Seamless-PV

D2.2 – Analysis of regulatory frameworks applicable to IPV systems

Funded by the European Union

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Project funded by

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs, Education and Research EAER
State Secretariat for Education, Research and Innovation SERI

Document control sheet

Project	**SEAMLESS-PV – Development of advanced manufacturing equipment and processes aimed at the seamless integration of multifunctional PV solutions, enabling the deployment of IPV sectors**

Topic identifier	HORIZON-CL5-2022-D3-01-03
Grant Agreement N°	101096126
Coordinator	Fundación Tecnalia Innovation and Research
Duration	01/01/2023 – 31/12/2026
Work package N°	2
Work package title	IPV markets, regulatory frameworks and consolidation of technical specifications
Work package leader	ICARES Consulting - Becquerel Institute (BI)
Task n°	2.2
Task leader	ICARES Consulting - Becquerel Institute (BI)
Document title	D2.2 – Analysis of regulatory frameworks
Lead Beneficiary	ICARES Consulting - Becquerel Institute (BI)
Dissemination level	Public
Authors	BI
Contributors	AKUO, BECSA, BIF, CASA, CEA, FD2, ONYX, PIZ, SONO, TECNALIA, SUPSI
Reviewer(s)	Jose M. Vega de Seoane (TECNALIA), F. Frontini, F. Parolini (SUPSI)
Issue date	10/10/2023

History of versions

Version	Date	Author - Beneficiary	Comments
v00	10/10/2023	Elina Bosch, Philippe Macé, André Penas, Julien Van Overstraeten, Adrien Van Rechem (BI) ; Caroline Plaza, Mélodie de l'Epine (BIF)	Submitted to the EC

Acknowledgements

The work described in this publication has received funding from the European Union's Horizon Europe research and innovation program under grant agreement N° 101096126.

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Executive Summary

This document reviews, for each integrated photovoltaics (IPV) market segment, the applicable regulatory framework, at European and national (or regional) level. The four segments of IPV are: building integrated PV (BIPV), infrastructure integrated PV (IIPV), agrivoltaics (AgriPV or AGRI) and vehicle integrated PV (VIPV). The (pre)definitions of IPV segments and systems existing in some countries are discussed, along with the associated regulation and support schemes. Moreover, announced or in preparation regulatory frameworks are addressed. Note that concerning national and regional regulations, the focus has been put on main European markets (e.g., in alphabetical order, Belgium, France, Germany, Italy, Netherlands, Spain, and Switzerland).

The first part consists of a summary of the main European policies of recent years that have shaped the current regulatory framework, amidst the need for strong regulations driving renewable energies, and in particular solar photovoltaic energy.

Then, an overview of general support schemes for each of the aforementioned countries, as well as specific definitions, regulations and support schemes for IPV is presented.

In the subsequent parts, regulations related to each IPV segment are detailed. For BIPV, European definitions and standards are provided, before listing national- or regional-level requirements related to buildings. These include laws on urban planning, construction, safety among others, as well as energy performance requirements.

IIPV is very rarely defined, so predefinitions or references mentioned in countries' regulations are gathered. In addition, the current regulatory framework for noise barriers is described, being the IIPV segment of application for the project. AgriPV has likewise different levels of definition depending on the country, but when defined, often has specific regulations and support schemes which are described.

Finally, the VIPV segment is unique amongst IPV sectors as it is usually not subject to most regulations related to PV. Instead, it is closely related to the vehicle industry. While no official definition of VIPV exists, we take a look at policies and incentives favoring its uptake in Europe and in the studied countries. This often relates to directives and regulations about electric vehicles.

The collected data is summarized in readable, easy-to-use country factsheets, providing a valuable resource for the technical work packages (WPs) of the SEAMLESS-PV project as well as external stakeholders.

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1 Introduction

1.1 Description of the deliverable content purpose

This document reviews, for each integrated photovoltaics (IPV) market segment, the applicable regulatory frameworks, at European and national (or regional) level. The four segments of IPV are: building integrated PV (BIPV), infrastructure integrated PV (IIPV), agrivoltaics (AgriPV or AGRI) and vehicle integrated PV (VIPV). The (pre)definitions of IPV segments and systems existing in some countries will be discussed, along with the associated regulation and support schemes. Moreover, we will have a look at announced or in preparation regulatory frameworks. Note that concerning national and regional regulations, the focus will be put on main European markets (e.g., in alphabetical order, Belgium, France, Germany, Italy, Netherlands, Spain, and Switzerland). The collected data is summarized in readable, easy-to-use country factsheets, providing a valuable resource for the technical work packages (WPs) of the SEAMLESS-PV project as well as external stakeholders.

1.2 Reference Material

This Deliverable has taken some data from the following documents:

- PVSITES
  - European regulatory framework for BIPV (Project report, July 2016)
- BIPVBOOST
  - Update on regulatory framework for BIPV (Project report, April 2019)
- IEA-PVPS Task 15
  - International definitions of "BIPV" (Report IEA-PVPS T15-04: 2018)
  - Analysis of requirements, specifications, and regulation of BIPV (Report IEA-PVPS T15-08: 2019)

1.3 Relation with other activities in the project

Table 1.3-1 depicts the main links of this deliverable to other activities (work packages, tasks, deliverables, etc.) within SEAMLESS-PV project. The table should be considered along with the current document for further understanding of the deliverable contents and purpose.

Table 1.3-1. Relation between current deliverable and other activities in the project

Project activity	Relation with current deliverable
Task 2.1	Use case definition from T2.1 have helped categorize IPV segments in this report.
Task 2.3	Inputs from this report will be used as a starting point to define regulatory requirements for IPV products in T2.3.
Task 2.4	Inputs from this report will be used as material to evaluate the market potential of IPV segments in T2.4.
Task 6.10	Inputs from this report will be used as material to evaluate the progress on standardization of IPV segments in T6.10.
WP 9	Inputs from this report will feed exploitation activities in WP9.

1.4 Abbreviation list, glossary and symbols used

Table 1.4-1. Abreviation list

Abbreviation	Meaning
AgriPV	Agrivoltaics
AVCP	Assessment and Verification of Constancy of Performance
BAPV	Building Applied PV
BIPV	Building integrated PV
BEV	Battery Electric Vehicle
BIPV	Building Integrated PV
DHW	Domestic Hot Water
DoP	Declaration of Performance
EV	Electric Vehicle
FCEV	Fuel Cell Electric Vehicle
HEV	Hybrid Electric Vehicle
HP	Heat Pump
IIPV	Infrastructure integrated PV
NEDC	New European Driving Cycle
NRD	Noise Reducing Device
PHEV	Plug-In Hybrid Electric Vehicle
PVNB	Photovoltaic Noise Barrier
SCR	Self-consumption rate
VIPV	Vehicle integrated PV
WLTP	Worldwide Harmonised Light Vehicles Test Procedure

Table 1.4-2. Glossary

Term	Meaning
Net-billing	Mechanism concerning the remuneration of injected electricity in which each kWh injected to the grid (i.e., not self-consumed) allows to partially reduce the electricity bill. Each injected kWh -- provided that combined with the self-consumed kWhs they do not exceed the electricity consumption (on an annual or monthly basis depending on the regulation) -- reduces the electricity bill but only partially, i.e., up to the commodity or energy component (i.e., not distribution and transmission network tariffs or taxes) expressed in €/kWh.

Table 1.4-3. Symbols

Symbol	**Meaning**
‖	logical “or”
&	logical “and”

2 EU level policy framework

The EU stands at the forefront of global efforts to combat climate change and promote sustainable development. At its core, the EU's policy framework is centered around ambitious initiatives such as the Green Deal, the European Climate Law, and REPower EU, all of which underscore the Union's commitment to addressing pressing environmental challenges. These policies not only exemplify the EU's leadership in the fight against climate change but also demonstrate its dedication to fostering economic growth, innovation, and social cohesion in a sustainable manner.

2.1 Before the Green Deal: The 2020 package (March 2007)

In March 2007, as a means of helping stimulate the United Nations (UN) negotiations on targets for the period after 2012, EU Heads of State agreed on a set of three targets referred to as "20-20-20 by 2020".
The 2020 package is a set of laws passed to ensure the EU meets its climate and energy targets for the year 2020. The package sets three key targets:

1. 20% cut in greenhouse gas emissions (from 1990 levels)
2. 20% of EU energy from renewables
3. 20% improvement in energy efficiency

The targets were set by EU leaders in 2007 and enacted in legislation in 2009.

The EU acted in several areas to meet the targets and passed Directive 2009/28/EC[1] of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources. As well as Directive 2009/29/EC[2] of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC to improve and extend the greenhouse gas emission allowance trading scheme of the Community.

2.2 Clean Energy for All Europeans (November 2019)

The Clean Energy for All Europeans initiative is a set of legislative measures proposed by the European Commission in 2016. After a political agreement between the EU Council and the European Parliament in May 2019, the rules have entered into force, giving EU countries 1-2 years to adopt them into national laws.

This new set of legislation is intended to bring significant benefits for consumers, the environment, and the economy. It aims to accelerate the transition to clean and sustainable energy in the EU. It includes targets for renewable energy and energy efficiency, regulations for market design and governance, and aims to create a competitive and secure energy market. The initiative promotes renewable energy, energy savings, and market integration while

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32009L0028
[2] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32009L0029

aligning national energy policies with EU objectives. Its goal is to achieve a low-carbon and sustainable energy system in Europe.[3]

The Clean Energy for All Europeans Package includes 8 different legislative acts that cover various aspects of the energy sector.

2.2.1 Energy Performance of Buildings Directive (EPBD)

To achieve its sustainable energy goals, the EU needs to implement measures to reduce the carbon emissions associated with the building stock, which represents around one-third of the EU's carbon emissions. A clear regulatory framework to guarantee the decarbonization of the building sector is needed, through the construction of NZEB (Nearly Zero-Energy Buildings) and establishing long-term strategies for the retrofitting of the existing building stock. This was made possible through the implementation of the 2018/844 Directive, also known as Energy Performance of Buildings Directive (EPBD), which was revised in 2021.

The 2018/844 Directive of the European Parliament amends the Directives of 2010/31/EU and 2012/27/EU, on energy performance of buildings and energy efficiency, respectively. The goals of this Directive include:

- Making long-term renovation strategies more efficient, with emphasis on the decarbonization of the construction field and the development of the NZEB building stock by 2050.
- Promoting private investment in retrofitting the existing building stock.
- Using monitoring and control systems to use energy more rationally.
- Raising the threshold for mandatory inspections of cooling and heating equipment and improving the transparency of the calculation methods.
- Engaging users to have an active role in the process of building renovation.
- Fighting energy poverty.[4]

[3] https://energy.ec.europa.eu/topics/energy-strategy/clean-energy-all-europeans-package_en
[4] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L0844&from=IT

Apart from the environmental benefits of implementing such a policy, efforts to improve the energy efficiency in buildings contribute to securing EU energy independence. Member states should consider linking the demands that such a legal framework might bring with existing initiatives, as well as promoting the development of professional qualifications in the sectors of construction and energy efficiency.[5,6]

The **2021 revised version** of the EPBD offers:

- New definitions for NZEB and "deep renovation".
- Each Member State must establish its own long-term strategy to support the retrofitting of both private and public building stocks, with the first drafts to be submitted before July 2024.
- All new buildings, where technically feasible, 100% of on-site energy consumption must be covered by renewable energy as of 2030, with an earlier adoption as of 2027 for public buildings
- All new private buildings in the EU must be zero emission buildings (ZEB) from 2030, while all new public buildings must be from 2027.
- Regarding retrofitting of buildings, a minimum EU-level efficiency standard will be introduced, where buildings with the worst classification of energy performance certificates (EPC) will need to be upgraded to the energy class above.

2.2.2 Energy Efficiency Directive (EED)

Energy efficiency is a key area of the energy transition to achieve the EU's carbon neutrality goals by 2050 and a priority to be considered in future investment decisions in energy infrastructure. It was first framed into a directive in 2012, with Directive 2012/27, to promote energy efficiency and benefit from huge energy saving potentials through the implementation of concrete energy efficiency measures and market regulation to achieve the previous energy efficiency goals of 2020.

The Energy Efficiency Directive is part of the broader EU energy efficiency policy framework, which is interconnected with other directives such as the EPBD, and the Renewable Energy Directive (RED). The Communication on the Climate Target Plan has considered the current efficiency target insufficient to achieve the greenhouse gas emission goals and required a target of 36%–37% energy efficiency on final consumption by 2030.

[5]https://www.ekinex.com/en/ekinex-lab/directive-eu-2018844-energy-performance-of-buildings.htm#:~:text=Directive%20Eu%202018%2F844%20of,Concil%20of%2030%20May%202018&text=The%20new%20directive's%20objectives%3A,NZEB%20building%20pool%20by%202050

[6]https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-revision-of-the-energy-performance-of-buildings-directive

In the scope of this Directive, the energy efficiency measures implemented by the Member States are eligible for achieving their obligations of energy efficiency savings in the final consumption. The Directive considers that efficiency improvements are possible in many sectors such as Transportation, Buildings, Industry, and the Public Sector. For instance, in the sector of Transportation, an increase in the usage of public transport and cycling transport is foreseen, as well as an improvement in urban planning and mobility policies. Also in the Transportation sector, the adoption of vehicles with less energy consumption per kilometer is expected. In the Buildings sector, this Directive is complementary to the EPBD, as it takes a broader approach to establish a long-term renovation strategy to improve energy efficiency in buildings. In the Industry sector, the EED intends to improve the efficiency of the sector by tightening the energy efficiency targets, for instance, through energy audits, replacement of heating and cooling systems and implementing energy management systems.[7]

The Energy Efficiency Directive 2012/27 was amended in 2018 and became EU 2018/2002, it established a **new target for energy efficiency** in the EU of at least **32,5% by 2030**, this target was revised in 2023.

The amended Energy Efficiency Directive, formally agreed on **24 July 2023**, establishes **'energy efficiency first'** as a fundamental principle of EU energy policy.
In its revision, the Commission ensured that the new 2030 target was raised and will reduce greenhouse gas emissions **by at least 55%** (compared to 1990).
The amended directive will enter into force in September 2023 after its publication in the EU Official Journal.

2.2.3 Electricity Directive & Electricity Regulation

The Directive on common rules for the internal market for electricity (EU/2019/944) and the Regulation on the internal market for electricity (EU/2019/943), puts consumers at the center of the clean energy transition and allows their active participation, whilst putting in place a strong framework for consumer protection. By allowing electricity to flow freely to where it is most needed, society is expected to benefit increasingly from cross-border trade and competition. Investments will be promoted to ensure security of supply while decarbonizing the European energy system.

[7] https://www.ceer.eu/documents/104400/-/-/d52f8d36-0d08-27b2-eef9-52f66520619c

These rules contribute to the EU's goal of being the world leader in energy production from renewable energy sources by allowing greater flexibility to accommodate an increasing share of renewable energy in the grid. Under the current system, fossil fuel prices have a large impact on electricity prices. To decrease this impact, the changes aim to incentivize longer term contracts with non-fossil power producers and increase flexibility through measures such as storage and demand response. The electricity market design allows to achieve the goals set out in the European Green Deal and the REPowerEU plan.[8]

On **14 March 2023**, the European Commission published its legislative proposal for an amending regulation to improve the EU electricity market design. The new proposed rules include:

- A wider choice of contracts and clearer information for consumers, with the possibility to lock in secure long-term prices but also to take advantage of dynamic pricing contracts.
- Reducing the risk of supplier failure, through new requirements on price risk management and the establishment of suppliers of last resort.
- Enhanced sharing of renewable energy, for instance by selling excess electricity from rooftop solar installations to neighbours.
- More stable long-term contracts (Power Purchase Agreements) between companies and suppliers.
- Two-way Contracts for Difference (CfDs) between electricity generators and public entities.
- Obligations to facilitate integration of renewables into the system.

2.2.4 Renewable Energy Directive (RED)

The EU Renewable Energy Directive (RED), adopted in 2009, aimed to achieve a 20% share of renewable energy sources (RES) in EU final energy consumption by 2020. In 2018, the RED was revised to target a minimum 32% share of RES in final energy consumption by 2030. Under the "fit for 55 packages" part of the European Green Deal, the Commission proposed a significant revision to the RED on the 14th of July 2021. The proposal for a revised RED would increase the binding EU minimum share of RES in final energy consumption to 40 % by 2030 and establishing a comprehensive framework for RES deployment in sectors all sectors and focusing on sectors with slow progress, such as transport, buildings, and industry.

To support the 40% target, higher EU and national targets would be set for different sectors, including the promotion of hydrogen consumption. The proposal also introduces measures to boost renewable electricity in transport, streamline permitting procedures for new RES installations, facilitate collective Power Purchase Agreements, establish an EU labelling methodology for industrial products using renewable energy, and promote regional cooperation on renewables. [9]

[8] https://energy.ec.europa.eu/topics/markets-and-consumers/market-legislation/electricity-market-design_en
[9]https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-revision-of-the-renewable-energy-directive

The Directive covers heating, cooling, and transport sectors, and imposes rules for financing electricity from renewables. The updated Directive also limits the use of first-generation biofuels produced from food crops.[10]

Given the need to speed up the EU clean energy transition, the Directive (2009/28/EC) was **revised and entered into force** in **2018**. It has been **legally binding** since **June 2021**. The 2021 proposed rules include:

- Apply more ambitious GHG reduction criteria, agreed as part of the 2018 RED, to existing biomass-based installations and not just new installations.
- Lower the threshold for applying sustainability criteria for small-scale RES installations to 5MW.
- Provides a new financing framework for renewable energy, aiming for a minimum of 32% share of RES in the EU's final energy consumption by 2030.
- Member States must increase the use of renewable energy for heating and cooling by 1.3 percentage points from 2021 onward.
- Fuel marketers are required to raise the share of renewables fuels by 14% by 2030.

On **30 March 2023**, a provisional agreement was reached for a binding target of at least 42.5% by **2030** but aiming for **45%**. Once this process is completed, the new legislation will be formally adopted and enter into force.

2.3 Green Deal (December 2019)

The European Green Deal is a comprehensive and ambitious plan proposed by the European Commission to tackle climate change and promote sustainable development across Europe. It was introduced in December 2019 as the EU's roadmap for transforming the bloc into a climate-neutral economy by 2050.[11] The European Green Deal aims to transform the EU into a modern, resource-efficient, and competitive economy, ensuring:

- No net emissions of greenhouse gases by 2050
- Economic growth decoupled from resource use
- No person and no place left behind

The European Green Deal is also a lifeline out of the COVID-19 pandemic. One third of the €1.8 trillion investments from the NextGenerationEU Recovery Plan, and the EU's seven-year budget will finance the European Green Deal. It seeks to create new opportunities for innovation and investment, as well as:

- Reduce emissions,
- Create jobs and growth
- Reduce external energy dependency

[10] https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-revision-of-the-renewable-energy-directive

[11] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

- Improve health and wellbeing
- Address energy poverty

The European Commission has adopted a set of proposals ("Fit for 55"[12]) to make the EU's climate, energy, transport, and taxation policies fit for **reducing net greenhouse gas emissions by at least 55% by 2030**, compared to 1990 levels. All 27 EU Member States committed to this target.

2.4 European Climate Law (July 2021)

The European Climate Law[13] was published on July 9, 2021, and entered into force on July 29, 2021. It writes into law the goal set out in the European Green Deal, namely that the European economy and society should become climate neutral by 2050, with the intermediate target of reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels.

The European Climate law is intended to ensure that all EU policies contribute to this goal and that all sectors of the economy and society play their part. This law sets a legally binding target of net zero greenhouse gas emissions by 2050. Consequently, the EU institutions and the EU Member States are bound to take the necessary measures at the EU and national level to achieve the target, taking into account the importance of promoting fairness and solidarity among Member States.

The Climate Law also addresses the necessary steps to reach the 2050 target:

- Based on a comprehensive impact assessment, the EU has set a new target for 2030 to reduce net greenhouse gas emissions by at least 55% compared to 1990 levels. The new EU target for 2030 is included in the law.
- In July 2021 the Commission adopted a series of proposals to revise all relevant policy instruments to achieve the additional emissions reductions for 2030.
- The Law also includes a process to set a climate target for 2040.

2.5 REPower EU (May 2022)

REPower EU[14] is a joint European action for more affordable, secure, and sustainable energy, necessary both to accelerate the green transition and to secure the EU's energy supply independently from fossil fuels imported from Russia.

This plan paves the way for an era of green energy at affordable prices while accelerating the deployment of renewable energies. It aims to:

- Achieve energy savings,
- Produce clean energy,

[12] https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/
[13] https://climate.ec.europa.eu/eu-action/european-green-deal/european-climate-law_en

[14]http://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en

- Diversify the bloc's energy supply sources.

The plan is based on financial and legal measures which will help build the new energy infrastructure and systems that Europe needs. REPower EU should include clear short- and medium-term milestones, aiming at a full independence from all Russian energy imports by 2027. Ultimately, the transition to clean energy will help lower energy prices and reduce import dependence and over time, it will lead to a cleaner European industry, energy, and economy.[15]

2.5.1 EU Solar Energy Strategy

As part of the REPower EU plan, the EU Solar Energy Strategy aims to bring online 320 GW of solar photovoltaic energy production capacity yearly by 2025 (more than double compared to 2020) and almost 600 GW by 2030.

This is possible because of the EU's renewable energy policy which helped bring PV costs down by 82% over the last decade, making it one of the most competitive sources of electricity in the EU.

The EU Solar Energy Strategy outlines a comprehensive vision to swiftly reap the benefits of solar energy and presents four initiatives to overcome the remaining short-term challenges.

- First, by promoting quick and massive PV deployment via the **European Solar Rooftops Initiative**. The primary aim of this initiative is to exploit the untapped capacity of rooftops to produce environmentally-friendly energy. It includes a proposal for a phased implementation of the obligation to integrate solar energy systems into different categories of buildings over the next few years. The initial phase would cover newly built public and commercial structures, before being extended to residential buildings. It is important to note that this proposal is currently being assessed by the co-legislators as part of the wider revision of the Energy Performance of Buildings Directive.
- Second, by making authorization procedures shorter and simpler. The Commission will address this issue by adopting a legislative proposal, a recommendation, and a guidance.
- Third, ensuring the availability of an abundant skilled workforce to meet the challenge of solar energy production and deployment across the EU. In line with the call for stakeholders to establish an EU large-scale skills partnership for onshore renewable energy under the Pact for Skills, as part of the REPowerEU plan.
- Fourth, by launching a **European Solar PV Industry Alliance (ESIA)** that aims to facilitate innovation-driven expansion of a resilient industrial solar value chain in the EU, particularly in the PV manufacturing sector.

The EU solar energy has great potential to quickly become a mainstream part of our power and heat systems and a key lever for achieving the goals put in place in the European Green Deal while gradually eliminating our dependence on Russian fossil fuels. This strategy proposes to seize the abundant opportunities offered by energy technologies that run on sunshine. It sets out a roadmap to achieve this while allowing citizens to directly benefit from the advantages of

[15]https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2022%3A230%3AFIN&qid=1653033742483

solar energy technologies and the EU industry to seize this growth opportunity, creating jobs and added value for the EU.[16]

2.6 The Green Deal Industrial Plan (announced Feb 2023)

Earlier in 2023, the Commission has presented a Green Deal Industrial Plan[17] aiming to provide a more supportive environment for the scaling up of the EU's manufacturing capacity for the net-zero technologies and products required to meet Europe's climate targets.

The Plan builds on previous initiatives and relies on the strengths of the EU Single Market, complementing ongoing efforts under the European Green Deal and REPowerEU. It is based on four pillars: a predictable and simplified regulatory environment, speeding up access to finance, enhancing skills, and open trade for resilient supply chains.

The Net-Zero Industry Act and the Critical Raw Materials Act have been proposed as part of this framework. A reform of the electricity market design is also targeted. In terms of faster access to funding, the Plan aspires to amend the Temporary State Crisis and Transition Framework and revise the General Block Exemption Regulation. It also intends to answer the investment needs by proposing a European Sovereignty Fund.

To date, this Plan has not been approved yet.

2.6.1 Net-Zero Industry Act

The Net-Zero Industry Act (NZIA)[18] has been proposed in March 2023 as part of the Green Deal Industrial Plan. It intends to increase the competitiveness and resilience of the EU's net-zero technology industrial base which is viewed as the backbone of an affordable, reliable, and sustainable clean energy system. The proposal sets out targets for technologies deemed necessary to decarbonize the bloc's economy, a move aimed at preventing the EU from deepening its reliance on third countries like Russia or China. Solar photovoltaic is included in the list of technologies. The proposal sets a benchmark for the manufacturing capacity of those technologies to meet at least 40% of the EU's annual deployment needs by 2030.

2.6.2 Critical Raw Materials Act

A set of actions to ensure the EU's access to a secure, diversified, affordable and sustainable supply of critical raw materials has been proposed along the NZIA[19]. This Critical Raw Materials Act (CRMA) identifies a list of strategic raw materials, which are crucial to technologies important to Europe's green and digital ambitions and for defense and space applications, while being subject to potential supply risks in the future. It then sets benchmarks for domestic capacity along the strategic raw material supply by 2030:

[16] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13338-EU-solar-energy-strategy_en
[17] https://ec.europa.eu/commission/presscorner/detail/en/ip_23_510
[18] https://single-market-economy.ec.europa.eu/industry/sustainability/net-zero-industry-act_en
[19] https://ec.europa.eu/commission/presscorner/detail/en/ip_23_1661

- At least 10% of the EU's annual consumption for extraction,
- At least 40% of the EU's annual consumption for processing,
- At least 15% of the EU's annual consumption for recycling,
- No more than 65% of the Union's annual consumption of each strategic raw material at any relevant stage of processing comes from a single third country.

2.6.3 Reform of the EU electricity market design

The reform announced in March 2023 foresees revisions to the Electricity Regulation, the Electricity Directive, and the REMIT Regulation. It intends to introduce measures that incentivize longer term contracts with non-fossil power production and bring more clean flexible solutions into the system to compete with gas, such as demand response and storage. The reform seeks to avoid a repeat of the 2022 energy crisis, which saw consumers faced with soaring energy bills due to record-high gas prices.

Parts of the reform have been agreed in June 2023[20], inducing minimal changes.

2.7 Ban on forced labour (announced Sep 2022)

The Commission has presented a proposal in September 2022 for a regulation to prohibit products made using forced labour, including child labour, on the internal market of the EU[21].
The proposal covers products of any type, including their components, regardless of the sector or industry, made available within the EU market, meaning both products made in the EU for domestic consumption and for export, and imported goods. Member States would be responsible for the enforcement of the regulation's provisions. Their national authorities would be empowered to withdraw products made using forced labour from the EU market, following an investigation.
To date, no progress has been announced on the proposal.

[20] https://www.consilium.europa.eu/en/press/press-releases/2023/06/19/council-reaches-agreement-on-parts-of-electricity-market-reform/
[21] https://ec.europa.eu/commission/presscorner/detail/en/ip_22_5415

3 PV support schemes and IPV specificities

In this section, an overview of the support schemes for PV, as well as specific conditions or regulations on integrated PV (IPV) is presented for Belgium, France, Germany, Italy, Netherlands, Spain and Switzerland. Subsequent sections will delve into each IPV segment: BIPV, IIPV, AgriPV and VIPV.

3.1 Belgium

3.1.1 Belgium - Brussels

Table 3.1-1. Overview of regulatory framework for IPV in Brussels

IPV market segment	IPV market subsegment	Specific definition / support scheme / regulations for IPV	Associated sections
BIPV	**Roof**	Same support scheme as for BAPV	**3.1.1**
	Skylight	Specific Green Certificate Grant rate	
	Ventilated façade	Specific Green Certificate Grant rate	
	Balustrades & balconies	Specific Green Certificate Grant rate	
	Sunshades	Specific Green Certificate Grant rate	
IIPV	**PVNB**	No definition, same support scheme as for conventional PV	**5.2.1.1**
	Carports	Defined as "repetitive structure", same support scheme as for BAPV	
AgriPV		There is currently no definition for AgriPV in Brussels	**6.1.1**

Table 3.1-2. Support schemes for PV in Brussels

Subcategory	Condition	General description	Associated appendixes
Self-consumed electricity	-	Allowed Savings on the electricity bill amounting to the compensable retail electricity price	
Remuneration of injected electricity	[0 – 5] kWp	Net-billing	
	[5 – [kWp	No subsidy (remuneration is equivalent to wholesale market price)	
Remuneration of whole production	(BA)PV or roof BIPV (excluding skylights)	Green Certificates (allocated over 10 years) depending on installed capacity	**8.1.1**
Remuneration of whole production	BIPV	Green Certificates (allocated over 10 years) with higher revenue	

3.1.2 Belgium - Flanders

Table 3.1-3. Overview of regulatory framework for IPV in Flanders

IPV market segment	IPV market subsegment	Specific definition / support scheme / regulations for IPV	Associated sections
BIPV		Same support scheme as for BAPV	**3.1.2**
IIPV	**PVNB**	Predefinitions ("PV systems on roadsides and marginal grounds") exist, eligible for specific calls	**5.2.1.2**
	Carport	No definition, same as for conventional PV	
AgriPV	**Vertical**		

	Interval **Elevated**	AgriPV is defined, but is not subject to specific regulations or support schemes	**6.1.2**

Table 3.1-4. Support schemes for PV in Flanders

Subcategory	Condition	General description	Associated appendixes
With self-consumption business model			
Self-consumed electricity	-	Allowed Savings on the electricity bill amounting to the compensable retail electricity price	
Remuneration of injected electricity	Above 25 kWp PV installations in energy communities, PV installations on residential buildings, floating PV, PV installations on marginal lands and other PV installations	Bonus (on top of market price) allocated through Green Power Calls	**8.1.3**
	-	No subsidy (remuneration is equivalent to wholesale market price)	
Investment	[0 – 10] kWp	Investment premium	**8.1.4**

3.1.3 Belgium - Wallonia

Table 3.1-5. Overview of regulatory framework for IPV in Wallonia

IPV market segment	IPV market subsegment	Specific definition / support scheme / regulations for IPV	Associated sections
BIPV		Same support scheme as for BAPV	**3.1.3**
IIPV		There is currently no (pre)definition for IIPV in Wallonia. The same support scheme as for conventional PV applies.	**5.2.1.3**
AgriPV		There is currently no definition for AgriPV in Wallonia	**6.1.3**

Table 3.1-6. Support schemes for PV in Wallonia

Subcategory	Condition	General description	Associated appendixes
With self-consumption business model			
Self-consumed electricity	-	Allowed Savings on the electricity bill amounting to the compensable retail electricity price	
Remuneration of injected electricity	[0 – 10] kWp	Net-metering (until end of 2023)	
	[10 – [kWp	No subsidy (remuneration is equivalent to wholesale market price)	
Additional fees for prosumers	[0 – 10] kWp & benefitting from net-metering	Prosumer tariff (capacity-based in €/kW.a or energy-based €/$kWh_{injected}$)	**8.1.7**

3.2 France

Table 3.2-1. Overview of regulatory framework for IPV in France

IPV market segment	IPV market subsegment	Specific definition / support scheme / regulations for IPV	Associated sections
BIPV	**Tiles**	Specific investment support for a defined list of BIPV tiles, meeting landscape integration conditions.	**3.2**

	Others	Same support scheme as for BAPV but not eligible for rooftop investment premium.	
IIPV	**PVNB**	No definition, same support scheme as for conventional PV	**5.2.2**
	Commercial Carport	Falls in the "buildings, warehouses or canopies" category and associated support schemes + obligation of PV installation on parking lots of a certain size	
	Residential Carport	Falls in the "buildings, warehouses or canopies" category and associated support schemes	
AgriPV	**PV + Grazing**	Specific regulatory framework, but no specific support scheme	**6.2**
	Vertical		
	Interval		
	Elevated	Specific regulatory framework and have the possibility to participate in the "innovative tenders" in France	
	Greenhouses & Shadehouses		

Table 3.2-2. Support schemes for PV in France

Subcategory	Condition	General description	Associated appendixes
With self-consumption business model			
Self-consumed electricity	-	Allowed. Savings on the electricity bill amounting to the compensable retail electricity price	
Remuneration of injected electricity	[0 – 500] kWp & buildings, warehouses or canopies*	Feed-in tariff	**8.2.1**
	[100 – 1 000] kWp & buildings, warehouses or canopies	Feed-in premium allocated through tenders	**8.2.2**
Investment	[0 – 100] kWp & Roofs*	Investment premium (can be combined with feed-in tariff)	**8.2.2**
	[0 – 500] kWp & BIPV roofs* **	Investment premium (can be combined with feed-in tariff)	**8.2.2**
Full injection business model			
Remuneration of injected electricity	[0 – 500] kWp & buildings, warehouses or canopies*	Feed-in tariff	**8.2.1**
	[100 – 500] kWp & buildings, warehouses or canopies	Feed-in premium allocated through tenders	**8.2.3**
	[500 – 8 000] kWp & buildings, warehouses or canopies	Feed-in premium allocated through tenders	**8.2.3**
	[500 – [kWp & Ground-mounted	Feed-in premium allocated through tenders	**8.2.4**

*Two more conditions apply:

C1: For all systems, the installer of the system must be a certified professional

C2: For systems > 100 kWp, the calculation (simplified, i.e. only concerning the modules) carbon impact must be lower than 550 kgeqCO2/kWp

**Only BIPV tiles meeting landscape integration conditions are eligible.

3.3 Germany

Table 3.3-1. Overview of regulatory framework for IPV in Germany

IPV market segment	IPV market subsegment	Specific definition / support scheme / regulations for IPV	Associated sections
BIPV		Same support scheme as for BAPV	3.3
IIPV	**PVNB**	Defined and included in the same tender category as BAPV	5.2.3
	Carport	Specific category but included in the same tender category as ground-mounted PV	
AgriPV	**PV + Grazing**	Falls within AgriPV regulation. Specific financial support for such systems in tenders if some conditions are met.	6.3
	Vertical		
	Elevated		
	Interval		
	Greenhouses & Shadehouses	Falls within AgriPV regulation. Same support scheme as for ground-mounted PV.	

Table 3.3-2. Support schemes for PV in Germany

Subcategory	Condition	General description	Associated appendixes
With self-consumption business model			
Self-consumed electricity	[0 – 1 000] kWp	Allowed. Savings on the electricity bill amounting to the compensable retail electricity price	
Remuneration of injected electricity	[0 – 100] kWp	Feed-in tariff (cannot be combined with FIP)	8.3.1
	[0 – 300] kWp	Feed-in premium (cannot be combined with FIT)	8.3.1
	[300 – 1 000] kWp	Feed-in premium for up to half of the production	8.3.1
Full injection business model			
Remuneration of injected electricity	[0 – 100] kWp	Feed-in tariff (cannot be combined with FIP)	8.3.1
	[0 – 1 000] kWp	Feed-in premium (cannot be combined with FIT	8.3.1
	[300 – [kWp	Feed-in premium allocated through tenders	8.3.1

3.4 Italy

Table 3.4-1. Overview of regulatory framework for IPV in Italy

IPV market segment	IPV market subsegment	Specific definition / support scheme / regulations for IPV	Associated sections
BIPV		Same support scheme as for BAPV	3.4
IIPV		No definition, same as for conventional PV	5.2.4
AgriPV	**PV + Grazing**	Falls within AgriPV regulation. No support scheme available	6.4
	Interval	Falls within AgriPV regulation. Support schemes available	
	Vertical		
	Elevated	Falls within AgriPV regulation. No support scheme available	
	Greenhouses & Shadehouses		

Table 3.4-2. Support schemes for PV in Italy[22]

Subcategory	Condition	General description	Associated appendixes
Self-consumed electricity	[0 –] kWp	Allowed. Savings on the electricity bill amounting to the compensable retail electricity price	
Remuneration of injected electricity	[0 – 500] kWp	Net-billing (Scambio Sul Posto)	
	[0 – 100] kWp	Minimum guaranteed price (Ritiro Dedicato)	**8.4.1**
	[20-250] kWp	Feed-in tariff allocated through tenders	**8.4.2**
	Above 20 kWp	Feed-in premium allocated through tenders	**8.4.2**
Investment	Residential PV & Combination of PV installation with primary energy efficiency works	Tax credit (Superbonus)	**8.4.3**

3.5 Netherlands

Table 3.5-1. Overview of regulatory framework for IPV in the Netherlands

IPV market segment	IPV market subsegment	Specific definition / support scheme / regulations for IPV	Associated sections
BIPV		Same support scheme as for BAPV	**3.5**
IIPV		No definition, same support scheme as for conventional PV	**5.2.5**
AgriPV	**Elevated**	Defined, but generally not encouraged by the national policies.	**6.5**
	Other	No definition	

Table 3.5-2. Support schemes for PV in the Netherlands

Subcategory	Condition	General description	Associated appendixes
Self-consumed electricity	-	Allowed Savings on the electricity bill amounting to the compensable retail electricity price	
Remuneration of injected electricity	[0 – 15] kWp	Net-metering	
	[15 – 100] kWp	Wholesale electricity price	
	Above 15 kWp	Premium on top of wholesale electricity price (SDE++) (cannot be combined with ISDE)	**8.5.2**
Investment	[15 – 100] kWp	Investment support (ISDE) (cannot be combined with SDE++)	**8.5.2**

[22] https://www.gse.it & https://www.arera.it

3.6 Spain

Table 3.6-1. Overview of regulatory framework for IPV in Spain

IPV market segment	IPV market subsegment	Specific definition / support scheme / regulations for IPV	Associated sections
BIPV		Same support scheme as for BAPV	3.6
IIPV		No definition, same support scheme as for conventional PV	5.2.6
AgriPV		No definition, same support scheme as conventional PV	6.6

Table 3.6-2. Support schemes for PV in Spain[23]

Subcategory	Condition	General description	Associated appendixes
With self-consumption business model			
Self-consumed electricity	-	Allowed. Savings on the electricity bill amounting to the compensable retail electricity price	
Remuneration of injected electricity	[0 – 100] kWp	Net-billing	
	-	Hourly spot price	
Investment	Residential sector, public administrations and tertiary sector & SCR > 80%	One-shot investment premium	8.6.1
	Services sector and other productive sectors	One-shot investment premium	
Full-injection business model			
Remuneration of injected electricity	Large scale PV	Feed-in tariff allocated through tenders	

3.7 Switzerland

Table 3.7-1 Overview of regulatory framework for IPV in Switzerland

IPV market segment	IPV market subsegment	Specific definition / support scheme / regulations for IPV	Associated sections
BIPV		Increased tariffs compared to BAPV.	3.7
IIPV		No definition, same support scheme as for conventional PV	5.2.7
AgriPV		Defined, but no specific support scheme. Generally not incentivized.	6.7

[23] https://www.miteco.gob.es/en/prensa/ultimas-noticias/el-gobierno-aprueba-el-real-decreto-por-el-que-se-regulan-las-condiciones-del-autoconsumo-de-energ%C3%ADa-el%C3%A9ctrica-/tcm:38-496257
https://www.idae.es/
https://www.unef.es/
https://www.censolar.org/legislacion-fotovoltaica-2021/

Table 3.7-2. Support schemes for PV in Switzerland

Subcategory	Condition	General description	Associated appendixes
With self-consumption business model			
Self-consumed electricity	-	Allowed. Savings on the electricity bill amounting to the compensable retail electricity price	
Remuneration of injected electricity	-	Sold at a value depending on municipality and DSO	
Investment	BAPV	One-shot investment aid, depending on installed capacity (price/kWp)	
	BAPV, Tilt > 75°	"Winter production" bonus.	
	BIPV, [0-100] kWp	One-shot investment aid, depending on installed capacity (price/kWp). Higher value.	
	BIPV, Tilt > 75°	Higher "Winter production" bonus	
Full-injection business model			
Remuneration of injected electricity	-	Sold at a value depending on municipality and DSO	
Investment	BAPV/BIPV	One-shot investment aid, depending on installed capacity (price/kWp) + auctioned subsidies for capacities > 150 kWp	
	BAPV, Tilt > 75°	"Winter production" bonus.	
	BIPV, Tilt > 75°	Higher "Winter production" bonus	

4 Regulatory framework for BIPV

First, European level definitions and standardization of BIPV are presented. Then, regulations associated with buildings, that are of interest for the BIPV market and stakeholders, are provided for each studied country or region.

4.1 International and European definition and standards on BIPV

According to the works of IEA PVPS Task 15[24,25], a BIPV module is a *PV module and a construction product together, designed to be a component of the building. A BIPV product is the smallest (electrically and mechanically) non-divisible photovoltaic unit in a BIPV system which retains building-related functionality. If the BIPV product is dismounted, it would have to be replaced by an appropriate construction product.* Furthermore, a BIPV system is *a photovoltaic system in which the PV modules satisfy the definition above for BIPV products. It includes the electrical components needed to connect the PV modules to external AC or DC circuits and the mechanical mounting systems needed to integrate the BIPV products into the building.*

BIPV modules are required to have dual functionality as both construction product and electricity generation unit. This double characterization is expressed in European standard EN 50583 *Photovoltaics in buildings* (EN 50583-1 on BIPV modules and EN50583-2 on BIPV systems) and international standard IEC 63092 *Photovoltaics in buildings* (IEC 63092 -1 on BIPV modules and IEC 63092 -2 on BIPV systems). While IEC 63092 is on an international voluntary basis, EN 50583, now published as Part 1 and Part 2, which can be used voluntarily, could come into force as mandatory for CE marking according to the LVD, with its revision (currently in progress, September 2023) and thus define the regulatory situation for BIPV modules in the EU. The latter is considered as reference when analyzing the regulatory framework in Europe.

4.1.1 EN 50583

EN 50583 treats BIPV modules and systems as both electrical components and building products, consequently applying requirements for electrical products and systems as defined in:

- the Low Voltage Directive (LVD, 2014/35/EU)
- the Electromagnetic Compatibility (EMC) Directive (2014/30/EU)
- the Waste from Electrical and Electronic Equipment (WEEE) Directive (2012/19/EU)

as well as requirements from the construction sector:

- the Construction Product Regulation (CPR, (EU) n° 305/2011)
- the Energy Performance of Buildings Directive (EPBD, 2010/31/EU).

[24]https://iea-pvps.org/wp-content/uploads/2020/02/IEA-PVPS_Task_15_Report_C0_International_definitions_of_BIPV_hrw_180823.pdf

[25]https://iea-pvps.org/wp-content/uploads/2020/01/IEA-PVPS_15_R08__Analysis_of_requirements_specifications_regulation_of_BIPV__report.pdf

As a result, EN 50583-1 and EN5083-2 are umbrella standards covering general, electrical, building-related, labelling, documentation, testing and inspection requirements. They provide references to international electrical standards on photovoltaics such as IEC 61215 and IEC 61730. As those are well-known in the PV industry, and have been described in the BIPVBOOST project[26], they will not be detailed here. Typical standards of the building sector are also referenced, such as EN 13501 on fire testing or EN 12578 on sound insulation of glass in buildings. Those standards have been analyzed in the PVSITES project[27].

A revision of EN 50583 is currently ongoing and the new version has been forwarded to the national technical committees to give their approval or comments on the new document. The ongoing discussions and details are confidential and cannot be disclosed for the time being. The revision aims to update, among other topics, (i) the specification that the current version of the standard applies to BIPV modules that contain one or more glass pains, (ii) a better specification of the five mounting categories (A-E), (iii) the indication of related conformity standards,(iv) the definition of further requirements for BIPV modules (such as thermo-mechanical stress and impact resistance) and (v) a proposal for the correct labelling of the BIPV modules according to the new standard.

4.1.2 IEC 63092

IEC 63092 is a collection of existing standards based on EN 50583 and using the same categorization (part 1 – BIPV modules and part 2 – BIPV systems). It is organized to answer possible constraints and requirements of glass based BIPV modules and systems. Explicit references to Directives and Regulations of the European Union have been replaced by more general language and references to EN standards have been replaced by international standards wherever possible.

A third part, currently under evaluation and finalization, is intended to provide a versatile method to evaluate the solar heat gain coefficient (SHGC) of BIPV modules with a variety of designs. It applies to BIPV modules as defined in IEC 63092-1 and to different module designs using identical components such as cells, interconnection, encapsulation and front/back sheets. The title of the third chapter is IEC 63092-3 *Photovoltaics in buildings — Part 3: Evaluation methodology of SHGC for Building integrated photovoltaic modules with various designs.*

The full list of referenced standards is provided in Appendix 8.8.

4.1.3 IEC TR 63226

- IEC TR 63226:2021 *Solar photovoltaic energy systems - Managing fire risk related to photovoltaic (PV) systems on buildings* is a technical report (not a standard) discussing fire prevention measures during design, installation, commissioning and maintenance of PV

[26]https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5c36a19c8&appId=PPGMS

[27] https://www.pvsites.eu/downloads/download/report-standardization-needs-for-bipv

systems on buildings (including BIPV). It is intended for use as guidance for reducing fire risks in general and for site-specific needs for buildings with PV systems.

4.2 Country-specific regulations on buildings

Regulation on buildings possibly having an impact on PV and BIPV is included. Energy requirements are singled out in separate tables.

4.2.1 Belgium

Table 4.2-1 Regulatory framework for buildings in Belgium

Category	Region(s)	Regulatory document	Content
Urban planning	Brussels	Brussels Town Planning Code *(CoBAT)*	The urbanism laws regarding building integration of solar modules are contained in the Government Decree of 13 November 2008. This decree establishes under which conditions urbanism permission is needed for a solar installation. The need for permission (or the involvement of a government employee, local authorities, the royal commission for monuments, or an architect) can be avoided if the solar modules are not visible from the public space or located in roofs, parallel to the roof slope, not exceeding a 30 cm height or exceeding roof limits."
	Flanders	Flemish Code for Environmental Planning	Provides for a mixed system involving a duty to obtain a permit, a duty to notify, and certain exemptions. The exemption from planning permission for the placement of photovoltaic modules (except in certain protected areas or areas with special requirements) is contained in the Exemptions decree.
	Wallonia	Walloon code for town and country planning, urbanism, heritage and Energy (*CWATUPE*)	The installation of photovoltaic solar modules does not need an urbanism permission (Art. 262, paragraph 2) as long as the installation: - Does not imply non-fulfilment of other legal requirements (sector plans, local urbanism legislations) - Is not located on a protected building - Does not need actions or works under the conditions of urbanism permissions. The modification of the nature of colour of an element of the building envelope (which can be the case with BIPV) is subject to permission.
Thermal insulation	Brussels	*Arrêté du Gouvernement de la Région de Bruxelles-Capitale du 21 décembre 2007 déterminant des exigences en matière de performance énergétique et de climat intérieur des bâtiments* (decree)	Compliance with maximal thermal transmittance (or minimal thermal resistance) requirement should be reached in the following cases. - For all building elements of new buildings: passive performances are needed - For modified building elements of buildings undergoing major renovations - For modified building elements of buildings undergoing heavy renovations
	Flanders		New buildings should comply with U-value-related requirements.
	Wallonia	*Arrêté du Gouvernement wallon portant exécution du décret du 28 novembre 2013 relatif à la performance énergétique des bâtiments* (decree)	Under the performance-based building code approach, new buildings (and renovated part of refurbished buildings) should comply with: - U-value requirements - Overheating requirements - K-global level requirements
Fire regulation	All	*Koninklijk Besluit 'Basisnormen inzake brandpreventie'*	Roofing (sloped and flat) must meet the requirements of class BROOF T1 in case of external fire with burning debris (NBN EN 13501-5 / Test NBN CEN/TS 1187). This applies not only to the covering part but to all components.

Acoustic regulation	All	NBN S01-401	Protection against noise is regulated in Belgium through European standards for test and calculation methods and Belgian standards defining performance levels. Noise levels may not exceed the maximum laid down in standard NBN S01-401, category 4.
Insurance	All	Insurance Code	For housing: obligatory insurance of decennial guarantee of the covered and closed structural and watertightness works.

Table 4.2-2. Energy requirements of buildings in Brussels[28]

Requirement	Contribution of PV to meeting requirement	Associated appendixes
For new buildings and buildings undergoing a major renovation		
Total primary energy	The whole electricity production from renewable energy can be deducted in the primary energy demand calculation.	**8.1.2**
Net energy demand for heating	None	
Per element and global insulation	None	

Table 4.2-3. Energy requirements of buildings in Flanders[29]

Requirement	Contribution of PV to meeting requirement	Associated appendixes
For new buildings		
Total primary energy	The whole electricity production from renewable energy can be deducted in the primary energy demand calculation.	**8.1.5**
Contribution of renewable energy	The requirement can be met with a certain production of solar photovoltaic energy or solar thermal energy as well through other means including heat pump, biomass, external heat supply, but also in the case of new residential buildings, by financially participating in renewable energy projects	**8.1.6**
Per element and global insulation	None	
For buildings undergoing a major renovation		
Total primary energy	The whole electricity production from renewable energy can be deducted in the primary energy demand calculation.	**8.1.5**
Contribution of renewable energy	The requirement can be met with a certain production of solar photovoltaic energy or solar thermal energy as well through other means including heat pump, biomass, external heat supply, but also in the case of new residential buildings, by financially participating in renewable energy projects	**8.1.6**

[28] Arrêté du Gouvernement de la Région de Bruxelles-Capitale du 21 décembre 2007 déterminant des exigences en matière de performance énergétique et de climat intérieur des bâtiments (https://document.environnement.brussels/opac_css/elecfile/PEB_Arrete_Exigences_du_21_dec_2007_Vcoord_2023_FR.pdf?_ga=2.172361697.314270071.1665062949-624975124.1665062949)

[29] Decree of the Flemish Government concerning general provisions on energy policy ("Energy Decree") of the 19th of November 2010 - Tile IX of the Decree ("Energy performance of buildings")

Table 4.2-4. Energy requirements of buildings in Wallonia

Requirement	Contribution of PV to meeting requirement	Associated appendixes
For new buildings, reconstruction and extensions		
Total primary energy	The whole electricity production from renewable energy can be deducted in the primary energy demand calculation.	8.1.8
Per element and global insulation	None	
For major renovations		
Per element and global insulation	None	

4.2.2 France

Table 4.2-5 Regulatory framework for buildings in France

Category	Regulatory document	Content
Urban planning	Urban planning code	Legislative and regulatory provisions for town planning law.
Construction	Code of Construction and Housing	Legislative and regulatory articles: requirements in the field of safety, accessibility, acoustics and thermal insulation, and leaves the other performances to technical standards of a contractual nature. This code refers to main general regulatory for energy control; fire safety; Acoustic; Health; Seismic and structural; New EU Construction Products Regulation; Reach
Thermal Insulation	*Arrêté du 3 mai 2007 relatif aux caractéristiques thermiques et à la performance énergétique des bâtiments existants* (decree)	Official French legal code collecting various provisions relating to energy law. Work to install or replace thermal insulation on an opaque wall or glazed wall should be undertaken in a way that satisfies the RE2020 criteria for energy consumption (several classes exist).
Mechanical aspects	NF P78-116 *Verre dans la construction - Modules photovoltaïques en verre incorporés au bâti - Dimensionnement en toiture sous charges climatiques*	"Glass in building - Glass photovoltaic modules incorporated to the building - Sloped glass design under climatic loads" Aims to establish the sizing rules for photovoltaic modules integrated into building. The sizing approach is similar to that of conventional glazing.
	Seismic risk to determine mounting systems, depending on zones (Eurocode 8)	Calculation of mechanical characteristics for claddings and mounting systems. Drives to some extent the weight reduction of PV panels.
Fire regulation	Code of Construction and Housing	Fire behavior is judged on two criteria: - Fire reaction: represents the capability of a material to inflame and therefore to contribute to the development of a fire. - Fire resistance: means the property of a material or assembly in a building to withstand fire or give protection from it.
	NF EN 13501 Fire classification of construction products and building elements - Part 1 : classification using data from reaction to fire tests	provides a harmonized procedure for the classification of reaction to fire of construction products, including products incorporated within building elements like BIPV.
Acoustic regulation	Code of Construction and Housing	Many decrees give minimal acoustic characteristic depending on building type. To follow different French regulation requirements, different class levels in terms of:

		· Airborne sound insulation global between rooms-DnT,A · Façade sound insulation- DnT,A,tr · Impact sound insulation between rooms L'nT,w · Service equipment noise global - LnAT in dB(A)
Environment	RE2020 regulation specifying carbon emissions, Climate and Resilience law (2023)	Along with energy consumption reduction by thermal insulation enhancement, reduction of carbon emissions are considered in the last regulation RE2020 with calculated figure of merit, various class and thresholds and calculation method.
Consumer protection	Consumer Code	Include the legal provisions relating to the consumer law, which is a subset of the business law. Identify the risks relating to use of the product and implement measures to prevent them. Compliance with this obligation may be presumed on the basis of standards or test protocols.
Insurance	Insurance Code	Obligatory insurance of decennial guarantee implies a technical verification of the conformity of the works with technical standards by a controller contracted by the insurance company

Table 4.2-6. Energy requirements of buildings in France

Requirement	Contribution of PV to meeting requirement	Associated appendixes
For new buildings		
Energy demand	None	
Primary energy consumption	The primary energy consumption only accounts for imported energy. Therefore, renewable energy produced on site (e.g., PV) is not taken into account in the calculations and thus allows to reach lower primary energy consumption values.	**8.1.5**
Primary non-renewable energy consumption	None	
Climatic impact of energy consumption	The Climatic impact of energy consumption only accounts for imported energy. Therefore, renewable energy produced on site (e.g., PV) is not taken into account in the calculations and thus allows to reach lower Climatic impact of energy consumption values.	**8.2.6**
Climatic impact of construction	The use of solar cells can negatively impact the environmental footprint	**8.2.7**
Per element and global insulation	None	
"Solarisation" or revegetation obligation	New buildings of a certain size must be equipped with PV or a vegetal roof.	
For buildings undergoing a major renovation		
Per element and global insulation	None	

4.2.3 Germany

Table 4.2-7 Regulatory framework for buildings in Germany

Category	Regulatory document	Content
Construction	European Construction Products Regulation (EU-CPR). Annex 1	Basic requirements for buildings are defined in Annex I of the European Construction Products Regulation (EU-CPR). From these basic requirements of Annex I, as well as on the basis of harmonized specifications entailed in the CE marking, requirements for building products and their labelling are determined

Thermal insulation	Gesetz zur Einsparung von Energie und zur Nutzung erneuerbarer Energien zur Wärme- und Kälteerzeugung in Gebäuden (GEG)	For new residential and non-residential constructions, the maximum value of the specific transmission heat loss related to the heat-transferring enclosing area should not exceed defined values. For renovated buildings or building extensions, a threshold not to be exceeded is defined based on values for new buildings.

Table 4.2-8. Energy requirements of buildings in Germany[30]

Requirement	Contribution of PV to meeting requirement	Associated appendixes
For new buildings		
Total primary energy	Electricity from renewable energy can be deducted in the primary energy demand calculation under certain conditions and following a set of rules.	**8.3.3**
Share of renewable energy in heating and cooling demand	PV can help achieve the requirement. But, multiple alternatives are also possible (e.g., solar thermal, geothermal energy, environmental heat, waste heat from waste water, solid, liquid and gaseous biomass, renewable cold, heat from combined heat and power, district heating, district cooling) In the case of residential buildings, the requirement is also met if a certain absolute installed capacity of solar PV is installed.	**8.3.4**
Per element and global insulation	None	
For buildings undergoing a major renovation		
Total primary energy	None	**8.3.3**
Share of renewable energy in heating and cooling demand	None (Requirement only applies to public buildings and requirement cannot be met with renewable electricity)	
Per element and global insulation	None	

4.2.4 Italy

Table 4.2-9 Regulatory framework for buildings in Italy

Category	Regulatory document	Content
Construction	Construction code: d.P.R. 6 giugno 2001, n. 380 – «Testo unico delle disposizioni legislative e regolamentari in materia edilizia», update 2018	The first part defines the general recommendations. It defines urban and building parameters, building interventions, building function, procedures for building permission, height and density limits, distance between buildings. The second part gives accommodation to local regulators. It defines internal procedures, quality and sustainability regulations, technical requirements.
Mechanical aspects	D.M. 17 gennaio 2018 - Aggiornamento delle «Norme tecniche per le costruzioni»	The technical standards are inherent in the structural safety of the works. Themes like expected performance, actions on buildings, civil and industrial constructions, bridges. The structural design and calculation, the Geotechnical reports for earthquakes, the static test.
Thermal insulation		The global heat transfer coefficient, external wall mass and thermal transmittance should satisfy defined thresholds.
Fire regulation	D.M. 3 agosto 2015 – «Approvazione di norme	As code for fire prevention, it contains fire safety requirements for the design, construction and use of buildings. It defines terms,

[30] GEG - Gesetz zur Einsparung von Energie und zur Nutzung erneuerbarer Energien zur Wärme- und Kälteerzeugung in Gebäuden (http://www.gesetze-im-internet.de/geg/index.html)

	tecniche di prevenzione incendi»	symbols and risk conditions, and provides rules for fire prevention, protection and risk reduction.
Acoustic regulation	D.P.C.M. 5 dicembre 1997 – "Determinazione dei requisiti acustici passivi degli edifici"	Defines the performance that must own the buildings about noise isolation between different units, from outside noise, noise, noise of continuous and discontinuous and reverberation time.
Environment	Testo unico Ambiente (TUA), update 2018	Implementation of directives 2001/42/EC and 85/377/EEC (VAS) (VIA) regulates the procedures for strategic environmental assessment (sea), environmental impact assessment (EIA) and the integrated environmental authorization (IPPC); soil conservation and combating desertification, the protection of waters against pollution and water resources management; waste management and remediation of contaminated sites; the protection of the air and the reduction of atmospheric emissions; compensatory protection against environmental damage.

Table 4.2-10. Energy requirements of buildings in Italy

Requirement	Contribution of PV to meeting requirement	Associated appendixes
For new buildings and buildings undergoing major renovations		
Useful thermal performance index for heating and cooling	None	
Primary energy consumption	Monthly compensation between energy needs and renewable energy produced on site is possible but only for the same energy carrier (renewable electricity compensates non-renewable electricity).	**8.4.4**
Installed capacity for renewable electricity generation	Even though the regulation is technology agnostic, PV is the most straightforward option to meet the requirement	**8.4.5**
Share of renewable energy for domestic hot water needs & for domestic hot water, heating and cooling needs combined	PV can help achieve the requirement. But multiple alternatives are also possible (e.g., solar thermal, biomass; aeraulic, geothermal and hydraulic sources in the case of heat pumps for the portion considered renewable)	**8.4.6**
Per element and global insulation	None	

4.2.5 Netherlands

Table 4.2-11 Regulatory framework for buildings in the Netherlands

Category	Regulatory document	Content
Solar system integration in roofs and façades	NEN 7250/A1: specific norm for solar energy systems	The Netherlands developed specific norm regarding the integration in roofs and facades of solar energy systems (thermal and PV). It concerns BAPV and BIPV applications and focus on building aspects (wind and water resistance, snow…).

Table 4.2-12. Energy requirements of buildings in the Netherlands[31],[32]

Requirement	Contribution of PV to meeting requirement	Associated appendixes
For new buildings		
Total final energy demand	None	
Total primary fossil energy demand	The whole electricity production from renewable energy can be deducted in the primary energy demand calculation.	**8.5.3**
Share of renewable energy	PV can help achieve the requirement. But, multiple alternatives are also possible (e.g. solar energy, geothermal energy, wind energy, energy from outside air and solid biomass (under certain conditions).	**8.5.4**
Per element and global insulation	None	
Material-related environmental performance of buildings and civil engineering works	The use of solar cells can negatively impact the environmental footprint.	
For buildings undergoing a major renovation		
Renewable energy requirement	PV can help achieve the requirement. But, multiple alternatives are also possible (e.g. solar panels, heat pumps or heat networks)	**8.5.5**
Per element and global insulation	None	

4.2.6 Spain

Table 4.2-13 Regulatory framework for buildings in Spain

Category	Regulatory document	Content
Construction	Technical Building Code – (Código Técnico de la Edificación - CTE) Real Decreto RD 314/2006 Approved on 17th March 2006 (BOE 28-03-2006) and modifications.	It is the regulatory framework that establishes the requirements to be met by buildings in relation to the basic requirements of safety and habitability established by the LOE (Law on Building Ordinances).
Thermal insulation	National norm on thermal insulation – Documento Basico, HE, Ahorro de Energia, part of CTE	Each element of the thermal envelope should satisfy defined U-value thresholds (depending on the element), for new buildings and existing buildings in the case of an extension, a change of use or a renovation.
	National norm on solar control – Documento Basico, HE, Ahorro de Energia, part of CTE	The solar control, expressed in kWh.m².month, is the relationship between the solar gains during the month of July for openings in the thermal envelope (assuming solar protection devices are activated) and the useful surface of the living spaces. It should not exceed defined thresholds. This applies to new buildings and existing buildings in the case of an extension, a change of use or a renovation.

[31] https://www.nen.nl/nta-8800-2022-nl-290717

[32] Building Decree, Decree of 29 August 2011 establishing regulations with regard to the construction, use and demolition of structures, last amended by the Decree of 22 December 2021 (https://rijksoverheid.bouwbesluit.com/Inhoud/docs/wet/bb2012)

Certification	CE marking	In Spain, CE marking is the first "certification" asked and it is enough in most cases.
	DAU (Document of Assessment for fitness of Use)	The DAU is the statement of a favorable opinion on the performances of an innovative product or system regarding its intended uses and defined constructive solutions, within the field of building and civil engineering construction. A DAU assesses the fitness for the intended use of a constructive solution on the basis of objective levels or required limit values for building works and on functional requirements established case by case. ITeC (Insituto de Tecnología de la Construcción) has developed the voluntary option of the DAU, which is officially recognized by State Administration
	DIT (Documento de Idoneidad Técnica)	The DIT is a voluntary document which contains a favourable technical assessment o the suitability for use in building and/or civil works, of non-traditional or innovative construction materials, systems or procedures. The IETcc (The Eduardo Torroja Institute for Construction Sciences) of the CSIC is the only Spanish Organisation that has been granted, by Decree 3652/1963 of the Presidency of the Government and Ministerial Order 1265/1988 the authority to grant the DIT.
	TC (Technical Conformity Report)	The TC is a public declaration that assesses the technical approval of an innovative construction product or system with regard to the requirements derived from the CTE (Spanish Technical Building Code) and the CPR. TECNALIA drafts and grants the TC which is recognised by the Public Administration.

Table 4.2-14. Energy requirements of buildings in Spain[33]

Requirement	Contribution of PV to meeting requirement	Associated appendixes
For new buildings and buildings undergoing a major renovation		
Total primary energy	The primary energy conversion factor for renewable (in-situ or direct vicinity) electricity is significantly lower than the factor used for electricity from the grid. Consequently, renewable electricity which is self-consumed for the considered uses (heating, cooling, DHW, ventilation, temperature control, humidity and lighting) can actually contribute to reach lower consumption of total primary energy.	8.6.2
Total primary non-renewable energy	None	8.6.3
Share of renewable energy in DHW demand	PV can help achieve the requirement as this later can be fulfilled by renewable energy produced on site or, in the vicinity of the building (installed on the building plot). Yet, multiple alternatives are also possible (e.g., connection to an urban heating system, heat pumps reaching a certain average seasonal performance, residual energy from refrigeration equipment, dehumidifiers and residual heat from combustion of thermally-driven heat pump motors).	8.6.4
Electricity generation from renewable energy sources	Even though the regulation is technology agnostic, PV is the most straightforward option to meet the requirement.	8.6.5
Per element and global insulation	None	

[33] Documento Basico, HE, Ahorro de Energia

4.2.7 Switzerland

Buildings in Switzerland are regulated by federal laws as well as by laws and ordinances of the Cantons. Since Switzerland is a federal state made of 26 Cantons, there are 26 different Building Laws. Building permits are usually obtained from the local authority where the construction work is to be performed. The local authority coordinates with the authorities of the Canton and all other instances involved in issuing the building permit. Switzerland, to promote trade in goods by removing some technical barriers, signed the Mutual Recognition Agreements (MRAs) with the European Community, which entered into force on June 1, 2001, as a constituent of seven Bilateral Agreements that cover the main product categories, including construction products. Mutual Recognition Agreements (MRAs) are bilateral agreements that support commerce in commodities between the European Union and third nations, ease market access, and make conformity assessment more accessible. They define the circumstances in which one Party (non-member country) will accept conformity assessment results (such as testing or certification) completed by the other Party's (the EU) designated conformity assessment bodies (CABs) to demonstrate compliance with the first Party's (non-member country's) requirements. The authority which controls the Construction Product market in Switzerland is the Bundesamt für Bauten und Logistik (BBL). It is responsible for the application of the CE mark on building products. In Switzerland, the requirements for construction works are defined by a company of private law named SIA (Swiss Society of Engineers and Architects), and are typically considered as state of the art. Some of the standards or part of their content are referenced by the law and are therefore mandatory.

Table 4.2-15 Regulatory framework for buildings in Switzerland

Category	Regulatory document	Content
Construction	Construction product regulation (Bauproduktenverordnung, BauPV)	If a construction product is manufactured according to a technical specification, its conformity to the latter must be examined as part of a conformity assessment. Depending on the technical specification should preferably apply one of the following conformity assessment procedures: - assessment of conformity by the manufacturer; - conformity assessment by a conformity assessment body accredited According to the type of installation (façades or roof for example) PV modules can be treated as glazing system so the construction rules of constructive glass building must be met. Since concrete Swiss glazing rules do not exist, often German standards are used.
Thermal insulation	Mustervorschriften der Kantone im Energiebereich (MuKEn)	For new buildings and new building elements, there are requirements concerning: U-values, linear thermal transmittance coefficient and point coefficient of thermal transmittance. For transformed (not renovated) buildings and buildings changing their use, there are U-values requirements.
Acoustic regulation	Swiss Civil Code of 1907	It is the codified law ruling in Switzerland and regulating relationship between individuals. It contains rules that apply to the abatement of nuisances such as water or air pollution, as well as noise.

Table 4.2-16. Energy requirements of buildings in Switzerland

Requirement	Contribution of PV to meeting requirement	Associated appendixes

For new buildings		
Total final energy demand	The primary energy conversion factor for self-produced electricity is significantly lower than the factor used for electricity from the grid. Consequently, renewable electricity which is self-consumed for the considered uses (heating, cooling, DHW, ventilation, temperature control, humidity and lighting) can actually contribute to reach lower consumption of total primary energy.	**8.7.1**
Total primary fossil energy demand	None	
Share of renewable energy	A minimum installed capacity P of electricity generation (in, on or near the building) should be installed.	**8.7.2**
Per element and global insulation	New building elements have requirements regarding U-value, linear transmittance coefficient and point coefficient of thermal transmittance.	
For buildings undergoing a major renovation		
Renewable energy requirement	None	
Per element and global insulation	New building elements have requirements regarding U-value.	

5 Regulatory framework for IIPV

Infrastructure integrated PV (IIPV) has no definition per se in the countries of interest or in Europe, but we see mentions of specific PV cases that can come under the IIPV categorization, namely PV along highways such as PV noise barriers, or carports. In this section, these "pre-definitions" of IIPV across countries are listed, as well as regulations or support schemes applying to these segments.

Focusing on PVNBs, the use case in the infrastructure segment of SEAMLESS-PV, the applicable regulatory framework for noise barriers in Europe is summarized next. Even if there is no specific reference to PV noise barriers, it is expected that a future amendment would be based on the current normative framework, as it is being the case for BIPV. As of today, the applicable regulatory framework for PVNB would therefore be based on the current regulatory framework for noise barriers, complemented with PV-specific regulatory and standardisation frameworks (e.g. LVD and IEC 61215-61730).

5.1 Regulatory framework for Noise Barriers in the EU

Noise barriers for road infrastructure are construction products and consequently fall under the Construction Product Regulation (CPR 305/2011). CPR covers construction products in two different ways: stated requirements are compulsory when a harmonized standard is in force, while in the absence of it, they become voluntary. Among categories belonging to road equipment, noise barriers are regulated by the harmonized standard hEN 14388 published in the Official Journal of the European Union (OJEU)[34] and, therefore, their fulfillment is compulsory.

Below, the regulatory framework for noise reducing devices (NRD) and the CE marking process applicable to NRDs is presented.

5.1.1 European Noise Directive (END): Directive 2002/49/EC

The aim of this Directive is to define a common approach intended to avoid, prevent or reduce those harmful effects which derive from the exposure to environmental noise. The following actions are to be implemented progressively: (a) the determination of exposure to environmental noise, through noise mapping; (b) ensuring that information on environmental noise and its effects is made available to the public; (c) adoption of action plans by the Member States, based upon noise-mapping results, with a view to preventing and reducing environmental and to preserving environmental noise quality where it is good. Article 2 defines the application scope of this Directive, which shall apply namely to environmental noise to which humans are exposed in particular in built-up areas, in public parks or other quiet areas in an agglomeration, in quiet areas in open country, near schools, hospitals and other noise-

[34] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:C:2018:092:FULL&from=MT

sensitive buildings and areas. The Directive shall not apply to noise that is caused by the exposed person himself, noise from domestic activities, noise created by neighbours, noise at work places or noise inside means of transport or due to military activities in military areas.

5.1.2 CE marking (hEN 14388)

The CE marking process for NRDs relies on the harmonized standard *EN 14388:2015 - Road traffic noise reducing devices – Specifications*. Manufacturers must provide declaration of performance (DoP) for the essential requirements defined by the standard and affix the CE marking, thus taking responsibility for the declared performances. The scope is restricted to "noise barriers", "cladding", "coverings" and their structural and acoustic elements which act solely on noise propagation:

- Noise barriers: NRDs which obstruct the direct transmission of airborne sound emanating from road traffic.
- Claddings: NRDs which are attached to a wall or other structure and reduce the amount of sound reflected.
- Road covers: NRDs which either span or overhang the road.

Declaration of Performance:
According to CPR, CE marking is a harmonized way to declare the performance of construction products so that they can circulate within the common market. Performance has to be declared for the essential characteristics listed in Annex ZA of the harmonized standard.

Annex ZA is the part of the harmonized standard which identifies essential characteristics and provides the Assessment and Verification of Constancy of Performance (AVCP) to which the products need to be submitted before the manufacturer is entitled to draw up a Declaration of Performance (DoP) and to affix the CE marking.

The full NRD (complete system, not specific parts of it -e.g. acoustic panel-) is the product to be incorporated into a road infrastructure and its performance has to be declared for the following essential characteristics:

- Noise reduction
- Stability requirements (wind load and dynamic load of passing vehicles)
- Safety in use: resistance to impacts, light reflection
- Fire behaviour
- Long term performance
- Sustainable use of natural resources

Requirements:
hEN 14388 does not fix product requirements unless threshold values are established within the standards by Mandate. Authorities or Member States are in charge of establishing requirements but shall not impede the use of construction products bearing the CE marking,

when the declared performances correspond to the requirements for such use in that Member State.

The applicable standards to show evidence of compliance with essential characteristics is described next:

- **Noise reduction**
  - Acoustic screens to be installed in diffuse field conditions
    - Sound insulation required for diffuse field applications: measurements of the airborne noise insulation index DL_R carried out in accordance with EN ISO 10140-3 and as indicated in UNE EN 1793-2
    - Sound absorption required for diffuse field applications: The sound absorption index DL_α of the screen shall be determined on the basis of measurements carried out in accordance with EN ISO 354 and as indicated in EN 1 793-1.

  - Acoustic screens to be installed in direct field conditions
    - Sound insulation required for direct field applications: The airborne noise insulation index DL SI, corresponding to the area of acoustic elements and the airborne noise insulation index $DL_{SI,P}$ corresponding to the area of the support posts, will be determined as indicated in the UNE EN 1793-6 standard
    - Acoustic reflection for direct field applications: The overall sound reflection index DL_{RI} of the noise reducing device shall be determined as indicated in UNE EN 1793-5.

- **Stability requirements**
  In general, acoustic screens will consist of modular panels arranged between the standard steel profiles, which constitute the frame or support structure. Both the panels and the support structure must have been dimensioned, at least, in accordance with the provisions of the UNE-EN 1 794-1 and UNE-EN 1794-2 standards and without prejudice to greater requirements required in any other standard that is applicable.

  The behaviour under static loads (wind load and dynamic load of passing vehicles), risk of detachment, snow loads and impact behaviour are characteristics to be verified according to the standards above for the DoP.
- **Safety in use**
  When the project requires so, evidence of the performance of the test described in the UNE EN 1794-2 Annex D standard must be presented and verify that the declared values satisfy the requirements established to achieve the class required by the designer, as detailed in table D.1 of the corresponding annex of the aforementioned standard.

- **Fire behaviour**
  Evidence of the performance of the test described in the UNE EN 1794-3 standard must be presented and verify that the declared values satisfy the requirements established to reach, at least, the class that is applicable according to Table A.1 of Annex A, of the aforementioned standard.

- **Long term performance**
  Long-term acoustic and mechanical characteristics are tested according to EN 14389-1 and EN 14389-2, respectively.

5.2 Country pre-definitions on IIPV

5.2.1 Belgium

5.2.1.1 Brussels

The Brussels regulation around PV defines a specific segment (classified within BIPV) of "repetitive structures". Prefabricated structures that do not require the intervention of a stability engineer, such as pergolas or carports fall into this category[35].

5.2.1.2 Flanders

In Green Power Calls[36], "PV systems located on roadsides and marginal grounds" are eligible for specific calls. PVNB could qualify for this category.

5.2.1.3 Wallonia

There is no (pre)definition of IIPV in Wallonia as of the time of publishing of this report.

5.2.2 France

New parking lots above a certain size are the subject of a specific law, making a PV installation (in the form of a solar carport or canopy "*ombrière*") or a vegetal roof mandatory. Threshold sizes and cover ratio are defined to evolve progressively with time. Existing parking lots will also be subject to this law starting from 2028[37].

Table 5.2-1 Evolution of the obligation for PV installation on parking lots

Starting date	Scope	Size threshold	Cover ratio
November 2019	New parking lots, extensions or major refurbishments	1000 m²	30%
July 2023		500 m²	30%
July 2026		500 m²	40%
July 2027		500 m²	50%
January 2028	All existing parking lots	500 m²	To be defined

The word "*ombrière*" although not an actual definition, is increasingly used to describe elevated covering PV systems such as carports or bike lane covering PV systems. It is used for a specific category of support scheme tariffs, namely "buildings, warehouses or canopies" ("*bâtiment, hangar ou ombrière*").

[35] https://www.ejustice.just.fgov.be/eli/arrete/2015/12/17/2015031887/justel

[36] See Appendix BE(VL)1

[37] https://www.photovoltaique.info/fr/preparer-un-projet/quel-type-de-projet/obligations-de-solarisation/

5.2.3 Germany

Noise barrier PV systems (PVNB) are defined as a solar system segment along with BAPV. Tenders are based on this segment and therefore include bids for both types of systems.

Carports are not defined, but the implementation of PV on parking lots is considered in the ground-mounted segment of solar systems.

5.2.4 Italy

There is no (pre)definition of IIPV in Italy as of the time of publishing of this report.

5.2.5 Netherlands

PV installations on and near highways has been explored in the Netherlands, including through PV noise barriers, and is included in the energy strategy of the country[38], but no official definition exists as of the time of publishing of this report.

5.2.6 Spain

There is no (pre)definition of IIPV in Spain as of the time of publishing of this report.

5.2.7 Switzerland

Like the Netherlands, Switzerland is home to several PVNB projects, but there is no definition of IIPV in its regulatory texts as of the time of publishing of this report.

[38]https://www.rijksoverheid.nl/onderwerpen/duurzame-energie/meer-duurzame-energie-in-de-toekomst/duurzame-energie-infrastructuur

6 Regulatory framework for AgriPV

Agrivoltaics have various degrees of definition in the countries of interest. In this section, the scope and implications of these definitions are detailed, as well as associated regulations or support schemes.

6.1 Belgium

6.1.1 Belgium – Brussels

There is no definition in Brussels for AgriPV as of the time of publication of this report.

6.1.2 Belgium - Flanders

Table 6.1-1. AgriPV definition in Flanders and applications implied in the definition

Definition	Generation of solar energy on structures above agricultural crops or between crop rows. For local use or delivery to the grid depending on scale. (KULeuven definition)	Applications considered in the definition				
		Greenhouses	Grazing	Interval	Vertical	Elevated
				X	X	X

6.1.3 Belgium – Wallonia

There is no definition in Wallonia for AgriPV as of the time of publication of this report.

6.2 France

Table 6.2-1. AgriPV definition in France and applications implied in the definition.

Definition of AgriPV	A solar PV system can be considered agrivoltaic when the solar PV modules are located on the same area of plot as the agricultural production, and when they impact the agricultural production by providing one of the services listed below, without inducing any significant degradation of the agricultural production, or any farm income loss. Services: Climate change adaptation; Hazard protection; Animal welfare; Specific agronomic. The agrivoltaic project must also ensure its agricultural vocation, guarantee the sustainability of the agricultural site throughout its lifetime [..] its reversibility and its adequacy with local and territorial development, while limiting its impact on the environment, the soil and landscapes. [..]	Applications considered in the definition				
		Greenhouses	Grazing	Interval	Vertical	Elevated
		X	X	X	X	X

Table 6.2-2. AgriPV specific requirements and remuneration schemes in France.

	Requirements	Description	Specific Remuneration scheme
General regulation for agriPV	Expert Authorization, Agricultural authorities authorization	-	Non existant
	Territorial and landscape assessment to qualify for financial support	-	
	Impact on soil assessment	-	
	Reversibility and dismantling of the PV system	-	
	Specific zone exclusion	-	
	Agricultural production yield (production/ha)	The agricultural productivity must be > or = reference	
	Economic value (€/ha)	The economic value of the PV project + agricultural production per unit of the area must be > or = to the reference economic value	
	Dual use	Dual use must be guaranteed	
Elevated and greenhouses	-	-	There are tenders with incentives for "Innovative" technologies with more advantageous incentives (AgriPV can take part in regular tenders)

6.3 Germany

Table 6.3-1. AgriPV definition in Germany and applications implied in the definition.

		Applications considered in the definition				
		Greenhouses	Grazing	Interspace	Vertical	Elevated
Definition	Agrivoltaics is the combined use of the same land area for agricultural production as the primary use and for electricity PV production as the secondary use. (DIN SPEC 91434 definition, referred to by Germany's Renewable Energy Sources Act (EEG), to define support schemes.)		X	X	X	X

Table 6.3-2. AgriPV specific requirements in Germany[39].

	Requirements	Description
General regulation for AgriPV	Agricultural production yield (production/ha)	The agricultural productivity must be > 66% to the reference
	Dual use	Dual use must be guaranteed
	Reversibility	Dismantling must be possible
Elevated PV	Minimum & Maximum height	A minimum height of 2,1m is required for permitting.
	Area PV/ Total area	The PV-dedicated area must cover < 10%, for overhead systems of the area dedicated to agricultural production
Interval PV	Minimum & Maximum height	A maximum height of 2,1m is required for permitting.
	Area PV/ Total area	The PV-dedicated area must cover <15%, in the case of interval systems of the area dedicated to agricultural production

[39] https://www.gesetze-im-internet.de/eeg_2014/

Table 6.3-3 AgriPV specific remuneration schemes in Germany (EEG 2023[40]).

Condition	Specific Remuneration scheme
On arable land that is not a bog soil, with simultaneous crop cultivation on the same area,	Bonus on top of the existing support schemes: - 1,2 c€/kWh in 2023 - 1 c€/kWh in 2024 - 0,7 c€/kWh from 2024 to 2026 - 0,5 c€/kWh between 2026 and 2028
On arable land that is not a bog soil, with simultaneous agricultural use in the form of a cultivation of permanent crops or perennial crops on the same area	
On grassland, which is not a bog soil, with simultaneous agricultural use as permanent grassland, if the grassland is not located in a Natura 2000 area and is not a habitat type set out for the conservation of natural habitats and wild animals and plants.	
On moorland soils that have been drained and used for agriculture if the areas are permanently recovered with the construction of the solar system	0,5 c€/kWh bonus

6.4 Italy

Table 6.4-1. AgriPV definition in Italy and applications implied in the definition.

		Applications considered in the definition				
		Greenhouses	Grazing	Interval	Vertical	Elevated
Definition of AgriPV	Refers to a photovoltaic system that adopts solutions aimed at preserving the continuity of agricultural and pastoral farming activities, on installation site. Agrivoltaic systems that can, at a minimum, ensure interaction between energy production and agricultural production.	X	X	X	X	X

Table 6.4-2. AgriPV specific requirements and remuneration schemes in Italy.

	Requirements	Description	Specific Remuneration scheme
General regulation for agriPV	Agricultural production yield	The agricultural productivity must be at least = to the reference	The compliance with these requirements is mandatory and are not enough to be eligible to incentives.
	PV yield	The PV yield must be >60% to the reference	
	Economic value	The economic value of the PV project + agricultural production per unit of the area must be > or = to the reference economic value	
	Area PV/ Total area	The PV-dedicated area must cover < 40% of the total area	
	Agri Area / Total area	The PV-dedicated area must cover > 70% of the total area	
	Dual use	Dual use must be guaranteed	
	Productivity, water and crops monitoring	The agriPV system is equipped with a monitoring system to assess the impact on crops, water savings, agricultural activity and the continuity of the activities. This requirement	This requirement is mandatory for vertical and elevated systems, but optional for the rest. Incentives are provided for these systems.
	Soil fertility, microclimate and climate change monitoring	The agriPV system is equipped with a monitoring system to assess the recovery of soil fertility, microclimate and resilience to climate change.	This requirement is optional. The compliance of this requirement for vertical and elevated systems makes them eligible for accessing the National Recovery and Resilience Plan.
Elevated	Minimum Height	A minimum height is required of 1m for cultivation and 3m for livestock. This technology is considered as "innovative"	These systems are eligible for incentives for incentives, payable in the electricity tariff
Vertical	-	This technology is considered as "innovative"	

[40] https://www.gesetze-im-internet.de/eeg_2014/

6.5 Netherlands

Table 6.5-1. AgriPV definition in the Netherlands and applications implied in the definition

Definition of AgriPV	A form of sustainable agriculture in which crops are grown under panels that generate solar energy, allowing for efficient use of available land and solar energy. The dual use of land must be granted, and the PV production should not affect the agricultural activity. The National Environmental Vision (NOVI) includes a preference for solar energy on roofs. Only in the last instance can we install solar panels on agricultural and natural land.	**Applications considered in the definition**				
		Greenhouses	**Grazing**	**Interval**	**Vertical**	**Elevated**
			If grazing activity happens below the PV system (e.g. shelter)			X

Table 6.5-2. AgriPV specific requirements and remuneration schemes in the Netherlands.

	Requirements	**Description**	**Specific Remuneration scheme**
General regulation for agriPV	Technical & administrative authorizations	In some municipalities an authorization is required	Non existant
	Dual use	Agricultural activity must be maintained for at least 10 years	
	Agri Area / Total area	There must be no loss of agricultural land	
	Agricultural production yield (production/ha)	According to the Dutch government website there could be consequences for a reduced agricultural production, but the consequences are not specified.	

6.6 Spain

There is no definition in Spain for AgriPV as of the time of publication of this report.

6.7 Switzerland

Table 6.7-1 AgriPV specific requirements and remuneration schemes in the Netherlands.

	Requirements	**Description**	**Specific Remuneration scheme**
General regulation for agriPV	Technical & administrative authorizations	Agrivoltaic installations are only allowed in zones where the impact on the landscape is of little importance. Additionally, installation on protected zones can be subject to an obligation for further authorizations.[41]	Non existant
	Dual use	Agricultural activity must be the main use, with energy production being secondary. The PV installation must have positive impacts on the agricultural production (such as an agricultural yield improvement) or be deployed as experimentation or research.[42]	

[41] https://www.fedlex.admin.ch/eli/cc/1979/1573_1573_1573/fr

[42] https://fedlex.data.admin.ch/filestore/fedlex.data.admin.ch/eli/cc/2000/310/20220701/fr/pdf-a/fedlex-data-admin-ch-eli-cc-2000-310-20220701-fr-pdf-a-1.pdf

7 Regulatory framework for VIPV

Little to no definition, regulations or incentives specific to VIPV exist. However, several policies and directives are aimed at electric vehicles (EVs) that could in turn drive VIPV technologies. In this section, EU policies on EVs are presented, then country-specific regulations and incentives around EVs are detailed.

7.1 EU level policies on vehicles

7.1.1 Regulation (EC) No 661/2009 and Regulation (EU) 2018/858

EC Regulation 661/2009," is a European Union regulation that pertains to the type-approval requirements for motor vehicles and their trailers. It was adopted on July 13, 2009, and it establishes specific technical and administrative provisions for the approval of various categories of motor vehicles and trailers in the European Union. The regulation covers aspects such as (i) the definition of vehicle categories and the establishment of specific requirements for each category, such as passenger cars, commercial vehicles, and trailers; (ii) safety and environmental standards that vehicles must meet to be approved for sale and use within the EU, including requirements related to emissions, lighting, braking, and other safety features; (iii) it outlines the type approval procedures that manufacturers must follow to demonstrate that their vehicles comply with the specified technical requirements, typically involving testing and certification by competent authorities; (iv) it introduces provisions related to vehicle emissions, aligning with environmental goals and standards in the EU and setting limits on emissions of pollutants such as carbon dioxide (CO2) and nitrogen oxides (NOx); (v) technical requirements for various vehicle components and systems, such as engine emissions, safety features, and lighting are also introduced; (vi) Conformity of Production; manufacturers are required to ensure that vehicles produced in series conform to the approved type.

Regulation (EU) 2018/858 is part of the EU's regulatory framework for ensuring the safety, environmental performance, and quality of vehicles sold within the European Union. It tackles the type-approval and market surveillance of motor vehicles and their components and systems. Key provisions of the regulation address: (i) Strengthening Vehicle Type Approval, introducing stricter requirements for vehicle manufacturers and establishing more stringent control mechanism; (ii) strengthens market surveillance measures to ensure that vehicles already in circulation meet the required safety and environmental standards; (iii) Recall and Non-Conformity Reporting in cases of serious safety or environmental risks; (iv) vehicle data sharing entitling manufacturers to allow data sharing with authorized third parties, including independent operators and repair shops, to enable effective diagnostics and repair of vehicles; (vi) higher transparency on type approval process; (vii) cybersecurity and (viii) access to OBD information.

Regulation (EU) 2018/858 represents a significant step toward enhancing the safety and environmental performance of vehicles on European roads, as well as ensuring better control over the type-approval process and aftermarket services. It is part of a broader effort to align

vehicle regulations with the latest technological advancements and emerging challenges, such as cybersecurity.

Manufacturers and stakeholders involved in the automotive industry need to adhere to the requirements and provisions outlined in these regulations when manufacturing, distributing, or maintaining vehicles and their components within the EU market.

7.1.2 CO_2 emission performance standards for cars and vans (update Apr 2023)

On 1 January 2020, Regulation (EU) 2019/631 entered into force, setting CO_2 emission performance standards for new passenger cars and vans[43]. It replaced and repealed the former Regulations (EC) 443/2009 (cars) and (EU) 510/2011 (vans). The Regulation sets EU fleet-wide CO_2 emission targets applying from 2020, 2025 and 2030 and includes a mechanism to incentivize the uptake of zero- and low-emission vehicles.

On 19 April 2023, the European Parliament and the Council adopted Regulation (EU) 2023/851 amending Regulation (EU) 2019/631 to strengthen the CO_2 emission performance standards for new passenger cars and new light commercial vehicles in line with the European Union's increased climate ambition, as part of the Fit for 55 packages. In particular, the amendment strengthens the emission targets applying from 2030 and sets a 100% reduction target from 2035 onwards.

7.1.2.1 EU fleet-wide CO_2 emission target levels

The target levels refer to the NEDC emission test procedure. From 2021, the emission targets for manufacturers are based on the WLTP (Worldwide harmonized Light vehicles Test Procedure). For the period starting in 2025, the EU fleet-wide CO2 emission targets are defined as a percentage reduction from a 2021 starting point.

Table 7.1-1. EU fleet-wide CO2 emission targets for cars and vans

	2020 - 2024	2025 - 2029	2030 - 2034	2035 onwards
Cars	95 g_{CO2}/km	15% reduction	55% reduction	100% reduction
Vans	147 g_{CO2}/km	15% reduction	50% reduction	100% reduction

From 2035 onwards, the EU fleet-wide CO_2 emission target for both cars and vans are a 100% reduction, meaning 0 g CO_2/km. The annual specific emission targets of each manufacturer are based on these EU fleet-wide targets, taking into account the average mass of its newly registered vehicles.

If the average CO_2 emissions of a manufacturer's fleet exceed its specific emission target in a given year, the manufacturer has to pay – for each of its vehicles newly registered in that year – an excess emissions premium of €95 per g/km of target exceedance.

[43]https://climate.ec.europa.eu/eu-action/transport-emissions/road-transport-reducing-co2-emissions-vehicles/co2-emission-performance-standards-cars-and-vans_en

7.1.2.2 Incentive mechanism for zero- and low-emission vehicles

From 2025, a new zero- and low-emission vehicles (ZLEV) crediting system will apply to both car and van manufacturers. Following the amendments introduced in 2023, this system will apply until the end of 2029. It allows for the relaxation of a manufacturer's specific emission target, if its share of new ZLEVs (vehicles with emissions between 0 and 50 g CO_2/km (WLTP)) registered in a given year exceeds the following benchmarks (as amended by Regulation (EU) 2023/851): 25% for cars, 17% for vans.

A one percentage point exceedance of the ZLEV benchmark will increase the manufacturer's CO_2 target (in g CO_2/km) by one percent. The target relaxation is capped at maximum 5% to safeguard the environmental integrity of the Regulation.

7.1.2.3 Eco-innovations

Manufacturers may obtain emission credits for vehicles equipped with innovative technologies for which it is not possible to demonstrate the full CO_2 savings during their type of approval. The manufacturer must demonstrate these savings based on independently verified data.

"Battery charging solar roofs" for passenger cars have approved as eco-innovation under NEDC[44]. This could represent an opportunity for VIPV.

The maximum emission credits for these eco-innovations per manufacturer are 7 g CO_2/km per year (until 2024), 6 g CO_2/km from 2025 until 2029 and 4 g CO_2/km from 2030 until and including 2034.

7.1.3 CO_2 emission performance standards for heavy-duty vehicles (2019, revision proposal 2023)

EU-wide CO_2 emission standards targets for heavy-duty vehicles (trucks and buses) were first adopted in 2019 with Regulation (EU) 2019/1242. In 2023, the Commission proposed a revision of the Regulation on CO_2 emission standards for heavy-duty vehicles, introducing stronger targets and extending the scope of the Regulation to cover smaller trucks, city buses, long-distance buses and trailers[45].

7.1.3.1 EU fleet-wide CO_2 emission target levels

The fleet-wide average CO_2 emission targets for new vehicles are defined as a percentage reduction from the 2019 starting point.

[44]https://circabc.europa.eu/ui/group/4cf23472-88e0-4a52-9dfb-544e8c4c7631/library/a0fe865a-f615-4889-b04d-bab46aa00104/details

[45]https://climate.ec.europa.eu/eu-action/transport/road-transport-reducing-co2-emissions-vehicles/reducing-co2-emissions-heavy-duty-vehicles_en

Table 7.1-2. EU fleet-wide CO2 emission targets for heavy-duty vehicles (trucks and buses)

	2025	2030	2035	2040
2019 Regulation	15% reduction	30% reduction	-	-
2023 Revision proposal	15% reduction	45% reduction	65% reduction	90% reduction

Furthermore, 100% of new city buses will have to be zero emissions from 2030 onwards.

In case of non-compliance with the CO_2 targets, the level of the penalties is set to €4,250 per gCO_2/tkm of target exceedance in 2025 and €6,800 euro per gCO_2/tkm of target exceedance in 2030.

7.1.3.2 Incentive mechanism for zero- and low-emission vehicles

The uptake of zero- and low-emission vehicles (ZLEV) is incentivized. Lorries without an internal combustion engine, or with an internal combustion engine that emits less than 1gCO_2 per kWh or per km are considered zero-emission vehicles (ZEV). Lorries with a technically permissible maximum laden mass of more than 16t, with CO_2 emissions of less than half of the average CO_2 emissions of all vehicles in its group registered in the 2019 reporting period are considered low-emission vehicles (LEV).

Until 2024, a super-credit system applies, counting ZLEV vehicles multiple times for the calculation of the fleet-wide average specific emissions of a manufacturer. A multiplier of 2 applies for ZEV, and a multiplier between 1 and 2 applies for LEV, depending on their CO_2 emissions. An overall cap of 3% is set to preserve the environmental integrity of the system.

From 2025 onwards, a benchmark-based crediting system will be used. The average specific CO_2 emissions of a manufacturer are adjusted downwards if the share of ZLEV in its entire new heavy-duty vehicles fleet exceeds the 2% benchmark.

7.2 Country-specific incentives regarding electric vehicles and charging stations

7.2.1 Belgium

Table 7.2-1 Incentives regarding electric vehicles in Belgium

Policy applying to	Incentive type	Target	Details	Notes
EVs	**Direct financial incentives**	Individuals	Flanders: Some local governments in Flanders have purchase subsidies for zero-emission taxi's/shared cars.	
		Companies	Company EV purchases are 100% deductible from tax. Brussels: In the Brussels Capital Region micro and small companies who need to replace a diesel van due to the Brussels' Low Emission Zone (LEZ), may receive a purchase subsidy for a non-diesel van for 20 % of the purchase price (max €3 000).	Until 2026
	Indirect financial incentives	Individuals	Flanders: Registration and ownership tax exemption: - BEVs and FCEVs (M1) are exempt (registration) - BEVs and FCEVs (M1 and N1) are exempt (ownership) - 6% VAT (instead of 21%) for electricity consumption For benefit in kind (BIK), the government also checks CO2 emissions from 2021. In 2021, BIK was €1 370 per year if the catalogue value is lower than or equal to €39 958. Brussels and Wallonia: Registration and ownership tax advantages: - minimum tax rate (€61.50) for BEVs and FCEVs (M1).(registration) - minimum rates for BEVs and FCEVs (ownership) - 6% VAT (instead of 21%) for electricity consumption For benefit in kind (BIK), the government also checks CO2 emissions from 2021. In 2021, BIK was €1 370 per year if the catalogue value is lower than or equal to €39 958. 75 % from the cost of charging can be deducted from Income Tax.	
		Companies	Tax benefits for BEVs and FCEVs apply to company cars as well. Maximum deductibility (100%) of expenses for M1 with ≤ 50g CO2/km (NEDC) and battery capacity ≥ 0.5kWh per 100kg of vehicle weight. Minimal annual benefit in kind for BEVs, FCEVs and PHEVs (M1): 4% of the list value. Battery electric vehicles (BEVs) are 100 % deductible from 2020 onwards. Applicable for companies and self-employed (*ZZP*). Tax advantages are only available for EV company cars.	
	Non-financial incentives	Individuals	/	
		Companies	/	
	Incentives disadvantaging alternatives	Individuals	/	
		Companies	Tax deductible % of thermal vehicles will decrease to reach 0 in 2028.	
Charging stations	**Direct financial incentives**	Individuals	Flanders: Some local governments in Flanders have subsidies for the installation of charging infrastructure.	
		Companies	Brussels: For micro or small companies, up to €15,000 to replace max. 3 N1 vehicles/year.	
		Individuals	Purchase and installation cost deduction.	Until 2024

	Indirect financial incentives		Federal level: 35% deduction of investment in new BEVs and FCEVs (N1-N3) and in related charging and fueling infrastructure.	
		Companies	Flanders: Purchase and installation cost deduction: - 40% of additional cost of up to €400,000/ vehicle for max. 2 BEVs (N2 and/or N3). - 27.5% of additional cost of up to €600,000/vehicle for max. 2 BEVs (M2 and/or M3). - 22.5% of additional cost of up to €350,000/vehicle for max. 2 FCEVs (N2 and/or N3).	
	Non-financial incentives	Individuals	/	
		Companies	/	

7.2.2 France

Table 7.2-2 Incentives regarding electric vehicles in France

Policy applying to	Incentive type	Target	Details	Notes
EVs	**Direct financial incentives**	Individuals	Ecological Bonus on purchase or loan (*bonus/malus écologique*), scrappage premium (*prime à la conversion*). Bonus to buy car or van with ≤ 20g CO2/km: - €6,000 for households, if vehicle ≤ €45,000 - €4,000 for legal persons, vehicle ≤ €45,000 - €2,000 for households and legal persons, vehicle between €45,000 and €60,000, FCEV vans and cars, or vans > €60,000 Bonus to buy car or van > 21 and ≤ 50g CO2/km: - €1,000 for households, vehicle ≤ €50,000 Bonus BEV or FCEV heavy-duty vehicles: - €50,000 for N2/N3 vehicles - €30,000 for M2/M3 vehicles Scrappage scheme for purchase of secondhand or new vehicles with ≤ 50g CO2/km, price ≤ €60,000: - Cars: up to €5,000, based on income - Vans: up to €9,000, based on the weight	
		Companies	/	
	Indirect financial incentives	Individuals	Regions provide a tax exemption (*taxe sur les certificats d'immatriculation*), either total or 50%, for alternatively powered vehicles (i.e., electric, HEVs, CNG, LPG and E85). BEVs, FCEVs, PHEVs (with a range of > 50km) are exempt from the mass-based malus.	
		Companies	Exemption from CO2-based tax component (*TVS*) for vehicles emitting less than 60g CO2/km (apart from diesel vehicles).	
	Non-financial incentives	Individuals	Loan system for modest revenues (*microcrédit véhicules propres*). Cities like Paris have introduced low-emission zones where only cleaner vehicles, including EVs, are allowed and thermal vehicles are progressively phased out until 2030.	
		Companies	Fleet share obligations (public and private).	
	Incentives disadvantaging alternatives	Individuals	Malus on purchase or loan (*bonus/malus écologique*), tax depreciation disadvantage (*plafonnement de l'amortissement*).	
		Companies	/	

Charging stations	**Direct financial incentives**	Individuals	Until the end of 2023, *ADVENIR*, the French EV Infrastructure Charging Programme, will offer a grant to cover 50% of the cost (maximum €1,160) for collective charging stations to multiple owners in condominiums.	Until the end of 2023
		Companies	Commercial charging incentives covered by the *ADVENIR* program: 50% of the investment, with a cap of €2,700 from April 1st, 2022.	
	Indirect financial incentives	Individuals	Until the end of 2023, *ADVENIR* will offer a tax credit of €960 for purchasing and installation of a charging station.	Until the end of 2023
		Companies	/	
	Non-financial incentives	Individuals	/	
		Companies	Obligation of pre-equipment on new buildings.	

7.2.3 Germany

Table 7.2-3 Incentives regarding electric vehicles in Germany

Policy applying to	Incentive type	Target	Details	Notes
EVs	**Direct financial incentives**	Individuals	Purchase grant. Bonus for cars with net list price ≤ €40,000: - €9,000 for BEVs and FCEVs - €6,750 for PHEVs Bonus for cars with net list price > €40,000: - €7,500 for BEVs and FCEVs - €5,625 for PHEVs	Stricter requirements in discussion
		Companies	/	
	Indirect financial incentives	Individuals	Registration tax and ownership tax exemption. For initial registrations until 31 December 2030, there is a tax exemption of 10 years for electric vehicles (purely electric or fuel-cell vehicles, not hybrid vehicles). After the exemption, the car tax will amount to 50 % of €11.25 (up to 2,000 kg), €12.02 (up to 3 000 kg) or €12.78 (up to 3 500 kg) for each 100 cc or part thereof. Private usage of a fully electric company car with a list price below €60,000, is taxed at only 0.25% of the list price per month. In comparison, Internal Combustion Engine (ICE) cars are taxed at 1%. Private usage of a hybrid company car or a fully electric company car with a list price above €60,000, is taxed at only 0.5% of the list price per month.	Until 2030
		Companies	Employers offering free charging of electric vehicles or bicycles will not be taxed for this service until 2030.	Until 2030
	Non-financial incentives	Individuals	Certain cities in Germany allow EVs to use bus lanes, which can result in a significant reduction in commuting times. EVs are allowed unrestricted access to environmental green zones (*Umweltzone*), while certain other types of vehicles are restricted or must pay a fee.	
		Companies	/	
	Incentives disadvantaging alternatives	Individuals	Certain types of vehicles (non-EV) are restricted or must pay a fee to access environmental green zones (Umweltzone).	
		Companies	/	
Charging stations	**Direct financial incentives**	Individuals	The *KfW* programme, awards grants on behalf of the Federal Ministry of Transport and Digital Infrastructure (*BMVI*). €900 is currently awarded for a charging station. From September 2023, a new program will provide grants for the simultaneous	

			purchase of PV systems (> 5kW), storage systems (> 5kWh) and charging stations (> 11 kW).	
		Companies	/	Incentive program for SMEs closed in 2021
	Indirect financial incentives	Individuals	Company car owners that charge their EVs at home can benefit from a tax reduction.	
		Companies	/	
	Non-financial incentives	Individuals	/	
		Companies	/	

7.2.4 Italy

Table 7.2-4 Incentives regarding electric vehicles in Italy

Policy applying to	Incentive type	Target	Details	Notes
EVs	**Direct financial incentives**	Individuals	Financial contribution on purchase: - €3,000 (€5,000 with scrappage) for an electric car (M1) emitting ≤ 20g CO2/km and with a selling price of ≤ €35,000 + VAT. - €2,000 (€4,000 with scrappage) for an electric car (M1) emitting 21-60g CO2/km and with a selling price of ≤ €45,000 + VAT.	
		Companies	Financial contribution on purchase	
	Indirect financial incentives	Individuals	Electric vehicles are exempt from the annual ownership tax for a period of 5 years from the date of their first registration. After this five-year period, they benefit from a 75 % reduction of the tax rate applied to equivalent petrol vehicles in many regions.	
		Companies	Fringe benefit cars emitting up to 60 g/km CO2 are taxed at a lower rate (25 % on conventional parameters related to an average journey and cost per km) compared to the previous taxation (30 % applied to all vehicles based on the above-mentioned parameters). Different rates based on car emissions: - 30 % for cars emitting from 61 to 160 g/km CO2; - 50 % for cars emitting from 161 to 190 g/km CO2; - 60 % for cars emitting from 191 g/km CO2 upwards.	
	Non-financial incentives	Individuals	Free parking, free circulation in *ZTL* (Limited Traffic Zones)	
		Companies	/	
	Incentives disadvantaging alternatives	Individuals	/	
		Companies	/	
Charging stations	**Direct financial incentives**	Individuals	Natural and legal persons to benefit from a contribution for the installation and purchase of charging stations equal to 80 % of the expenditure made. A further contribution is envisaged for the purchase and installation of infrastructure for recharging electric cars: the maximum limit for this contribution is €1,500. However, the 2023 electric car incentives can be up to €8,000 euros if the stations are installed in apartment buildings.	
		Companies	Financial contribution on purchase and installation	
	Indirect financial incentives	Individuals	Tax credit granted to taxpayers who install EV charging infrastructures up to 22 kW. It amounts to 50 % of the purchase and installation cost up to €3 000, to be split into ten equal annual tranches.	
		Companies	/	

	Non-financial incentives	Individuals	/	
		Companies	/	

7.2.5 Netherlands

Table 7.2-5 Incentives regarding electric vehicles in the Netherlands

Policy applying to	Incentive type	Target	Details	Notes
EVs	**Direct financial incentives**	Individuals	Since July 2020, the Netherlands has applied a purchase subsidy for private persons. Subsidy scheme (*SEPP*) for individuals to buy/lease a small or compact BEV car, new or used. Subsidy scheme (*SEBA*) for entrepreneurs to buy/lease a new commercial vehicle (N1 or N2 weighing up to 4,250kg). For 2023, the subsidy amounts for electric passenger cars that meet the conditions are: - Used electric passenger car purchase or private lease: €2,000; - New electric passenger cars for sale or private lease: €2,950. Conditions: - The car is fully electric (i.e., not a plug-in hybrid) - The car was purchased by an individual. - The car was purchased in the year in which the subsidy is applied for. Subsidy budget must also still be available. - The car has been registered in the applicant's name continuously for at least 3 years. For private lease, this is 4 years. - The list price of the electric car is a minimum of €12,000 and a maximum of €45,000. Also, the range is at least 120 kilometers. - A used electric car is bought from a car company. - Environmental investment deduction (*MIA*) for BEV and FCEV light commercial vehicles and BEV taxis. Arbitrary depreciation of environmental investments scheme (*VAMILI*) for FCEV cars or taxis and BEV cars equipped with solar panels.	Until 2025
		Companies	Purchase subsidy	Until 2025
	Indirect financial incentives	Individuals	Zero emission cars are exempt from paying registration tax (*BPM*). Exemption from *MRB*: Every vehicle owner pays 'motor vehicle tax' (also known colloquially as road tax), except owners of a fully electric car. They are exempt from MRB by the national government up to and including 2024. Individuals with a BEV have a lower percentage of the list price added to their income when using their company car also privately. Rate: 22% for petrol cars. For BEVs it changed from 4% to 16% in 2022 and remains for 2023. Increases to 17% in 2025, 22% in 2026. Cap for car list price: reduced from € 35,000 to € 30,000 in 2023.	Until 2025 (registration tax), Until 2024 (ownership tax)
		Companies	/	
	Non-financial incentives	Individuals	/	
		Companies	/	

	Incentives disadvantaging alternatives	Individuals	Zero emission cars are exempt from paying registration tax (*BPM*). For other cars, the system is progressive, with different levels of CO2 emissions that pay different amounts of registration tax.	
		Companies	/	
Charging stations	**Direct financial incentives**	Individuals	/	
		Companies	Environmental Investment Allowance (*MIA*): Using the *MIA*, companies can receive an investment deduction of up to 36% of the amount invested into a charging point.	
	Indirect financial incentives	Individuals	The Dutch government has introduced a reduction in the energy tax on the electricity supplied for charging stations up to and including 2024. This has no direct impact on private owners of electric cars.	Until 2024
		Companies	Arbitrary depreciation of environmental investments (*VAMIL*): *VAMIL* offers companies the possibility to depreciate 75% of the investment costs of a charging point.	
	Non-financial incentives	Individuals	Free charging points in public spaces in Amsterdam, Eindhover, the Hague, Rotterdam, Utrecht: Application and installation of a new public charging point are free. With a charge card, you can use the public charging points and pay based on energy consumption.	
		Companies	/	

7.2.6 Spain

Table 7.2-6 Incentives regarding electric vehicles in Spain

Policy applying to	Incentive type	Target	Details	Notes
EVs	**Direct financial incentives**	Individuals	Grant for purchase or lease, scrappage. Incentive scheme (MOVES III) in 2021-2023: Cars (M1): €4,500-7,000 for BEVs and FCEVs, and €2,500-5,000 for PHEVs, for private individuals, depending on whether a vehicle is being scrapped. Vans (N1): €7,000-9,000 for private individuals, depending on scrapping.	
		Companies	Incentive scheme (MOVES MITMA) for N2, N3, M2 and M3 vehicles: Scrappage of a vehicle registered before January 2019 (€25,000-2,500 depending on Euro class and type of vehicle) Acquisition of new alternatively fueled vehicles (BEV, PHEV, HEV, and gas for buses) Incentives from €190,000 to €15,000, depending on the vehicle type and the size of the company.	
	Indirect financial incentives	Individuals	Exemption from 'special tax' for vehicles emitting ≤ 120g CO2/km. Canary Islands: VAT exemption for alternatively powered vehicles (e.g. BEVs, FCEVs, PHEVs, EREVs, HEVs) emitting ≤ 110g CO2/km. Reduction of 75% for BEVs in main cities (e.g. Madrid, Barcelona, Zaragoza, Valencia, etc.) The use of a company car for private purposes is regarded as a payment-in-kind and included in the calculation of personal income tax: - 30 % reduction for BEVs and plug-in hybrid (PH)EVs ≤ €40 000; - 20 % reduction for HEVs ≤ €35 000.	

		Companies	Fringe benefit cars emitting up to 60 g/km CO2 are taxed at a lower rate (25 % on conventional parameters related to an average journey and cost per km) compared to the previous taxation (30 % applied to all vehicles based on the above-mentioned parameters). Different rates based on car emissions: - 30 % for cars emitting from 61 to 160 g/km CO2; - 50 % for cars emitting from 161 to 190 g/km CO2; - 60 % for cars emitting from 191 g/km CO2 upwards.	
	Non-financial incentives	Individuals	Toll exemption on regional highways EVs. Free parking in selected cities. Traffic lanes reserved for high occupancy circulation can be used only by the drivers of BEV's.	
		Companies	/	
	Incentives disadvantaging alternatives	Individuals	/	
		Companies	/	
Charging stations	**Direct financial incentives**	Individuals	Under the Moves II plan, private individuals and businesses can receive grants between 30-40% (up to a total sum of €100,000) of the purchase and installation cost of public or private chargers. Municipalities with less than 5 000 inhabitants will therefore receive a subsidy of an additional 10 % for charging stations from the central government. But EVs will also receive an additional 10 % subsidy.	
		Companies		
	Indirect financial incentives	Individuals	/	
		Companies	/	
	Non-financial incentives	Individuals	/	
		Companies	/	

7.2.7 Switzerland

Table 7.2-7 Incentives regarding electric vehicles in Switzerland

Policy applying to	Incentive type	Target	Details	Notes
EVs	**Direct financial incentives**	Individuals	Regional or municipality-based incentives exist, but most have been phased out.	
		Companies	Regional or municipality-based incentives exist. The canton of Basel-Stadt reimburses 20 % of the purchase price of purely electric vehicles (up to a maximum of CHF 5 000 per vehicle) to companies based in the canton.	
	Indirect financial incentives	Individuals	Tax reductions exist depending on each canton policy. The automobile tax in Switzerland is similar to the VAT. Electric cars (not plug-in hybrids) are exempt from automobile tax of 4 % of the vehicle value.	
		Companies	Tax reductions exist depending on each canton policy.	
	Non-financial incentives	Individuals	/	
		Companies	/	
	Incentives disadvantaging alternatives	Individuals	/	
		Companies	/	
Charging stations	**Direct financial incentives**	Individuals	/	
		Companies	The support is region dependent. For example, the canton of Bern supports charging stations for electric cars at companies. Maximum CHF 20 000 per charging station; max.CHF 60 000 per location.	
		Individuals	/	

	Indirect financial incentives	Companies	/	
	Non-financial incentives	Individuals	/	
		Companies	/	

8 APPENDIX

8.1 Belgium

8.1.1 Appendix BE(BXL)1: Green Certificates

For PV systems of any size allowance of Green Certificates (GCs) is possible. For each MWh produced, a certain number of GCs are received. Their value is market-based. Electricity suppliers are not forced to buy these GCs; therefore, the regional government guarantees to buy these GCs at a minimum value of 65 €. Electricity suppliers typically buy the GCs at an average value of 95€ (2021 average). Green Certificates remunerate the whole electricity production (self-consumed and injected) over a 10-year period. The allowance of Green Certificate is defined separately for PV and BIPV systems. The number of Green Certificates (GC) received for each MWh produced (or grant rate) is calculated as follow:
Grant rate [GC/MWh] = Reference grant rate * multiplication coefficient
Where:

- the reference grant rate is fixed at 1,81
    - the multiplication coefficient varies depending on the installed capacity and (since 12/2021) on the type of PV system (BAPV or BIPV)
- The correction coefficient is revised every year to maintain a flat return on investment in seven years. By 01/09 of the current year, the value of the granting rates is recalculated and is communicated by BRUGEL to the Minister for Energy. If this calculation results in a multiplication coefficient that differs from the coefficient in force, the Minister adapts it before October 1 of the current year and with effect from January 1 of the following year. However, earlier changes can be made if there is a 20% change observed in one or more of the following parameters during the year (average costs, subsidies, …).

Table 8.1-1. Minimum remuneration through Green Certificates for PV & BIPV systems in Brussels[46]

Type of PV system	Categories	Multiplication coefficient	Grant rate [CV/MWh]	Minimum revenues* [€/MWh]
PV	P ≤ 5 kWp	1,045	1,9	123,5
	5 kWp < P ≤ 36 kWp	0,99	1,8	117
	36 kWp < P ≤ 100 kWp	0,935	1,7	110,5
	100 kWp < P ≤ 250 kWp	0,77	1,4	91
	250 kWp < P	0,66	1,2	78
BIPV (for any size)	Skylight	1,045	1,9	123,5
	Balcony	1,045	1,9	123,5
	Sun shading	0,99	1,8	117
	Ventilated façade	1,33	2,4	156
	Repetitive structure, full roof system, solar tiles	Same as BAPV		

* Assuming a GC value of 65 €/MWh

[46] https://www.brugel.brussels/themes/energies-renouvelables-11/mecanisme-des-certificats-verts-35

8.1.2 Appendix BE(BXL)2: Primary energy demand requirement

For new residential buildings, the consumption of primary energy, expressed in kWh/m²$_{net\ floor\ area}$*for heating, cooling, DHW, ventilation, and auxiliary services of (part of) a building in the spaces contained inside the thermal envelope of the building should not exceed 45 kWh/m²$_{net\ floor\ area}$*a. For major renovations of residential buildings, this minimal requirement is multiplied by 1,2 (54 kWh/m²$_{net\ floor\ area}$*a). For heavy renovations of residential buildings, this minimal requirement is 150 kWh/m²$_{net\ floor\ area}$*a.

For new non-residential buildings, the consumption of primary energy, expressed in kWh/m²$_{net\ floor\ area}$*a for heating, cooling, DHW, ventilation, lighting and auxiliary services of a building or part of a building in the spaces contained inside the thermal envelope of the building should not exceed a certain share of the primary energy consumption of a reference building (i.e., a building which is the same size and shape as the actual building and has standardized properties for building envelope and technical systems), referred to as E. For major renovations of non-residential buildings these minimal requirements are multiplied by 1,2. For heavy renovations of non-residential public buildings these minimal requirements are multiplied by 1,6[47].
Examples of primary energy factors to be used can be found in the following table, and the whole PV production on site can be deducted in the calculations using the primary energy conversion factor indicated.

Table 8.1-2. Primary energy factors in Brussels[48]

Energy vector	Primary energy factor
Fossil fuel	1
Electricity from the grid	2,5
Electricity from an on-site cogeneration of photovoltaic installation	2,5
Biomass	1

8.1.3 Appendix BE(VL)1: Green Power Calls

For rooftop PV and for larger PV systems located on roadsides and marginal grounds, additional support can be received by participating in green power calls. It is a competitive bidding process during which each applicant submits a bid for a project expressed in €/kWh. The best-ranked bids will be paid out according to the budget.[49]

For rooftop PV, there is a condition on the maximal investment costs to be able to participate in the call. This condition may prevent some BIPV roof systems from participating because of their higher investment costs.

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[47] *Arrêté du Gouvernement de la Région de Bruxelles-Capitale du 21 décembre 2007 déterminant des exigences en matière de performance énergétique et de climat intérieur des bâtiments* (https://document.environnement.brussels/opac_css/elecfile/PEB_Arrete_Exigences_du_21_dec_2007_Vcoord_2023_FR.pdf?_ga=2.172361697.314270071.1665062949-624975124.1665062949)

[48] *Arrêté du Gouvernement de la Région de Bruxelles-Capitale du 26 janvier 2017 établissant les lignes directrices et les critères nécessaires au calcul de la performance énergétique des unités* PEB (https://document.environnement.brussels/opac_css/elecfile/PEB_Arrete_Lignes_Directrices_du_26_janv_2017_Vcoord_2023_FR_NL.pdf?_ga=2.83927771.314270071.1665062949-624975124.1665062949)

[49] https://www.vlaanderen.be/call-groene-stroom/resultaten-call-groene-stroom-2022-call-2

Table 8.1-3. Maximal eligible costs to bid in the green power calls[50]

Installed capacity	Maximal eligible costs [€/kWp]
25 kWp < P < 250 kWp	1030
250 kWp < P < 750 kWp	858
750 kWp < P < 5 000 kWp	696

For larger PV systems located on roadsides and marginal grounds, they are eligible to apply for each sub-call 2 ("all other PV installations"). In addition, facilities on marginal lands are also subject to a specific call (Call 2, sub-call 1) where they can receive support.

In 2023, three calls will again be held, subject to:

- Call 1 (from April 17th-May 2nd):
  - for PV installations in energy communities and PV installations on residential buildings (sub-call 1),
  - all other PV installations (sub-call 2)
- Call 2 (from May 30th-June 13th):
  - for floating PV installations and PV installations on marginal lands (sub-call 1),
  - all other PV installations (sub-call 2)
- Call 3 (from October 17th-October 31st):
  - for PV installations in energy communities and PV installations on residential buildings (sub-call 1),
  - all other PV installations (sub-call 2)

8.1.4 Appendix BE(VL)2: Investment support

For roof PV systems with an installed capacity below 10 kWp, investment support exists. In any case, the subsidy will not exceed 1500 € and 40% of investment costs (incl. VAT).[51]

Table 8.1-4. Investment support in Flanders for small residential PV systems

	Subsidy for the first 4 kWp [€/kWp]	Subsidy for capacity between 4 and 6 kWp [€/kWp]
2022	300	150
2023	150	75
2024	75	37,5

8.1.5 Appendix BE(VL)3: Primary energy demand requirement

The consumption of primary energy, expressed in kWh/m² of usable floor area for heating, cooling, DHW, ventilation, auxiliary energy (and lighting for non-residential buildings) should not exceed the values found in The thresholds are presented in terms of E-level, where the value after the "E" corresponds to the ratio between the primary energy consumption of the real building and the primary energy consumption of a reference buildings.

[50] https://energiesparen.be/groene-energie-en-wkk/wetgeving
https://codex.vlaanderen.be/PrintDocument.ashx?id=1036500&datum=&geannoteerd=false&print=false
[51] https://www.energiesparen.be/premie-zonnepanelen-2022

Table 8.1-5. Primary energy demand requirements in Flanders

Type of building		New construction	Major renovation
Residential building		E30	E60
Non-residential building	Office	E50	E70
	Education	E55	E65
	Healthcare	E50-E60	E60-E70
	Sport Centre	E40-E50	E60

Table 8.1-6. Primary energy factors in Flanders

Energy Vector	Primary energy conversion factor
Fossil fuels	1
Electricity (also used to deduce PV production)	2,5
Self-generated electricity by means of cogeneration	1,8
Biomass	1

8.1.6 Appendix BE(VL)4: Contribution of renewable energy requirement.

For new construction and major renovations as well as for residential buildings and non-residential buildings a requirement concerning renewable energy exists. The requirement can be met with a certain production of solar photovoltaic energy or solar thermal energy as well through other means including heat pump, biomass, external heat supply, but also in the case of new residential buildings, by financially participating in renewable energy projects. Exact requirements quantification can be found below.

Table 8.1-7. Renewable energy contribution requirements in Flanders52

	New construction		Major renovation
	Residential building	**Non-residential building**	
Condition to meet requirement with PV	> 15 kWh/year.m²$_{\text{usable floor area}}$	> 20 kWh/year.m²$_{\text{usable floor area}}$	> 15 kWh/year.m²$_{\text{usable floor area}}$
Alternatives to meet requirement	> 0,025 m²$_{\text{collector}}$/m²$_{\text{usable floor area}}$ of solar thermal energy system Biomass boiler, biomass stove, building-related CHP on biomass for heating > 85% of the gross space heating energy requirement covered by a heat pump Connection to an external heat supply system > 20€/m²$_{\text{usable floor area}}$ financial participation in a project to produce energy from renewable energy sources in the Flemish Region. The project will produce at least 15 kWh/year.m²$_{\text{usable floor area}}$, added up for the buildings of all participants taking this measure to comply with this decision.	> 20 kWh/year.m²$_{\text{usable floor area}}$ of solar thermal energy system 100% of gross energy requirement for space heating covered by biomass boiler, biomass stove, building-related CHP on biomass for heating, heat pump, or external heat supply system.	> 15 kWh/year.m²$_{\text{usable floor area}}$ of solar thermal energy system 100% of gross energy requirement for space heating covered by biomass boiler, biomass stove, building-related CHP on biomass for heating, heat pump, or external heat supply system.

[52] Besluit van de Vlaamse Regering houdende algemene bepalingen over het energiebeleid (Energiebesluit van 19 November 2010), Subsection III/2 Share of renewable energy, Article 9.1.12/2

8.1.7 Appendix BE(WAL)1: Prosumer tariff

Beneficiaries of net-metering are liable to a "prosumer" tariff to compensate for the fact that because of the net-metering design, prosumers do not pay network tariffs for a part of their electricity consumption (equivalent to the amount of electricity injected to the grid). There are two possibilities for this tariff:

- A capacity-based prosumer tariff: its value is expressed in terms of €/kW and varies from one area in Wallonia to another. The value of the capacity-based prosumer tariff assumes a self-consumption rate of 37,76%.
- An energy-based prosumer tariff: its value is expressed in terms of €/$kWh_{injected\ to\ the\ grid}$. Choosing this tariff is only possible if a smart meter is installed and is only advantageous if the self-consumption rate is higher than 37,76%.

The net-metering scheme and consequently the prosumer tariff should be phased out during the next regulatory period (2024-2028).

Table 8.1-8 Prosumer tariff in Wallonia[53,54]*

Capacity-based prosumer tariff [€/kW.a]	Energy-based prosumer tariff [€/$kWh_{injected}$]
80 ± 5	0,15

8.1.8 Appendix BE(WAL)2: Primary energy demand requirement

New buildings (residential and non-residential, but not industrial) as well as reconstructions and extensions under some conditions (where a volume of 800 m³ is created, the existing volume is a least doubled or the technical systems and at least 75% of the building envelope are replaced) should comply with primary energy consumption requirements. The requirement is twofold for residential buildings: absolute (E_{spec}) and relative to a reference building i.e., share between the primary energy consumption of the real building to that of the reference building (E_W). For non-residential buildings the requirement is only relative (E_W). The primary energy consumption is expressed in kWh/m².a where the m² refer to the heated and/or cooled floor area and covers the following uses: heating, cooling, domestic hot water, auxiliary energy (and lighting for non-residential buildings).

Table 8.1-9. Primary energy demand requirements in Wallonia[55]

Building type		E_{spec} [kWh/m².a]	E_W [-]
Residential		85	45
Non-residential (excluding industrial)	Office	-	45
	Education	-	45
	Sport	-	90
	Health	-	90

Table 8.1-10. Primary energy factors in Wallonia

Energy vector	Primary energy factor
Fossil fuel	1
Electricity from the grid	2,5
Electricity from an on-site cogeneration of photovoltaic installation	2,5
Biomass	1

[53] https://www.ores.be/particuliers-et-professionnels/tarif-prosumer-calcul
[54] https://www.cwape.be/node/150#compteur-double-flux
[55] https://wallex.wallonie.be/eli/arrete/2014/05/15/2014027210/2021/01/01

8.2 France

8.2.1 Appendix FR1: Applicable FIT

Table 8.2-1. Applicable feed-in tariffs in c€/kWh in France

	With self-consumption scheme* (01/02/23 – 30/04/23)	Full-injection scheme* (01/02/23 – 30/04/23)
P <= 3 kWp	13,13	23,49
3 kWp < P <= 9 kWp	13,13	19,96
9 kWp < P < 36 kWp	7,88	14,30
36 kWp < P < 100 kWp	7,88	12,43
100 kWp < P < 500 kWp	12,87 * K_{n+2}/K_n	

* For up to 1600 full load hours (remuneration above the limit is 50 €/MWh)

** For up to 1100 full load hours (remuneration above the limit is 40 €/MWh)

8.2.2 Appendix FR2: Investment support

Table 8.2-2. Investment support in case of business model with self-consumption[56]

	Investment support [€/Wp] (01/02/23 – 30/04/23)
P <= 3 kWp	0,5
3 kWp < P <= 9 kWp	0,37
9 kWp < P < 36 kWp	0,21
36 kWp < P < 100 kWp	0,11

Table 8.2-3. Investment premium for BIPV systems meeting landscape integration conditions[57]

	Investment support [€/Wp] From October 2022 to October 2023 while the cumulative installed capacity does not exceed 115 MW
P <= 100 kWp	0,133
100 kWp < P <= 250 kWp	0,128
250 kWp < P < 500 kWp	0,125

Only the following BIPV tiles systems are eligible to the landscape integration investment premium BIPV systems meeting landscape integration conditions:

Table 8.2-4. Eligible BIPV tiles to the landscape integration investment premium

Product	**Company**
Sunstyle	SUNSTYLE INTERNATIONAL
Tuiles et Ardoises PV	EDILIANS
FAG 10 Solaire	EDILIANS
SYSTOVI P-MAX intégré	CETIH CARQUEFOU
Sunstyle Acier	SUNSTYLE INTERNATIONAL
Solardoise	VMH ENERGIES

[56] https://www.photovoltaique.info/fr/actualites/detail/arrete-s21-modification-de-lindexation-et-mise-a-jour-des-tarifs-et-des-primes/

[57] Arrêté du 6 octobre 2021 fixant les conditions d'achat de l'électricité produite par les installations implantées sur bâtiment, hangar ou ombrière utilisant l'énergie solaire photovoltaïque, d'une puissance crête installée inférieure ou égale à 500 kilowatts telles que visées au 3° de l'article D. 314-15 du code de l'énergie et situées en métropole continentale

8.2.3 Appendix FR3: Feed-in premium allocated through tenders for PV on buildings, warehouses or canopies

In case of willingness to self-consume ("self-consumption call for tenders"):
For PV systems with an installed capacity between 100 kWp and 1 MWp, applicants submit a price per kWh which will be awarded for 10 years in the form of a feed-in premium, on top of the average wholesale market spot price of electricity.* The owners of the installation also benefit from the savings on the electricity bill thanks to self-consumption. Priority is given to the self-consumption of electricity and excess electricity can be valued through the feed-in premium scheme.

* 3 EUR/MWh are granted in addition to the remuneration provided for in the case of participative investment, i.e. crowdfunding. This premium equals 1 EUR/MWh in case of crowdlending.

In case of full feed-in (i.e., no self-consumption):
For PV systems with an installed capacity between 100 kWp and 500 kWp, candidates bid for a price per kWh. An electricity sales contract is concluded for a period of 20 years for the successful candidates, taking the form of a feed-in tariff.
For PV systems with an installed capacity between 500 kWp and 8 MWp, applicants (a) submit a price (b) per kWh which will be granted for 20 years in the form of a feed-in premium, on top of the average wholesale market spot price of electricity.

(a) Canopies are not eligible and must candidate to ground-mounted tenders (which follow similar rules).

(b) The offers are also evaluated according to their carbon footprint (25% of the final score), in addition to the price. To obtain the maximal score, the simplified CO_2 footprint of 200 kg_{eqCO2}/kWp should be obtained. Above 550 kg_{eqCO2}/kWp, the score is 0. [58]

8.2.4 Appendix FR4: Feed-in premium allocated through tenders for ground-mounted PV

For conventional PV[59]

The results of the two last auctions were respectively announced in March 2022 and August 2022 with average bid of 58,84 €/MWh and 68,51 €/MWh.

For innovative PV (including agriPV)[60]

The results of the last auction were announced in January 2023 with an average bid of 84,46 €/MWh.

8.2.5 Appendix FR5: Primary energy demand requirement

The indicator C_{ep} is used to evaluate the primary energy (non-renewable energy in the case of $C_{ep,nr}$) consumption for heating, cooling, domestic hot water, lighting, ventilation, parking's ventilation and lighting, collective areas' lighting, elevators or escalators. It is expressed in

[58] CRE, January 2022, Cahier des charges de l'appel d'offres portant sur la réalisation et l'exploitation d'Installations de production d'électricité à partir de l'énergie solaire « Centrales sur bâtiments, serres agricoles, hangars et ombrières de puissance supérieure à 500 kWc ». AO PPE2 PV Bâtiment

[59] https://www.ecologie.gouv.fr/solaire#scroll-nav__7

[60] https://www.lechodusolaire.fr/66-laureats-pour-la-1er-session-de-lappel-doffres-ppe2-pv-innovant/

kWh/m².a where the square meters are those of the livable area for residential buildings and the usable area for non-residential buildings.
The primary energy consumption only accounts for imported energy. Therefore, renewable energy produced on site (e.g., PV) is not taken into account in the calculations and thus allows to reach lower Cep values. In order to favour self-consumption, exported renewable energy (e.g. excess electricity fed into the grid) is not taken into account and is not deductible in primary energy consumption calculations.In order to comply with the requirement, the following condition should be met (In order to take into account regional and local differences as well as building-related specificities, this C_{ep}_max value is the result of a C_{ep}_maxmoyen value (i.e., national average) weighted by a series of coefficients which allow to increase the threshold if certain conditions make the requirements more difficult to meet):
$C_{ep} \leq C_{ep}$_max & $C_{ep,nr} \leq C_{ep,nr}$_max
Where:

- C_{ep}_max = C_{ep}_maxmoyen * (1 + Mcgéo + Mccombles + Mcsurf_moy + Mcsurf_tot + Mccat)
- $C_{ep,nr}$_max = $C_{ep,nr}$_maxmoyen* (1 + Mcgéo + Mccombles + Mcsurf_moy + Mcsurf_tot + Mccat)

The different Mc coefficient aim at reflecting different geographical and building related conditions:

- Mcgéo: reflects different climatic conditions related to different altitude and climatic zones.
- Mccombles: reflects the attic floor area installed in the building
- Mcsurf_moy: reflects the average surface of the dwellings
- Mcsurf_tot: reflects the total surface of the building
- Mccat: reflects the external constraints categories

Primary energy conversion factors to consider are presented in the table below.

Table 8.2-5. Primary energy conversion factors in France

Energy source	Primary energy factor for $C_{ep,nr}$ calculation	Primary energy factor for C_{ep} calculation
Electricity (grid)	2,3	2,3
On site renewable generation	0	0
Heat network	1 – R(1)	1
Cold network	1	1
Wood	0	1
Other non-renewables	1	1

(1) Share of renewable energy or recovery of the network

Table 8.2-6. Cep,nr_maxmoyen, Cep_maxmoyen in France

Building type	$C_{ep,nr}$_maxmoyen value [kWh/m².a]	C_{ep}_maxmoyen value [kWh/m².a]
Detached or semi-detached housing	55	75
Collective housing	70	85
Office buildings	75	85
Educational building – Primary school	65	72
Educational building – Secondary school	63	72

8.2.6 Appendix FR6: Climatic impact of energy consumption

The indicator is used to account for the impact of climate change on energy consumption over the building's lifetime (50 years assumed in the calculations). It is expressed in kg $_{eq.CO2}$/m² where the square meters are those of the livable area for residential buildings and the usable area for non-residential buildings.

In order to comply with the requirement, the following condition should be met:

$IC_{energy} \leq IC_{energy}\_max$

Where:

- $IC_{energy}\_max = IC_{energy}\_maxmoyen * (1 + Mcgéo + Mccombles + Mcsurf\_moy + Mcsurf\_tot + Mccat)$

The different Mc coefficient aims at reflecting different geographical and building related conditions.

- Mcgéo: reflects different climatic conditions related to different altitude and climatic zones.
- Mccombles: reflects the attic floor area installed in the building
- Mcsurf_moy: reflects the average surface of the dwellings
- Mcsurf_tot: reflects the total surface of the building
- Mccat : reflects the external constraints categories

Table 8.2-7. Emission factors for different energy vectors

Energy vector	Use	Emission factor [$g_{CO2,eq}/kWh_{Final\ Energy}$]
Wood, biomass – Forest chips	Any	24
Wood, biomass – Buche, granules (pellets) or briquettes	Any	30
Electricity (grid)	Heating	79
	Cooling	64
	Domestic Hot Water	65
	Lightning (tertiary)	64
	Lightning (households)	69
	Other	64
Methane gas from networks	Any	227
Butane gas, Propane gas	Any	272
Other fossil fuels	Any	324

Table 8.2-8. ICenergy_maxmoyen values in France

Building type	IC_{energy}_maxmoyen value [$kgCO_2/m^2$]		
	2022 to 2024	2025 to 2027	2028 and after
Detached or semi-detached housing	160 (1)	160 (1)	160 (1)
Collective housing	560	260 (2)	260
Office buildings	200 (3)	200	200
Educational building	240	140 (4)	100

(1) For detached or semi-detached housing, the IC_{energy}_maxmoyen is 280 $kgCO_2/m^2$ if the building permit application for the house was submitted before 31/12/2023; and one of the following conditions is met:

- the plot is covered by a development permit granted before 01/01/2022, providing for a connection to the gas network
- thethe plot is included in the perimeter of a concerted development zone whose implementation file, providing for a connection to the gas network of the perimeter, was approved before 01/01/2022.

(2) collective housing connected to a heating network, an intermediary threshold of 320 $kgCO_2/m^2$ will be applicable between the 1st January 2025 and the 31st December 2017.

(3) The value is 280 is the office building is connected to a district heat network.

(4) The value is 200 is the educational building is connected to a district heat network

8.2.7 Appendix FR7: Climatic impact of construction

The indicator is used to account for the impact on climate change of the construction phase (construction materials used, equipment (for heating, cooling, …), construction site's energy consumption, water consumption and disposal, earthmoving waste disposal). It is expressed in kg $_{eq.CO2}/m^2$ where the square meters are those of the livable area for residential buildings and the usable area for non-residential buildings. In order to comply with the requirement, the following condition should be met:

$IC_{construction} \leq IC_{construction}$_max

Where:

- $IC_{construction}$_max = $IC_{construction}$_maxmoyen * (1 + Micombles + Misurf) +Miinfra + Mivrd + Migéo + Mided + Mipv

The different Mi coefficient aims to reflect different geographical and building related conditions.

- Micombles: reflects the impact of attic floor area installed in the building
- Misurf: reflects the impact of average surface of the dwellings
- Miinfra: reflects the impact of foundations and spaces in the basement of the building
- Mivrd: reflects the impact of roads and various networks of the building
- Migéo: reflects the impact of different climatic conditions related to different altitude and climatic zones.
- Mided: reflects the impact of default environmental data and standard values in the evaluation of the building and taken into account the lack of specific environmental data availability
- Mipv: reflects the impact of the installation of a PV system for office buildings

Table 8.2-9. ICconstruction_maxmoyen value in France

Building type	$IC_{construction}$_maxmoyen value [$kgCO_2/m^2$]			
	2022 to 2024	2025 to 2027	2028 to 2030	As of 2031
Detached or semi-detached housing	640	530	475	415
Collective housing	740	650	580	490
Office buildings	980	810	710	600
Educational building	900	770	680	590

8.3 Germany

8.3.1 Appendix DE1: Applicable FIT and FIP

Table 8.3-1. Applicable feed-in premium in c€/kWh in Germany

	EEG 2023	
	With self-consumption scheme	Full-injection scheme
	January 2023	January 2023
P < 10 kWp	8,6	8,6+4,8=13,2
10 kWp < P < 40 kWp	7,5	7,5+3,8=11,2
40 kWp < P < 100 kWp	6,2	6,2+5,1=11,3
100 kWp < P < 400 kWp	6,2	6,2+3,2=9,4
400 kWp < P < 1 000 kWp	6,2	6,2+1,9=8,1

Table 8.3-2 - Applicable feed-in tariff in c€/kWh for new PV systems on buildings (1) 61

	January 2023
P < 10 kWp	8,2
10 kWp < P < 40 kWp	7,1
40 kWp < P < 100 kWp	5,8

(1) The feed-in tariffs are revised every month based on a monthly reduction rate but are guaranteed for the whole duration of the support scheme (20 years) once attributed.

8.3.2 Appendix DE2: Allocation of FIP through tenders

Two categories are considered in German PV tenders[62]:

1. Solar system of the first segment: ground-mounted PV (including agricultural land and parking lots)
2. Solar system of the second segment: PV on buildings and noise barriers.

The planned tender volume is the following. The volume is distributed evenly between the three annual bid dates (March, July, December).

Table 8.3-3 Planned tender volumes

	2023	2024	2025 - 2029
1st segment	5 850 MW	8 100 MW	9 900 MW
2nd segment	650 MW	900 MW	1 100 MW

Maximum values for tenders for solar system exist depending on the segment.

Table 8.3-4 Maximum values for tenders

	Maximum
1st segment	8% increase from the average of the winning bids of the last three bidding dates. Capped at 5,9 c€/kWh.
2nd segment	9 c€/kWh, decreasing 1% per calendar year.

61 https://www.lfl.bayern.de/mam/cms07/iba/dateien/information_pv_001_foerdersaetze_photovoltaik_20220202.pdf

62 https://www.gesetze-im-internet.de/eeg_2014/

8.3.3 Appendix DE3: Primary energy demand requirement

In Germany the maximum primary energy demand allowed is not given as an absolute value but as a share of the primary energy demand that would be obtained for a reference building (i.e., a building with identical geometry, usable or net floor area, orientation as the studied building and having a set of (in the law) predefined parameters). For new construction, the primary energy consumption should not exceed 75% of that of the reference building. For renovations, the primary energy consumption should not exceed 140% of that of the reference building. The maximum allowed primary energy demand can only be precisely quantitatively determined case by case.

Table 8.3-5. Primary energy factors in Germany

Energy source	Primary energy factor
Electricity	1,8
On site renewable generation	0 (*)
Fossil fuels	1,1 to 1,2
Wood	0,2
Biogas and biofuel	1,1
Municipal waste	0

(*) renewable electricity production is deductible in primary energy demand calculation. But for this, the methodology presented in the next paragraphs should be used

For new constructions, electricity from renewable energy can be deducted in the primary energy demand calculation under certain conditions and following a set of rules.[63]
The two conditions are that:

- the electricity is generated in direct spatial connection to the building
- self-consumption is conducted and only the non-self-consumed electricity is exported to the grid.

The deductible amount is determined based on the following rules and is deducted from the primary energy demand determined without considering renewable energy.

Table 8.3-6. Rules for the deduction of renewable electricity production from primary energy demand in Germany for new constructions in Germany

		Residential building		Non-residential building	
		Without electrochemical storage	With electrochemical storage (>1kWh$_{storage}$/kWp$_{RE}$)	Without electrochemical storage	With electrochemical storage (>1kWh$_{storage}$/kWp$_{RE}$)
Basis deductible amount		150 kWh$_{RE}$/kWp$_{RE}$	200 kWh$_{RE}$/kWp$_{RE}$	150 kWh$_{RE}$/kWp$_{RE}$	200 kWh$_{RE}$/kWp$_{RE}$
Additional deductible amount	Condition	P$_{RE}$>0,03*A/N (1)	P$_{RE}$>0,03*A/N	P$_{RE}$>0,01*A (4)	P$_{RE}$>0,01*A (4)
	Amount	70% * E (2)	100% * E (2)	70% * E (2)	100% * E (2)
Overall limitation for the deductible amount		<30% * P (3)	<45% * P (3)	<30% * P (3)	<45% * P (3)

(1) With: P$_{RE}$: installed RE capacity (kWp), A: usable area, N: number of heated or cooled floors
(2) With E: the electricity demand for machinery (this includes the electricity demand for pumps, control devices, …)
(3) With P: the primary energy demand of reference building
(4) With: P$_{RE}$: installed RE capacity (kWp), A: net floor area

[63] GEG, Teil 2, Abschnitt 3, §23

8.3.4 Appendix DE4: Share of heating and cooling needs met by renewable energy

For new buildings, a 15% of the heating and cooling needs of the building should be covered by renewable energy. The requirement can be met by different means:

- with different renewable technologies such as solar thermal, geothermal energy, environmental heat, waste heat from waste water, solid, liquid and gaseous biomass, renewable cold, heat from combined heat and power, district heating, district cooling
- with renewable electricity (wind and PV). In the case of residential buildings, the requirement is also met if the installed capacity (in kWp) is greater than 0,03 times the usable area divided by the number of heated or cooled floor.
- by exceeding the requirements for the heat transfer coefficient by at least 15%.[64]

For public buildings undergoing a major renovation (a measure replacing a boiler, converting the heating system or renovating more than 20% of the building envelope and this within a 2-year timeframe), a certain share of the heating and cooling needs of the building should be covered by renewable energy. The requirement can be met by different means such as solar thermal, biomass, renewable cold but most importantly cannot be met with renewable electricity. Indeed, the GEG law provides for this specific case a list of technologies or solutions which can allow to meet the requirement but solar photovoltaic is not one of the listed options.

[64] GEG, Teil 2, Abschnitt 3 §34-45

8.4 Italy

8.4.1 Appendix IT1: Ritiro Dedicato

For systems with an installed capacity up to 100 kWp, the price is a minimum guaranteed price (updated every year and amounting to 44 €/MWh for 2023). [65]

8.4.2 Appendix IT2: Allocation of FIP through tenders

As part of the 04/07/2019 Decree, PV systems with an installed capacity greater than 20 kWp and smaller than 1 MWp, must be registered in the Registers. PV systems with an installed capacity greater than or equal to 1 MWp, must participate in auctions. In both cases the incentive mechanisms, attributed through tenders are the following:

- For PV systems with an installed capacity below 250 kWp, it can be chosen between the 20-year all-inclusive feed-in tariff or a 20-year feed-in premium
- For PV systems with an installed capacity greater than 250 kWp only the 20-year feed-in premium is accessible.

The reference tariffs used both to determine the feed-in tariff and the feed-in premium can be found in the following table. Applicants submit a reduction percentage of the reference tariffs (based on previous calls, reduction percentages of 2% to 70% have been typically observed for auction and up to 30% for registries).

Table 8.4-1 Reference tariffs to be considered for the incentives under the 04/07/2019 Decree

Type of installation	Installed capacity	Reference tariff [€/MWh]	Bonus on the share of net production consumed on site [€/MWh]
Other PV installations (Group A)	20 < P ≤ 100 kWp	99,75	10
	100 < P ≤ 1 000 kWp	85,50	-
	1 000 kWp < P	66,50	-
Installation in combination with asbestos removal	20 < P ≤ 100 kWp	105,00	10
	100 < P ≤ 1 000 kWp	90,00	-

8.4.3 Appendix IT3: Superbonus

The Superbonus has been extended to 2025 with scheduled reduction of the deduction rates (starting at 110% until 2023 and dropping to 70% in 2024 and then 65% in 2025). It applies to residential buildings (single family unit, mini condominium and condominium with 8 or more units). It consists in a tax credit amounting to 110% of the investment costs in energy efficiency works. The possible energy efficiency works are divided into primary works (installation of thermal cladding, installation of energy efficient heating and cooling systems, seismic improvements (for municipalities where the seismic risk is at least 3) and secondary works (including the installation of solar photovoltaic systems). In order to receive the tax credit for secondary works, at least one primary work has to be conducted. For solar panels, the tax credit cap is 2 400 €/kW and up to 48 000 €.

[65] https://www.arera.it/it/elettricita/prezziminimi.htm#prezzimin

8.4.4 Appendix IT4: Primary energy demand requirement

The global energy performance, expressed in kWh.m²$_{useful}$.a, represents the primary energy consumption for heating, domestic hot water, ventilation, cooling, (in the case of non-residential buildings, primary energy consumption for lighting and internal transport (lift, escalators, etc. are also taken into account) and should not exceed that of the reference building. Primary energy conversion factors to be considered in the calculations can be found in the table below.

According to the TECHNICAL SPECIFICATION UNI / TS 11300-5 "Part 5: Calculation of primary energy and the share of energy from renewable sources", compensation between energy needs and renewable energy produced is allowed but under certain conditions:

- Renewable energy should be produced on site
- Compensation is conducted on a monthly basis
- Only self-consumed renewable energy is considered (exported energy is not taken into account)
- Compensation is possible only for the same energy carrier (renewable electricity compensates non-renewable electricity, renewable thermal energy compensates non-renewable thermal energy)
- Electricity from renewables used for the auxiliaries of a boiler for the working of a heat pump or for the electrical auxiliaries of a controlled mechanical ventilation system can be taken into account but not electricity from renewables used to produce heat through a resistance (i.e., using the Joule effect). [66]

Table 8.4-2 Primary energy conversion factors in Italy

Energy vector	$F_{non-ren}$	F_{ren}	F_{tot}
Natural gas	1,05	-	1,05
Diesel and fuel oil	1,07	-	1,07
Electricity from the grid	1,95	0,47	2,41
Electricity produced by photovoltaic	-	1	1
Energy from the external environment (heat pump)	-	1	1
District heating	1,5	-	1,5
Thermal energy from solar collector	-	1	1

8.4.5 Appendix IT5: installed capacity for renewable electricity generation

The installed capacity for renewable electricity generation should be greater than a certain threshold P determined as P= K*S

With:

- P the minimum capacity for renewable electricity generation to be installed in kW
- K a coefficient equal to:
- 0,025 kW/m² for existing buildings
- 0,05 kW/m² for new constructions
- S the plan surface of the building at ground level in m²

The renewable energy generation facility needs to be installed above the building, inside the building or in its appurtenances. The requirement is applicable for new buildings and major

[66] Decree 26th June 2015, Appendix 1, Section 1.1

renovations (existing building with a usable surface greater than 1000 square meters, subject to complete renovation of the building elements making up the envelope or existing building subject to demolition and reconstruction)
For public buildings the requirements have been increased by 10%.
As of January 2024, the requirements presented here will be updated at least every five years to take into account technological evolution. At the occasion of the first update, the requirements will be extended to:

- buildings undergoing first level renovation (involving > 50% of the building envelope or the heating system rather than involving the whole building envelope)
- buildings of categories E2 (typ. Offices), E3 (typ. Hospitals), E5 (typ. Commercial buildings) with usable surface greater than 10 000 m² even if they are not subject to renovation.

8.4.6 Appendix IT6: Share of renewable energy

The expected energy consumption for domestic hot water and for domestic hot water, heating and cooling combined should be covered at least by 60% by renewables.

- For the parts of the territory affected by urban agglomerations that have a historical, artistic character and of particular environmental value or by portions of them, including the surrounding areas, which can be considered an integral part, due to these characteristics, of the agglomerations themselves the requirements are reduced by 50% (60% => 30%)
- For public buildings the requirements are increased to 65%
- The requirement is considered fulfilled if the building is connected to a district heating network that covers the entire heat requirement for space heating and the supply of domestic hot water.
- The requirement cannot be fulfilled through plants from renewable sources that exclusively produce electricity which, in turn, feeds devices or plants for the production of domestic hot water, heating and cooling. This does not disqualify PV production used to power a heat pump, but rather aims at avoiding the use of electric boiler that rely on the Joule effect.
- As of January 2024, the requirements presented here will be updated at least every five years to take into account technological evolution. At the occasion of the first update, the requirements will be extended to:
    - buildings undergoing first level renovation (involving > 50% of the building envelope or the heating system rather than involving the whole building envelope)
    - buildings of categories E2 (typ. Offices), E3 (typ. Hospitals), E5 (typ. Commercial buildings) with usable surface greater than 10 000 m² even if they are not subject to renovation.

8.5 Netherlands

8.5.1 Appendix NL1: SDE++

For PV systems with an installed capacity above 15 kWp (large scale electricity consumers with a connection to the electricity grid with a total maximum throughput of more than 3x80 Amper), the SDE++ support scheme applies. Under this support scheme, self-consumption and associated savings on the electricity bill are possible and a premium applies for injected electricity. This premium compensates for the difference between the average PV system electricity cost and the market price of electricity. The support scheme is granted for 15 years (for the equivalent of up to 900 full load hours per year). This support scheme was recently prolonged for a couple years at least.

8.5.2 Appendix NL2: ISDE

For PV systems with an installed capacity between 15 kWp and 100 kWp (companies with a connection to the electricity grid with a total maximum throughput of less than 3x80 Amper), the ISDE support scheme applies. Under this support scheme self-consumption and associated savings on the electricity bill are possible and an investment aid of maximum 125 €/kWp can be received. This support scheme is expected to last until the end of 2023. [67]

8.5.3 Appendix NL3: Primary fossil energy demand requirement

The maximum primary fossil energy consumption is expressed in terms of kWh per square meter of usable area per year. The maximal values are summarized in the following table for different building configurations. Any (building-related) energy produced on-site, for example solar power, wind energy and electricity supply from a building-related cogeneration installation, can be deducted, after conversion to avoided primary fossil energy.

Table 8.5-1 Primary fossil energy demand requirements in the Netherlands

Category	Subcategory	Primary fossil energy demand [kWh/m_{usable}^2.year]
Residential	Housing	50
Non-residential	Office	40
	Nursery	70
	Gathering place	60
	Hospital/Health	130
	Day care	50
	Industry	-
	Accommodation	130
	Education	70
	Sport	90
	Commercial	60

[67] RVO NL (https://www.rvo.nl/subsidies-financiering/isde/zakelijke-gebruikers/zonnepanelen)

8.5.4 Appendix NL4: Share of renewable energy

The minimum share of renewable energy requirement is expressed in terms of percentage and is summarized in Table 8.5-2. The following technologies are considered renewable in the NTA 8800:2022: solar energy, geothermal energy, wind energy, energy from outside air and solid biomass (under certain conditions). The definition in the NTA 8800:2022 of renewable energy is also consistent with the agreements that should be included in the new Renewable Energy Sources Directive (RES). Consequently, cold can also be considered a renewable energy under the form of seasonal storage in the ground (ATES) or cold from a (deep) lake. Passive (solar) heat and passive cooling (such as summer night ventilation) are not considered as renewable energy and neither is the purchase of "green" electricity.

Table 8.5-2. Renewable energy share requirements in the Netherlands

Category	Subcategory	Renewable energy share [%]
Residential	Housing	40
Non-residential	Office	30
	Nursery	40
	Gathering place	30
	Hospital/Health	30
	Day care	40
	Industry	-
	Accommodation	40
	Education	40
	Sport	30
	Commercial	30

8.5.5 Appendix NL5: Renewable energy requirements for major renovations

As of February 2022, there is a renewable energy requirement in the case of a major renovation only. A renovation is considered major if there is a change of more than 25% of the surface of the building envelope. In addition, the change must have been implemented on the integral building envelope (i.e., the boundary between the inside of a house or building and the outside world which consists of the ground floor, the outer walls, the windows, the frames, the doors and the roof). [68]

The requirement consists in a minimum renewable energy value. Applicable renewable energy solutions include solar panels, heat pumps or heat networks. If solar panels are the only chosen solution, the requirement can be met with a yearly normalised production (kWh.m²$_{usable}$.year) above a certain threshold T determined according to the following formula.

T=30* Min (A_roof/A_g ;1)

Where:

- A_roof is the roof area
- A_g is the total usable area

[68] Building Decree, Decree of 29 August 2011 establishing regulations with regard to the construction, use and demolition of structures, last amended by the Decree of 22 December 2021, Chapter 5, Article 5.6 "Renovate" (https://rijksoverheid.bouwbesluit.com/Inhoud/docs/wet/bb2012)

8.6 Spain

8.6.1 Appendix ES1: Subsidies partially covering investment costs for self-consumption facilities

Subsidies partially covering investment costs are available for any distributed PV system with self-consumption. Systems of any size are eligible but only the first 5 000 kWp are covered by the subsidy. Within the framework of the Recovery, Transformation Plan and Resilience (PRTR), the Council of Ministers has approved a Royal Decree 477/2021, of June the 29th 2021, to grant 900 million euros (with an initial endowment of 450 million), in subsidies for self-consumption facilities.[69] The subsidy which will be coordinated by the Institute for Energy Diversification and Efficiency (IDAE) is divided into 5 programs for renewable electricity self-consumption facilities which will run until the 31st of December 2023.

Table 8.6-1. Description of Incentive Program 1&2

<table>
<tr><td>Name:</td><td colspan="8">Incentive program 1 & 2</td></tr>
<tr><td>Scope:</td><td colspan="8">Implementation of self-consumption facilities, with renewable energy sources, respectively in the services sector and in other productive sectors, with or without storage</td></tr>
<tr><td>Eligible cost:</td><td colspan="3">E = Min((Ceu-Cuf) ; Cmax+Csau) * P</td><td colspan="5">With:
E: the eligible costs in €
Ceu: the unit cost in €/kWp
Cuf: the unit cost of a reference installation in €/kWp
Cmax: the maximum eligible unit cost
Csau: the additional maximum eligible unit cost in €/kWp
P: the installed capacity in kWp</td></tr>
<tr><td rowspan="6">Subsidy:</td><td rowspan="2">Installed capacity</td><td rowspan="2">Cuf [€/kWp]</td><td rowspan="2">Cmax [€/kWp]</td><td colspan="2">Csau [€/kWp]</td><td colspan="3">Subsidy [% eligible cost covered by subsidy]</td><td rowspan="2">Bonus for “demographic challenge”[1]</td></tr>
<tr><td>In case of combination with asbestos removal</td><td>In case of installation of canopy for PV [2]</td><td>Large companies</td><td>Medium companies</td><td>Small companies</td></tr>
<tr><td>P ≤ 10 kWp</td><td></td><td>1188</td><td rowspan="2">660</td><td rowspan="4">500</td><td rowspan="4">15%</td><td rowspan="4">25%</td><td>45%</td><td rowspan="4">5%</td></tr>
<tr><td>10 ‹ P ≤ 100 kWp</td><td></td><td>910</td><td rowspan="3">35%</td></tr>
<tr><td>100 ‹ P ≤ 1 000 kWp</td><td></td><td>749</td><td>450</td></tr>
<tr><td>1000 ‹ P ≤ 5 000 kWp</td><td>120</td><td>460</td><td>210</td></tr>
</table>

[1] when the facilities are located in municipalities with up to 5 000 inhabitants, or non-urban municipalities with up to 20 000 inhabitants or whose urban areas have a population of less than or equal to 5 000 inhabitants

[2] If a canopy (i.e., cover like a roof shelter) is installed which will then welcome a PV installation

Table 8.6-2. Description of Incentive Program 4[70]

<table>
<tr><td>Name:</td><td colspan="5">Incentive program 4</td></tr>
<tr><td>Scope:</td><td colspan="5">Realization of self-consumption installations, with renewable energy sources, in the residential sector, public administrations and the tertiary sector, with or without storage.</td></tr>
<tr><td>Condition:</td><td colspan="5">For PV systems with an installed capacity greater than 2,63 kW, at least 80% of the generation should be self-consumed (in annual terms).</td></tr>
<tr><td rowspan="3">Subsidy:</td><td rowspan="2">PV system installed capacity</td><td colspan="2">Subsidy [€/kWp]</td><td rowspan="2">Bonus for “demographic challenge”[1]</td><td colspan="2">Additional subsidy [€/kWp]</td></tr>
<tr><td>Residential sector</td><td>Public administrations and tertiary sector</td><td>In case of combination with asbestos removal</td><td>In case of installation of canopy for PV</td></tr>
<tr><td>P ≤ 10 kWp</td><td>600</td><td>1 000</td><td>55</td><td>160</td><td>120</td></tr>
</table>

[69] https://www.boe.es/diario_boe/txt.php?id=BOE-A-2021-10824

[70] https://www.boe.es/diario_boe/txt.php?id=BOE-A-2021-10824

	10 < P ≤ 100 kWp	450	750	40		
	100 < P ≤ 1 000 kWp	350	650	35	110	
	1000 < P ≤ 5 000 kWp	300	500	30	50	

[1] when the facilities are located in municipalities with up to 5 000 inhabitants, or non-urban municipalities with up to 20 000 inhabitants. whose urban areas have a population of less than or equal to 5 000 inhabitants

8.6.2 Appendix ES2: Total primary energy requirement.

The following requirement applies to:

- New buildings
- Existing buildings in the case of:
  - An extension during which the constructed area or volume is increased by more than 10% and the extension's useful area is greater than 50 m².
  - A change of use if the useful area is greater than 50 m²
  - A renovation concerning the heating system and more than 50% of the buildings thermal envelope.[71]

The consumption of total primary energy, expressed in kWh/m²$_{useful\ area}$.a for heating, cooling, DHW, ventilation, temperature control, humidity and lighting of a building or part of a building in the spaces contained inside the thermal envelope of the building should not exceed the values found in the table below.[72] Primary energy conversion factors to be considered can also be found below.

Table 8.6-3. Maximal allowed consumption of total primary energy

Type of building	**Type of project**	**Maximal allowed consumption of total primary energy [kWh/m².a][3]**					
		Climatic zone[2]					
		α	A	B	C	D	E
Residential	New construction or extension	40	50	56	64	76	86
	Change of use to residential	55	75	80	90	105	115
Non-residential		165 + 9 * C_{FI}[1]	155 + 9 * C_{FI}	150 + 9 * C_{FI}	140 + 9 * C_{FI}	130 + 9 * C_{FI}	120 + 9 * C_{FI}

[1] C_{FI} is the average internal load

[2] Climatic zones can be found in the map below:

[3] For extrapeninsular territory (Illes Balears, Canarias, Ceuta and Melilla), values should be multiplied by 1.15 for residential buildings and by 1.4 for non-residential buildings

[71] Documento Basico, HE, Ahorro de Energia, Section HE 0: Limitation of energy consumption
[72] Documento Basico, HE, Ahorro de Energia, Section HE 0: Limitation of energy consumption, Section 3.2

Table 8.6-4. Examples of primary energy conversion factors in Spain

Energy Vector	Primary energy conversion factor
Natural gas	1,195
Heating oil	1,182
Pellets	1,113
Electricity from the grid	2,403
Renewable electricity (in-situ on in the direct vicinity of the building)	1

8.6.3 Appendix ES3: Total primary non-renewable energy requirement.

The following requirement applies to:

- New buildings
- Existing buildings in the case of:
    - An extension during which the constructed area or volume is increased by more than 10% and the extension's useful area is greater than 50 m².
    - A change of use if the useful area is greater than 50 m²
    - A renovation concerning the heating system and more than 50% of the buildings thermal envelope.[73]

The consumption of non-renewable primary energy, expressed in $kWh/m^2_{useful\ area}.a$ for heating, cooling, DHW, ventilation, temperature control, humidity and lighting of a building or part of a building in the spaces contained inside the thermal envelope of the building should not exceed the values found in Table 8.6-5.

Primary energy conversion factors to be considered are the same as for total primary energy calculations.

Table 8.6-5. Maximal allowed consumption of non-renewable primary energy

Type of building	Type of project	Maximal allowed consumption of non-renewable primary energy [kWh/m².a][3]					
		Climatic zone[2]					
		α	A	B	C	D	E
Residential	New construction or extension	20	25	28	32	38	43
	Change of use to residential	40	50	55	65	70	80
Non-residential		70 + 8 * C_{FI}[1]	155 + 9 * C_{FI}	150 + 9 * C_{FI}	140 + 9 * C_{FI}	130 + 9 * C_{FI}	120 9 * C_{FI}

[1] C_{FI} is the average internal load

[2] Climatic zones can be found in the map above

[3] For extrapeninsular territory (Illes Balears, Canarias, Ceuta and Melilla), values should be multiplied by 1.25 for residential buildings and by 1.4 for non-residential buildings

8.6.4 Appendix ES4: Share of renewable energy in DHW demand

The following requirement applies to:

- New buildings with a DHW demand greater than 100 L/day
- Existing buildings in the case of:
    - An extension during which the constructed area or volume is increased by more than 10%, the extension's useful area is greater than 50 m² and the DHW demand (before extension) is greater than 5 000 L/day

[73] Documento Basico, HE, Ahorro de Energia, Section HE 0: Limitation of energy consumption

- A change of use if the useful area is greater than 50 m² and if the DHW demand is greater than 100 L/day
- A renovation concerning the heating system and more than 50% of the buildings thermal envelope and if the DHW demand is greater than 100 L/day.[74]

The energy demand for DHW (and pool heating) should be covered at least by:

- 70% by renewables if the DHW demand is more than 5 000 L/day
- 60% by renewables if the DHW demand is less than 5 000 L/day

In the case of an extension, only the additional DHW demand compared to the demand before extension should respect this requirement.

8.6.5 Appendix ES5: Electricity generation from renewable energy sources

The following requirement applies to:

- New buildings with a built area greater than 1 000 m²
- Existing buildings in the case of:
  - An extension during which the built area is increased by more than 1 000 m²
  - A change of use with a built area greater than 1 000 m²
  - A renovation with a built area greater than 1 000 m² [75]

The installed capacity for electricity production from renewable sources for own use or supply to the grid should be greater than a certain threshold P (in kW) defined as follow:

P=Min (F*S ;0,1*(0,5*Sc-Soc)

Where:

- F is the electricity production factor, expressed in kW/m² and amounting to 0,005 for residential buildings and 0,01 for other buildings
- S is the built area of the building
- Sc is the roof area which is not passable or accessible
- Soc is the roof area which is not passable or accessible and is occupied by a solar thermal system.

[74] Documento Basico, HE, Ahorro de Energia, Section HE 4: Minimum contribution of renewable energy to cover the demand for domestic hot water, Section 1

[75] Documento Basico, HE, Ahorro de Energia, Section HE 5: Minimum generation of electricity from renewable sources, Section 1

8.7 Switzerland

8.7.1 Appendix CH1: Total primary energy requirement

For new buildings, there are requirements concerning annual primary energy demand for heating, cooling, ventilation and domestic hot water needs[76]. Primary energy conversion factors to be used can be found below.

Table 8.7-1 Maximum primary energy demand requirements in Switzerland

Building type	Maximum primary energy demand [kWh/m².a]
Single family house	35
Multifamily house	35
Administration	40
Education	35
Commercial	40
Catering*	45
Hospitals	70
Industrial	20
Sport Centre*	25

* For Catering and Sport Centres, the primary energy demand requirement does not include domestic hot water. For Catering and Sport Centres, at least 20% of the energy needs for heating and domestic hot water needs should be covered by renewable energy.

Table 8.7-2 Primary energy conversion factors, Switzerland

Energy vector	Conversion factor
Fossil fuel	1
Electricity from the grid	2
Self-produced electricity	0
Biomass	0,5
Heating network	0,4 to 1 depending on the part from fossil fuels (<25% = 0,4 / >75% = 1)

8.7.2 Appendix CH2: On-site electricity production requirement

For new buildings, a minimum installed capacity P of electricity generation (in, on or near the building) should be installed. P should be determined through the following formula.
P [W] = Max (30 000; 10 * SRE)
SRE refers to the floor area (SRE: *Surface de Référence Energétique*, energetical reference surface).
Notes:

- Typically, photovoltaic systems will be used to meet this requirement. However, the regulation does not impose any specific technology.
- The regulation specifically mentions that façade integrated PV is allowed.
- In multi-floor buildings, façade integrated PV should be considered
- If the requirement is not met, a tax should be paid (canton-dependent, but approx. CHF 1 000 per kW not realized)

[76] Mustervorschriften der Kantone im Energiebereich (MuKEn) Ausgabe 2014, Nachführung 2018, Section D, Article 1.23

8.8 References in IEC 63092

Standards referenced in IEC 63092-1 and IEC 63092-2

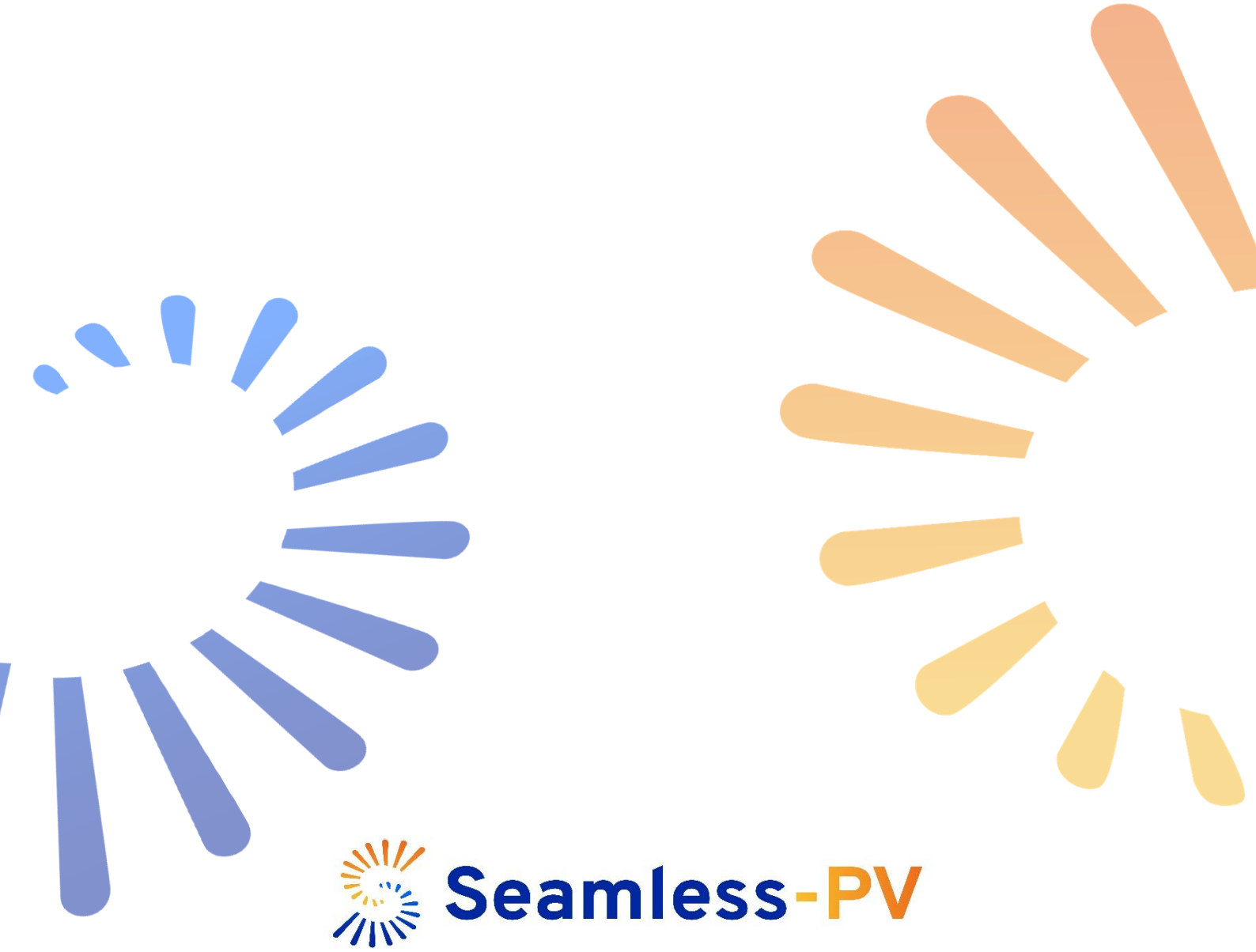
IEC 60050. International Electrotechnical Vocabulary.
IEC 60364-1. Low-voltage electrical installations — Part 1: Fundamental principles, assessment of general characteristics, definitions
IEC 60364-4-41. Low-voltage electrical installations — Part 4-41: Protection for safety - Protection against electric shock
IEC 60364-4-42. Low-voltage electrical installations — Part 4-42: Protection for safety - Protection against thermal effects
IEC 60364-4-43. Low-voltage electrical installations — Part 4-43: Protection for safety - Protection against overcurrent
IEC 60364-4-44. Low-voltage electrical installations — Part 4-44: Protection for safety - Protection against voltage disturbances and electromagnetic disturbances
IEC 60364-5-51. Electrical installations of buildings — Part 5-51: Selection and erection of electrical equipment — Common rules
IEC 60364-5-52. Low-voltage electrical installations — Part 5-52: Selection and erection of electrical equipment — Wiring systems
IEC 60364-5-53. Low-voltage electrical installations — Part 5-53: Selection and erection of electrical equipment — Devices for protection for safety, isolation, switching, control and monitoring
IEC 60364-5-54. Low-voltage electrical installations — Part 5-54: Selection and erection of electrical equipment — Earthing arrangements and protective conductors
IEC 60364-5-55. Electrical installations of buildings — Part 5-55: Selection and erection of electrical equipment — Other equipment
IEC 60364-5-56. Low-voltage electrical installations — Part 5-56: Selection and erection of electrical equipment — Safety services
IEC 60364-6. Low-voltage electrical installations — Part 6: Verification
IEC 60364-7-712. Low-voltage electrical installations — Part 7-712: Requirements for special installations or locations — Solar photovoltaic (PV) power supply systems
IEC 61082-1, Preparation of documents used in electrotechnology — Part 1: Rules
IEC 61215-1. Terrestrial photovoltaic (PV) modules — Design qualification and type approval - Part 1: Test requirements.
IEC 61215-2. Terrestrial photovoltaic (PV) modules — Design qualification and type approval - Part 2: Test procedures.
IEC 61215-1-3. Terrestrial photovoltaic (PV) modules — Design qualification and type approval - Part 1-3: Special requirements for testing of thin-film amorphous silicon based photovoltaic (PV) modules.
IEC 61215-1-4. Terrestrial photovoltaic (PV) modules — Design qualification and type approval - Part 1-4: Special requirements for testing of thin-film Cu(In,Ga)(S,Se)2 based photovoltaic (PV) modules.
IEC 61215-2. Terrestrial photovoltaic (PV) modules — Design qualification and type approval - Part 2: Test procedures
IEC 61724-1. Photovoltaic system performance — Part 1: Monitoring
IEC 61730-2. Photovoltaic (PV) module safety qualification — Part 2: Requirements for testing.

IEC 62446-1. Photovoltaic (PV) systems — Requirements for testing, documentation and maintenance — Part 1: Grid connected systems - Documentation, commissioning tests and inspection
IEC 62548 Photovoltaic (PV) arrays — Design requirements
IEC 63092-1. Photovoltaics in buildings – Part 1: Building-integrated photovoltaic modules
IEC 82079-1, Preparation of instructions for use — Structuring, content and presentation — Part 1: General principles and detailed requirements
IEC TS 61724-2. Photovoltaic system performance — Part 2: Capacity evaluation method
IEC TS 61724-3. Photovoltaic system performance — Part 3: Energy evaluation method
IEC 61730-1. Photovoltaic (PV) module safety qualification — Part 1: Requirements for construction
IEC TS 61836. Solar photovoltaic energy systems — Terms, definitions and symbols
IEC 63092-2. Photovoltaics in buildings – Part 2: Building-integrated photovoltaic systems.
IEC TS 62915. Photovoltaic (PV) modules — Type approval, design and safety qualification - Retesting.
IEC TS 63126. Guidelines for qualifying PV modules, components and materials for operation at high temperatures.
ISO 2394. General principles on reliability for structures
ISO 3010. Bases for design of structures — Seismic actions on structures
ISO 4354. Wind actions on structures
ISO 4355. Bases for design of structures — Determination of snow loads on roofs
ISO 4356. Bases for the design of structures — Deformations of buildings at the serviceability limit states
ISO 6946. Building components and building elements – Thermal resistance and thermal transmittance – Calculation methods
ISO 9050. Glass in building. Determination of light transmittance, solar direct transmittance, total solar energy transmittance, ultraviolet transmittance and related glazing factors.
ISO 10291. Glass in building — Determination of steady-state U values (thermal transmittance) of multiple glazing — Guarded hot plate method.
ISO 10292. Glass in building — Calculation of steady-state U values (thermal transmittance) of multiple glazing.
ISO 10293. Glass in building — Determination of steady-state U values (thermal transmittance) of multiple glazing — Heat flow meter method.
ISO 12543-6. Glass in building — Laminated glass and laminated safety glass — Part 6: Appearance.
ISO 12494. Atmospheric icing of structures
ISO 12631. Thermal performance of curtain walling – Calculation of thermal transmittance
ISO 13033. Bases for design of structures — Loads, forces and other actions — Seismic actions on nonstructural components for building applications
ISO 15099. Thermal performance of windows, doors and shading devices. Detailed calculations.
ISO 15821. Doorsets and windows — Water-tightness test under dynamic pressure — Cyclonic aspects
ISO 16813. Building environment design — Indoor environment — General principles
ISO 16940. Glass in building — Glazing and airborne sound insulation — Measurement of the mechanical impedance of laminated glass.

ISO 19467 Thermal performance of windows and doors — Determination of solar heat gain coefficient using solar simulator
ISO 22111. Bases for design of structures — General requirements
ISO 22897. Glass in building — Glazing and airborne sound insulation — Product descriptions and determination of properties.
ISO 28278-1. Glass in building – Glass products for structural sealant glazing – Part 1: Supported and unsupported monolithic and multiple glazing.
ISO 28278-2. Glass in building – Glass products for structural sealant glazing – Part 2: Assembly rules
ISO 29584. Glass in building — Pendulum impact testing and classification of safety glass
ISO 52022-1. Energy performance of buildings – Thermal, solar and daylight properties of building components and elements – Part 1: Simplified calculation method of the solar and daylight characteristics for solar protection devices combined with glazing
ISO 52022-3. Energy performance of buildings – Thermal, solar and daylight properties of building components and elements – Part 3: Detailed calculation method of the solar and daylight characteristics for solar protection devices combined with glazing

Standards referenced in IEC 63092-3:
ISO 9050 Glass in building - Determination of light transmittance, solar direct transmittance, total solar energy transmittance, ultraviolet transmittance and related glazing factors
ISO 9845-1 Solar energy - Reference solar spectral irradiance at the ground at different receiving conditions - Part 1: Direct normal and hemispherical solar irradiance for air mass 1 ,5
ISO 10292 Glass in building - Calculation of steady-state U values (thermal transmittance) of multiple glazing
ISO 15099 Thermal performance of windows, doors and shading devices — Detailed calculations
ISO 19467 Thermal performance of windows and doors - Determination of solar heat gain coefficient using solar simulator
IEC 63092-1 ed1 Photovoltaics in buildings - Part 1: Building integrated photovoltaic modules
IEC 63092-2 ed1 Photovoltaics in buildings - Part 2: Building integrated photovoltaic systems
IEC 60584-1 Thermocouples - Part 1: EMF specifications and tolerances
IEC 60904-9 Photovoltaic devices - Part 9: Solar simulator performance requirements

Together with: IEC 61215-1, IEC 61215-2, IEC 63092-1, IEC 63092-2, IEC TS 61836 and ISO 19467 apply.



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Project funded by

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