and a limitation

Aesthetics emerged as both a strength and a limitation for IPV systems. Compared to conventional rooftop photovoltaic systems, IPV applications were generally perceived more positively because they can be integrated directly into the architectural design of buildings. Public respondents reacted more positively to systems that appeared visually integrated rather than simply added onto existing structures.

Stakeholders also explained that architectural integration can improve acceptance in dense urban areas, renovation projects, and architecturally sensitive environments. At the same time, aesthetic customization can increase technical and economic complexity. Several interviewees pointed out that colored modules, customized dimensions, or complex façade systems can increase costs and sometimes reduce photovoltaic efficiency.

The study therefore confirms that aesthetics are one of the strongest drivers of IPV acceptance, while also creating additional constraints in terms of cost, engineering, and performance.

Technical barriers are evolving

The cross-analysis showed that purely technical barriers are now less dominant than in earlier stages of IPV development. Most stakeholders considered photovoltaic technology itself relatively mature. Nevertheless, some technical concerns remain important, particularly regarding fire safety, maintenance, long-term durability, and replacement of integrated systems.

Because IPV systems are directly integrated into buildings, maintenance and replacement are often perceived as more complex than for standard rooftop photovoltaic installations. Several interviewees also raised concerns regarding the long-term availability of replacement products and the durability of customized systems over time.

At the same time, stakeholders acknowledged that technical progress continues to improve module reliability, integration systems, fire performance, and architectural flexibility. The results therefore suggest that the main challenge today is less about proving technical feasibility and more about creating the market, regulatory, and organizational conditions needed for wider deployment.

Table 5: Comparison between literature findings and stakeholder feedback

Topic	*Literature review*	*Stakeholder feedback*
Technology maturity	Technology improving rapidly	Technology generally considered mature
Main barriers	Regulations, costs, awareness	Coordination, costs, regulations, awareness
Aesthetics	Important for acceptance	Strong driver but increases complexity
Public awareness	Limited knowledge of IPV	Confirmed by surveys and interviews
Regulations	Need for harmonisation	Uncertainty and instability remain major issues

6 Conclusions

This study analyzed the main social barriers affecting the deployment and acceptance of Integrated Photovoltaics through a combination of literature review, public and professional surveys, and stakeholder interviews across several European countries.

The results show that IPV technologies are increasingly recognized as an important solution for combining renewable energy production with the decarbonization of buildings. Stakeholders generally consider the technology sufficiently mature for many applications, particularly for roofs and some façade systems. At the same time, the study confirms that the main barriers affecting deployment are no longer primarily technical.

The research highlights that **the current challenges are mainly organizational, economic, and regulatory**. Across the literature, surveys, and interviews, the same issues appeared repeatedly: lack of coordination between sectors, limited awareness among stakeholders, economic uncertainty, and complex regulatory frameworks.

One of the strongest findings concerns the fragmentation between the construction and photovoltaic sectors. IPV projects require collaboration between architects, engineers, manufacturers, installers, façade specialists, investors, and public authorities. However, these actors often work separately and become involved at different stages of the project process. As a result, photovoltaic integration is frequently considered too late, leading to technical compromises, additional costs, or reduced architectural quality.

The study also shows that **awareness and education remain central conditions for wider IPV adoption**. Many architects, engineers, developers, and public authorities still have limited knowledge of available IPV systems and their integration possibilities. This affects project development from the earliest design stages. Public awareness also remains limited, especially regarding façade systems and architectural photovoltaic applications.

Economic viability remains another major challenge. IPV systems are still widely perceived as more expensive and more complex than conventional rooftop photovoltaic installations. Stakeholders repeatedly highlighted the difficulty of evaluating IPV systems only through short-term financial return calculations. Because IPV products replace conventional construction materials, their value also includes architectural integration, building functions, environmental image, and contribution to sustainable construction.

Regulatory complexity and uncertainty also continue to slow down deployment. Fire safety requirements, certification procedures, insurance systems, and administrative processes were frequently identified as barriers, particularly for façade applications. However, the study also shows that stakeholders are generally not opposed to regulations themselves. The main issue is the lack of clarity, harmonization, and stability across countries and projects.

The results further confirm that aesthetics play a particularly important role in IPV acceptance. Compared to conventional photovoltaic systems, integrated solutions are often perceived more positively because they can become part of the architectural design of buildings. At the same time, aesthetic customization can increase technical complexity and costs, creating a constant balance between architectural quality, energy performance, and economic feasibility.

Despite these challenges, the study also identified several positive developments. Stakeholders highlighted growing political support for building decarbonization, increasing architectural interest in integrated photovoltaic solutions, and continuous improvements in IPV products and design flexibility. Public perception of IPV systems was generally positive, especially when systems were perceived as visually integrated and adapted to the building context.

Overall, the findings suggest that **the future development of IPV systems will depend less on technological progress alone and more on the ability to improve collaboration, awareness, regulations, and integration within standard construction practices**.

The findings of this study indicate that overcoming the current barriers to IPV deployment will require **coordinated action** from policymakers, industry actors, researchers, and the construction sector. **Education** emerged as one of the most important areas for improvement, as many architects, engineers, and building professionals still have limited knowledge of available IPV technologies and their integration possibilities. Strengthening IPV-related training in architecture and engineering courses, as well as through professional development activities, could help ensure that these solutions are considered **earlier in the design process**, where key decisions are made.

Regulatory improvements are also needed to reduce uncertainty and facilitate project development. Clearer guidance on **fire safety**, **certification procedures**, **insurance requirements**, and long-term responsibilities would help increase confidence among project developers, investors, and building owners. At the market level, **pilot and demonstration projects** remain important tools for showcasing successful applications, generating practical experience, and providing evidence of technical and economic performance under real conditions.

The study also highlights the need for stronger **stakeholder collaboration** throughout the project lifecycle. Earlier involvement of architects, engineers, manufacturers, installers, and building owners can help avoid technical compromises and improve both project quality and economic viability. Finally, greater efforts are needed to increase **public awareness** of IPV systems and their benefits. Better communication on **architectural integration**, **energy generation**, and the **multifunctional value** of IPV as both a building component and an energy technology could help improve acceptance and support wider market uptake.

Table 6: Possible actions to support IPV deployment

Area	Possible actions
Education	Integrate IPV into architecture and engineering training
Regulations	Clarify fire safety and certification procedures
Market support	Support pilot and demonstration projects
Stakeholder collaboration	Encourage early coordination between sectors
Public awareness	Improve communication on architectural integration and benefits

The study therefore confirms that overcoming social barriers is not only a question of public acceptance, but also of improving communication, coordination, and cooperation across the entire IPV value chain.

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Project partners:

#	Partner short name	Partner Full Name
1	VOL	VOLTEC SOLAR
2	ETW	ETWAY S.R.L.
3	HLP	HELIUP
4	M10	M10 INDUSTRIES AG
5	UNR	UNIRESEARCH BV
6	Fraunhofer	FRAUNHOFER GESELLSCHAFT ZUR FORDERUNG DER ANGEWANDTEN FORSCHUNG EV
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9 Appendix A – Quality Assurance Review Form

The following questions should be answered by all reviewers (WP Leader, reviewer, Project Coordinator) as part of the Quality Assurance procedure. Questions answered with NO should be motivated. The deliverable author will update the draft based on the comments. When all reviewers have answered all questions with YES, only then can the Deliverable be submitted to the EC.
NOTE: This Quality Assurance form will be removed from Deliverables with dissemination level "Public" before publication.

Question	**WP Leader**	**Reviewer**	**Project Coordinator**
	Josè M. Vega de Seoane (BIE)	Anna Molinari (UNR)	Mehdi SAHLI (Voltec Solar)
1. Do you accept this Deliverable as it is?	Yes	Yes	Yes
2. Is the Deliverable complete? *– All required chapters?* *– Use of relevant templates?*	Yes	Yes	Yes
3. Does the Deliverable correspond to the DoA? *– All relevant actions preformed and reported?*	Yes	Yes	Yes
4. Is the Deliverable in line with the SPHINX objectives? *– WP objectives* *– Task Objectives*	Yes	Yes	Yes
5. Is the technical quality sufficient? *– Inputs and assumptions correct/clear?* *– Data, calculations, and motivations correct/clear?* *– Outputs and conclusions correct/clear?*	Yes	Yes	Yes
6. Is created and potential IP identified and are protection measures in place?	n/a	n/a	n/a
7. Is the Risk Procedure followed and reported?	Yes	Yes	Yes
8. Is the reporting quality sufficient? *– Clear language* *– Clear argumentation* *– Consistency* *– Structure*	Yes	Yes	Yes