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Sustainable  
plus energy  
neighbourhoods



# Mainstreaming the neighbourhood approach into EU building policies

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## Glossary of Terms

EED	Energy Efficiency Directive
EMD	Energy Market Directive
EPBD	Energy Performance in Buildings Directive
EV	Electric vehicle
GHG	Greenhouse gas
GWP	Global warming potential
KPI	Key performance indicator
NBRP	National Building Renovation Plans
NZEB	Nearly zero-energy building
RED	Renewable Energy Directive
SPEN	Sustainable plus energy neighbourhood
ZEB	Zero-emission building

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# Executive summary

Sustainable plus energy neighbourhoods (SPENs) are highly energy efficient and energy flexible neighbourhoods with a surplus of energy from renewable energy sources. SPENs contribute to a climate-neutral building stock while offering multiple benefits for the community and society, such as improved comfort and public health, social inclusion, climate resilience and value retention. SPENs provide a range of shared spaces, services and facilities, such as shared heat pumps, solar photovoltaic panels, heat and electricity storage, electric vehicle charging stations, electric vehicles, electric bicycles, and common spaces with greenery, water and biodiversity. Compared to single apartments or buildings, neighbourhood approaches provide additional benefits to demand-side flexibility through the aggregation of energy assets and stacking of revenue streams, generating greater energy savings and economic benefits for homeowners. SPENs go beyond simply combining individual positive energy buildings. By integrating buildings and neighbourhood infrastructure, they create opportunities for sufficiency measures and increased ambition of energy performance, aiming for positive energy buildings. SPEN development implies a strong focus on sustainable behaviour, occupant satisfaction, co-design with residents, shared services and infrastructure, and – most importantly – close collaboration between private and public stakeholders in the local community.

This report aims to map the developing policy landscape at the EU level and to provide recommendations to guide policymakers in implementation at national level. To implement the social, process and technological innovations needed for SPENs, a favourable policy framework should be developed. A wide range of building, energy and finance policies at the EU level are relevant for SPENs, such as the Energy Performance of Buildings Directive (EPBD), the Renewable Energy Directive (RED), the Energy Efficiency Directive (EED), and the EU Taxonomy for sustainable activities.

For the first time, the 2024 EPBD recast includes an explicit mention of 'integrated district or neighbourhood approaches'. Multiple benefits of this approach are listed, such as cost-effectiveness and integration with energy, mobility, green infrastructure, circularity and sufficiency. Acknowledging and conceptualising the added values of the neighbourhood approach is a first step in introducing the SPEN approach into building policies; however, in the EPBD these are mentioned only in relation to renovations.

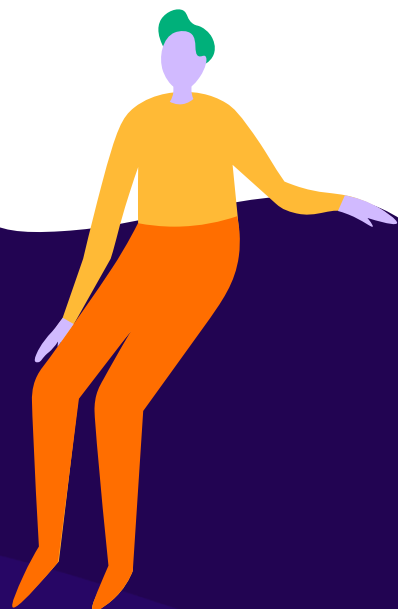
The 2024 EPBD recast introduced the concept of **zero-emission building (ZEB)**, replacing the nearly zero-energy buildings (NZEB) of the EPBD recast in 2010. By 2030, all new buildings should achieve ZEB standard and the goal for the existing stock is to become ZEB by 2050. The first difference between the concepts lies in considering the embodied carbon emissions along with operational emissions with the calculation of the **'Life-cycle Global Warming Potential (GWP)'**. The second difference concerns the sources of renewable energy, such as renewable energy communities, efficient district heating and energy from other carbon-free sources, besides the **'on-site and nearby'** renewable energy. These changes will also influence indirectly new developments of SPENs.

The provisions regarding solar energy in buildings introduce requirements for new constructions, renovations and large existing public buildings, which may contribute to the deployment of SPENs. A similar approach encouraging renewable energy in the built environment was introduced in REDIII with the concept of **'renewable acceleration areas'**. Member States should give priority to artificial and built surfaces, such as rooftops and facades of buildings, transport infrastructure, parking areas, etc., as well as degraded land unusable for agriculture.

To achieve these more ambitious social, energy and environmental targets, SPEN projects often require additional upfront investments compared to business as usual. Scaling up SPENs will require a more substantial contribution from private finance and will require sustainable finance solutions that generate inclusive and long-term benefits for all stakeholders. SPENs have a unique opportunity to integrate wider environmental and social objectives that are well aligned with all three ESG dimensions and EU taxonomy requirements. A first exploratory analysis of the EU Taxonomy of sustainable activities is provided in comparison to the syn.ikia framework. The level of ambition of the [EU Taxonomy](#) criteria is not in line with the EPBD and the Paris Agreement decarbonisation targets. More ambitious projects such as SPENs require significant additional investments, while at the same they provide multiple benefits for society and residents, and present a lower risk for investors.

### Key recommendations for EPBD implementation:

- In the renovation of worst-performing buildings, follow the recommendation of scaling up renovation through an integrated neighbourhood/district approach, while keeping the ambition set by the minimum requirements for major renovations at the building level.
- Extend the neighbourhood/district approach recommended for renovations to new constructions, considering interactions with the energy, water, mobility and green infrastructure, and implementing circularity and sufficiency principles.
- In ZEB implementation, prioritise 'on-site and nearby' renewable energy sources, to avoid costly grid upgrades.
- In the implementation of the common guidelines for the recalibration of EPCs, consider the need to ensure more comparability, transparency and consistency for validating and demonstrating alignment with the requirements of the EU Taxonomy.
- Implement the recommended A+ class in the harmonised EPC scheme for buildings with 20% lower energy demand than ZEB buildings (class A).
- Provide public incentives and enable green loans for projects with higher ambitions than minimum requirements for new construction (A+ buildings) and renovations.
- Provide public incentives based on income, tailoring them for vulnerable households (e.g. prioritise grants over tax rebates). Encourage access to private finance for lower-income households by providing additional guarantees and longer payback periods for loans.



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# 1. Introduction

A sustainable plus energy neighbourhood (SPEN) is defined as a group of interconnected buildings with associated infrastructure (infrastructure includes grids and technologies for exchange, generation and storage of electricity and heat). Infrastructure may also include grids and technologies for water, sewage, waste, mobility, information and communications, and an energy management system located within a limited geographical area and/or a virtual boundary. A SPEN aims to reduce its primary energy use towards zero over a year, and to increase its use and generation of renewable energy. The syn.ikia definition of a SPEN follows a similar basis for positive energy buildings, but the geographical boundary is physically or digitally expanded to the entire site of the neighbourhood, including local storage and energy supply units. Users, buildings and technical systems are connected via a digital cloud hub and/or common energy infrastructures. The SPEN framework includes a strong focus on cost efficiency, indoor environmental quality, spatial qualities, sustainable behaviour, occupant satisfaction, social factors (co-use, shared services and infrastructure and community engagement), power performance (peak shaving, flexibility and self-consumption) and greenhouse gas emissions.

The goal of this report is to provide recommendations for introducing the SPEN approach into EU policies. It builds on a previous publication analysing barriers and opportunities for plus energy neighbourhoods in national and local regulations. Since then, important updates in the EU-level directives have taken place, with the recast of the [Energy Performance of Buildings Directive \(EPBD\)](#) in 2024 and revisions of the Renewable Energy Directive (RED) and the Energy Efficiency Directive (EED) in 2023. The '[Fit for 55](#)' package in July 2021 and the [REPowerEU plan](#) in May 2022 brought increased ambition to decarbonisation and renewable energy targets. The current report summarises the latest developments in the EPBD, EED and REDIII with the goal of mapping the provisions which are relevant for SPEN scale-up.

For the first time, the EPBD includes an explicit mention of 'integrated district or neighbourhood approaches'. Multiple benefits of this approach are listed, such as cost-effectiveness and integration with the energy, mobility, green infrastructure, waste and water treatment and other aspects of urban planning which take into account local and regional resources, circularity and sufficiency. Acknowledging and conceptualising the added values of the neighbourhood approach is a first step of introducing the SPEN approach into building policies. Several provisions of the directives are also highly relevant to SPEN scale-up and are analysed in terms of drivers or barriers, focusing on five main areas:

- The district and neighbourhood approach
- Energy performance
- Renewable energy (sharing renewable energy at the building and neighbourhood scale)
- Digital technologies and demand-side flexibility
- Financing, affordability and business models

The analysis also offers policy recommendations for the REDIII and EPBD, in view of their imminent implementation. These recommendations are based on lessons learnt from the implementation of the 2018 [Clean energy for all Europeans package](#), and reflected in the [Factsheets: Policy recommendations for sustainable plus energy neighbourhoods and buildings](#). These four factsheets analyse both the gaps and the best practices in the implementation of REDII, EMD and EPBD in the four countries where the project demos are located: Spain, Austria, the Netherlands and Norway.

This report is also complementary to [Identification, design and evaluation of business models](#) and [An overview of financing opportunities and strategies to link them to syn.ikia innovations and investors](#). The EU Taxonomy requirements were compared with the syn.ikia framework's key performance indicators (KPIs) and the ambition level achieved by syn.ikia demo projects.

The report is structured in three parts. First, the definition of SPEN is elaborated, detailing the KPIs and boundaries for achieving a positive energy balance. Next, an in-depth analysis of the EPBD, REDIII and EED is provided. Finally, policy recommendations for the EPBD and REDIII implementation are provided, as well as reflections on the EU Taxonomy and sustainable finance.

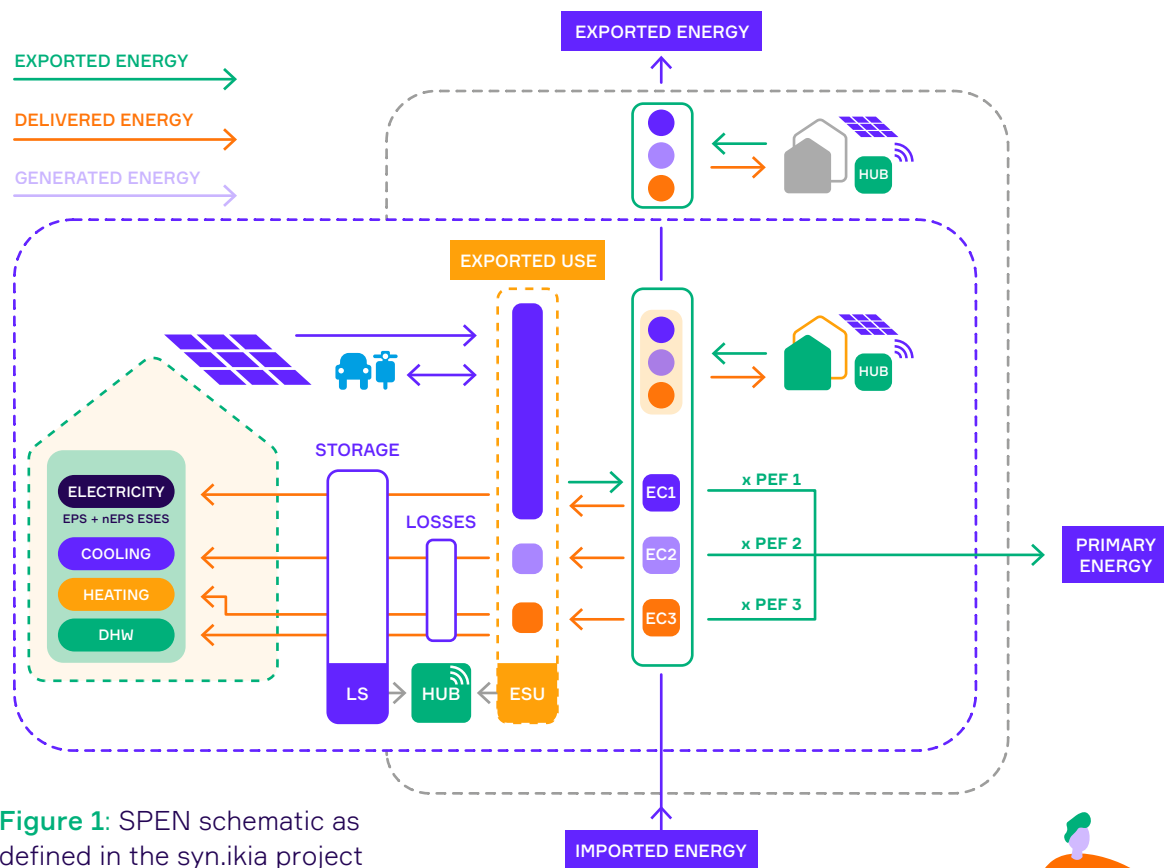
The insights presented are drawn from desk research, interviews with policymakers and NGOs who are experts on EU policies regarding energy efficiency and renewables, and a workshop with experts from the financial sector on the EU Taxonomy and green finance.



## 2. The sustainable plus energy neighbourhood concept

### SPEN definition

As defined in the syn.ikia's evaluation framework, a Sustainable Plus Energy Neighbourhood is a highly energy efficient and energy flexible neighbourhood with a surplus of energy from renewable sources (Salom et al., 2021). The syn.ikia definition of a SPEN is similar to that for a positive energy building, but the geographical boundary is physically or digitally expanded to take in the entire neighbourhood, including local storage and energy supply units (Figure 1). Users, buildings and technical systems are all connected via a digital cloud hub and/or common energy infrastructures. The SPEN framework includes a strong focus on cost efficiency, indoor environmental quality, spatial qualities, sustainable behaviour, occupant satisfaction, social factors (co-use, shared services and infrastructure, and community engagement), power performance (peak shaving, flexibility and self-consumption), and greenhouse gas emissions.



**Figure 1:** SPEN schematic as defined in the syn.ikia project

A SPEN is defined as a group of interconnected buildings with associated infrastructure (infrastructure includes grids and technologies for exchange, generation and storage of electricity and heat, and sometimes also for water, sewage, waste, mobility, information and communications, and an energy management system, located within a limited geographical area and/or a virtual boundary. (The neighbourhood concept in the syn.ikia project refers to – but is not limited to – the Building Portfolio definition within the ISO52000 that considers a set of buildings and common technical building systems whose energy performance is determined by their mutual interactions [SOURCE: ISO 52000-1:2017, 3.1.6].) A SPEN aims to reduce its primary energy use towards zero over a year, and to increase its use and generation of renewable energy.

## Boundaries of zero-emission buildings and of SPENs

There is an ongoing discussion over where to define the system boundaries, i.e. what energy elements to include when developing and defining positive energy districts (PEDs). From a technical point of view, a SPEN is characterised by achieving a positive energy balance within a given system of boundaries under an energy community scheme. There are multiple ways to cover renewable energy generation in a SPEN. Moving from the single building boundary to the neighbourhood scale widens the on-site generation possibilities significantly. The scale is not restricted to on-site boundaries, and – when using smartness attributes – a SPEN may expand beyond the physical boundaries of the community. The SPEN boundary may address two different levels:

- **Functional boundary:** On one hand, a functional boundary addresses the spatial-physical limits of the building portfolio and the neighbourhood. On the other, it addresses the limits of the energy grids, considering them as functional entities of the neighbourhoods that they serve. (e.g. a district heating system that can be considered as a functional part of the neighbourhood even if its service area is substantially larger than the heating sector of the building portfolio in question). The renewable energy share of the energy infrastructure (e.g. electricity from the grid) is included in the balance with the use of appropriate conversion factors from final energy to primary energy or CO<sub>2</sub> emissions.
- **Virtual boundary:** The energy balance takes place using the public grid, and the energy sharing between stakeholders within the SPEN's physical boundaries takes place in contractual terms. The SPEN's excess energy can also be shared externally with the district within a renewable energy community.

The net positive yearly energy balance of a SPEN will be assessed within these functional or virtual boundaries. Thus, a SPEN will achieve a positive yearly energy balance through dynamic exchanges within the functional/virtual boundaries, but in addition it will provide a connection between buildings inside the boundaries of the neighbourhood. In a SPEN, buildings can be digitally connected by means of a digital cloud hub, sharing information and communications infrastructure and energy management systems.

## Added values of the neighbourhood approach

The SPEN approach entails multiple benefits at the societal and individual level, which are detailed in D5.3 *On the identified measurable benefits in syn.ikia and their potential impact* and will be quantified by the MBx tool, a web based calculation tool to support decision-making and investment.

The concept of SPENs presents a new range of benefits, in addition to the benefits of individual energy-efficient buildings. Non-energy-related benefits include increased productivity, better health, improved educational outcomes, increased property values, employee satisfaction and retention, job creation and economic development.

Urban regeneration through SPENs offers opportunities to accelerate climate change mitigation and adaptation efforts, and results in a dynamic policymaking environment. Comprehensive approaches aiming to upgrade not only single buildings but rather whole neighbourhoods are needed to cost-effectively decarbonise the building stock and its energy system. As well as engaging communities, such approaches can also be more attractive to investors and

# 3. The latest developments in EU policies relevant for SPENs

## Energy Performance of Buildings Directive

The Energy Performance of Buildings Directive (EPBD)<sup>1</sup> was last amended in 2018 as part of the Clean energy for all Europeans package. With the [European Green Deal](#) in 2019 and the [European Climate Law](#) in 2021, the European Commission aimed to increase its overall climate ambition by setting the objective of reducing greenhouse gas (GHG) emissions by 55% by 2030 as compared to 1990. To achieve these increased targets for 2030 and priorities in climate and social action, the Commission released a series of proposals to update EU legislation including the EPBD, EED and REDIII.

The articles within the [2024 EPBD recast](#) that are relevant for SPEN are analysed under the following headings, highlighting aspects that contribute to SPEN scale-up – or that are, on the contrary, barriers:

- The district and neighbourhood approach
- Energy performance
- Renewable energy (sharing renewable energy at the building and neighbourhood scale)
- Digital technologies and demand-side flexibility
- Financing, affordability and business models

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<sup>1</sup> [EU 2018/844](#)

## The district and neighbourhood approach

The 2024 recast of the EPBD for the first time acknowledges the benefits of shifting from the individual building to a district and neighbourhood approach. It contains several mentions of ‘integrated district or neighbourhood approaches’, ‘renovations at district level’, ‘integrated renovation plans and overall renovation schemes applying to a number of buildings in a spatial context instead of a single building’, and ‘integrated renovation programmes’ in recitals, in Articles 17 and 18. Annex II contains a template for the national building renovation plan which requires Member States to inform the European Commission about how the plan will promote district and neighbourhood approaches and integrated renovation programmes at district level, which may address issues such as energy, mobility, green infrastructure, waste and water treatment and other aspects of urban planning, and may take into account local and regional resources, circularity and sufficiency. This is in line with the SPEN concept developed by syn.ikia.

However, the EPBD considers the integrated neighbourhood approach only in regard to renovations (Table 1), while ignoring the potential of this approach for new construction. Three of the syn.ikia demo neighbourhoods which are new constructions show the advantages of using the SPEN approach from an early design stage, considering the interaction between the buildings and with the infrastructure to optimise energy use. A more holistic design approach, considering local specificities such as grid capacity, renewable energy potential for production and storage (heat and electricity), integration with the mobility, green and water infrastructure are also beneficial for new developments. This integrated design approach, involving residents in the process, is a principle of SPENs, and could be applied for new constructions as well.

**Table 1:** EPBD Articles concerning the district and neighbourhood approach

Article	Provision	Drivers for SPEN approach	Barriers to SPEN approach
<u>Recital (24)</u>	<i>Supporting renovations at district level, including through industrial or serial type renovations, offers benefits by stimulating the volume and depth of building renovations and will lead to a quicker and cheaper decarbonisation of the building stock. Industrial solutions for construction and building renovation include versatile prefabricated elements providing different functions such as insulation and energy generation.</i>	Acknowledges that the district approach and industrial solutions for renovations can contribute to speeding up renovations and reduce costs.	The benefits of the district approach are acknowledged only for renovations, while new constructions have more flexibility to untap multiple benefits with sufficiency design measures and by considering integration with urban infrastructure.

Article	Provision	Drivers for SPEN approach	Barriers to SPEN approach
<u>Recital (48)</u>	<i>Integrated district or neighbourhood approaches help to increase the cost-effectiveness of the renovations required for buildings that are spatially related such as housing blocks. Such approaches to renovations offer multiple solutions at a larger scale.</i>	Acknowledges that the district approach and industrial solutions for renovations can contribute to speeding up renovations and reduce costs.	The benefits of the district approach are acknowledged only for renovations, while new constructions have more flexibility to untap multiple benefits with sufficiency design measures and by considering integration with urban infrastructure.
<u>Article 28</u> <i>Review</i>	The Commission shall <b>also</b> examine in what manner Member States could apply integrated district or neighbourhood approaches in Union building and energy efficiency policy, while ensuring that each building meets the minimum energy performance requirements, for example by means of <b>integrated renovation plans and</b> overall renovation schemes applying to a number of buildings in a spatial context instead of a single building.	Energy efficiency policies can be applied using integrated district or neighbourhood approaches.	The neighbourhood approach is sometimes perceived as threatening ambition at building level. A district approach should not exempt individual buildings from minimum requirements for renovations and new construction.
<u>ANNEX II</u> <i>Template for national building renovation plans (referred to in Article 3)</i>	<p>(c) Overview of implemented and planned policies and measures (mandatory indicators)</p> <p>(j) <b>the promotion of district and neighbourhood approaches and integrated renovation programmes at district level, which may address issues such as energy, mobility, green infrastructure, waste and water treatment and other aspects of urban planning and may take into account local and regional resources, circularity and sufficiency.</b></p> <p>Optional indicators: (g) <b>the role of renewable energy communities and citizen energy communities in district and neighbourhood approaches.</b></p>	The inclusion of integrated renovation programmes at district level in the NBRP reporting template is important for Member States to start considering district and neighbourhood approaches in their renovation policies and to keep track on progress. Added values of the district approach in relation to sufficiency and circularity are acknowledged.	

## Energy performance

### Zero-emission building (ZEB)

The 2024 EPBD recast introduced the concept of the ZEB, the next step after nearly zero-energy buildings (NZEB), the new construction requirement since 2020 introduced by the EPBD recast in 2010. By 2030, all new buildings should be ZEB, with 'zero on-site carbon emissions from fossil fuels and zero or a very low amount of operational greenhouse gas emissions'. The goal for the existing stock is to become ZEB by 2050. There are several conceptual changes for ZEB in relation to NZEB. Firstly, embodied carbon emissions are considered along with operational emissions. Embodied carbon emissions are calculated with '**Life-cycle Global Warming Potential (GWP)**', defined in Annex III of the Directive. No threshold levels for minimum operational energy performance for ZEB were set, which means Member States may have different ambitions.

The second difference concerns the sources of renewable energy. Where NZEB has minimum requirements for '**on-site and nearby**' renewable energy, for ZEB the sources of energy are extended to also allow for 'renewable energy provided by **renewable energy communities**, efficient district heating and cooling based on renewables or waste heat, **and energy from other carbon-free sources**. The definition of 'nearby' (Table 2) is similar to that for the geographical boundaries of a SPEN, being limited to low and medium-voltage grids, which should be prioritised as in the case of NZEB. The implications of allowing energy from renewable and 'carbon free sources' will be discussed in the next subsection.

Article 9 introduces **Minimum Energy Performance Standards (MEPS) and trajectories for progressive renovation** with the objective of a gradual phase-out of the worst-performing buildings and a continuous improvement of the building stock towards the 2050 ZEB goal. For the residential stock, Member States are required to adopt their own national trajectory to reduce the average primary energy use by 16% by 2030 and 20-22% by 2035 (both compared to 2020), with some flexibility for national circumstances and exemptions such as historical buildings. **At least 55% of the reduction in the average primary energy use should be achieved through the renovation of the 43% of buildings which perform least well.** Thus, the implementation of this article will occur through a wide range of instruments including MEPS and 'technical assistance and financial measures, in particular for vulnerable households'.

Article 19 creates the **A+ class for energy performance certificates (EPCs)**. Class A+ corresponds to 'buildings with a maximum threshold for energy demand which is at least twenty percent lower than the maximum threshold for ZEB and which generates more renewable energy on-site annually than its total annual primary energy demand'. A higher level of ambition than NZEB or ZEB is required at building level to achieve a positive energy balance at neighbourhood/district level, thus promoting A+ buildings within EPCs contributes to the advance of SPENs.

An overview of articles related energy performance requirements and life-cycle approach is provided in Table 2.

**Table 2:** EPBD Articles concerning energy performance that are relevant for SPEN

Article	Provision	Drivers for SPEN approach	Barriers to SPEN approach
<p><b>Article 2</b></p> <p>DEFINITIONS <b>'zero-emission building'</b></p>	<p>2. 'zero-emission building' means a building with a very high energy performance, as determined in accordance with Annex I, <b>requiring zero or a very low amount of energy, producing zero on-site carbon emissions from fossil fuels and producing zero or a very low amount of operational greenhouse gas emissions</b>, in accordance with <b>Article 11</b>;</p>	<p>Shift from NZEB to ZEB contributes to higher ambition for new constructions and reduces energy demand, thus is supportive of SPEN approach.</p>	
<p><b>Article 2</b></p> <p>DEFINITIONS <b>'energy from renewable sources produced nearby'</b></p>	<p>55. 'energy from renewable sources produced nearby' means energy from renewable sources, produced within a local or district-level perimeter of a particular building, which fulfils all of the following conditions:</p> <p>(a) it can be distributed and used only within that local and district-level perimeter through a dedicated distribution network;</p> <p>(b) it allows for the calculation of a specific primary energy factor valid only for the energy from renewable sources produced within that local or district-level perimeter; and</p> <p>(c) it can be used on-site through a dedicated connection to the energy production source, where that dedicated connection requires specific equipment for the safe supply and metering of energy for self-use of the building;</p>	<p>Similar approach to SPEN geographical boundary.</p>	
<p><b>Article 2</b></p> <p>DEFINITIONS <b>'life-cycle global warming potential' or 'life-cycle GWP'</b></p>	<p>25. 'life-cycle global warming potential' or 'life-cycle GWP' means an indicator which quantifies the global warming potential contributions of a building along its full life-cycle;</p>	<p>A common methodology to calculate embodied emissions is important to incorporate the whole life carbon perspective to ZEBs and SPENs.</p>	



Article	Provision	Drivers for SPEN approach	Barriers to SPEN approach
<p><b>Article 5</b></p> <p><b>Setting of minimum energy performance requirements</b></p>	<p>Member States shall take the necessary measures to ensure that minimum energy performance requirements for buildings or building units are set with a view to at least achieving cost-optimal levels <b>and, where relevant, more stringent reference values such as nearly zero-energy building requirements and zero-emission buildings requirements.</b></p> <p>When setting requirements, Member States may differentiate between new and existing buildings and between different categories of buildings.</p>	<p>More stringent minimum energy performance requirements for new constructions and renovations contribute to more ambitious SPENs.</p>	<p>No EU-level thresholds for minimum energy performance requirements can result in different levels of ambitions.</p>
<p><b>Article 6</b></p> <p><b>Calculation of cost-optimal levels of minimum energy performance requirements</b></p>	<p><b>Member States may take into account the life-cycle GWP.</b></p>	<p>The possible inclusion of the GWP is a positive step in cost-optimality calculation, shifting away from the narrow focus of the operational phase.</p>	
<p><b>Article 7</b></p> <p><b>New buildings</b></p>	<p><b>Member States shall ensure that new buildings are zero-emission buildings in accordance with Article 11:</b></p> <p><b>(a) as of 1 January 2028, new buildings owned by public bodies; and</b></p> <p><b>(b) as of 1 January 2030, all new buildings;</b></p> <p><b>Member States shall ensure that the life-cycle Global Warming Potential (GWP) is calculated in accordance with Annex III and disclosed through the energy performance certificate of the building.</b></p>	<p>The shift to ZEB for new constructions instead of NZEB is positive due to the calculation and disclosure of GWP and the new perspective of considering the embodied emissions.</p>	<p>No energy performance thresholds set up at EU level for ZEBs.</p> <p>No thresholds for GWP, will be introduced from 2030 onwards at national level.</p>

Article	Provision	Drivers for SPEN approach	Barriers to SPEN approach
<p><b>Article 9</b></p> <p><i>Minimum energy performance standards and trajectories for progressive renovation</i></p>	<p><i>Member States shall ensure that from 2020 the average primary energy use in kWh/(m<sup>2</sup>y) of the whole residential building stock:</i></p> <p><i>(a) decreases by at least 16% by 2030;</i></p> <p><i>(b) decreases by at least 20-22% by 2035;</i></p> <p><i>(c) by 2040, and every 5 years thereafter, is equivalent to, or lower than nationally determined value derived from a progressive decrease of the average primary energy use from 2030 to 2050 in line with the transformation of the residential building stock into a zero-emission building stock.</i></p> <p><i>Member States shall ensure that at least 55 % of the decrease of the average primary energy use is achieved through the renovation of worst-performing residential buildings.</i></p>	<p>MEPS and the residential trajectory will drive the renovation of the worst-performing buildings. Using the SPEN approach can be an effective way of implementing the scale-up of renovations.</p>	<p>Using targets for primary energy reduction rather than EPC labels for residential buildings may be more difficult to implement and communicate to stakeholders.</p>
<p><b>Article 11</b></p> <p><i>Zero-emission buildings</i></p>	<p><i>Member States shall ensure that the total annual primary energy use of a new or renovated zero-emission building is covered by:</i></p> <p><i>(a) energy from renewable sources generated on-site or nearby, fulfilling the criteria laid down in Article 7 of Directive (EU) 2018/2001;</i></p> <p><i>(b) energy from renewable sources provided from a renewable energy community within the meaning of Article 22 of Directive (EU) 2018/2001;</i></p> <p><i>(c) energy from an efficient district heating and cooling system in accordance with Article 26(1) of Directive (EU) 2023/1791; or</i></p> <p><i>(d) energy from carbon-free sources.</i></p> <p><i>Where it is not technically or economically feasible to fulfil the requirements laid down in this paragraph, the total annual primary energy use may also be covered by other energy from the grid complying with criteria established at national level.</i></p>	<p>ZEB includes various other sources of renewable energy compared to NZEB, which may encourage the SPEN approach because it goes beyond the building level.</p>	<p>There is no minimum requirement for 'on-site or nearby' renewable energy. Other sources of energy such as renewable energy communities and 'carbon-free sources' means having to rely on off-site sources or even non-renewable energy, causing grid congestions and the need for investments in grid upgrades. This goes against the SPEN approach of maximising the local production and self-consumption of renewable energy.</p>

Article	Provision	Drivers for SPEN approach	Barriers to SPEN approach
Article 18 <i>One-stop-shops for energy performance of buildings</i>	<i>One-stop-shops for energy performance of buildings shall provide independent advice on energy performance of buildings and may accompany integrated district renovation programs.</i>	Important that one-stop-shops provide information about district approaches, not only individual building renovation advice.	
Article 19 <i>Energy performance certificates</i>	<i>Member States may define an A+ energy performance class corresponding to buildings with a maximum threshold for energy demand which is at least twenty percent lower than the maximum threshold for zero-emission buildings, and which generates more renewable energy on-site annually than its total annual primary energy demand.</i>	A+ buildings may be necessary to achieve SPEN levels; it is positive to highlight them in EPCs.	

## Renewable energy

### Definition: ‘energy from renewable sources’

Sources of renewable energy for ZEBs are also very relevant for SPENs. In the definition of Article 2 are listed the following: ‘wind, solar (solar thermal and solar photovoltaic), and geothermal energy, ambient energy, tide, wave and other ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas, and biogas’. When designing a SPEN, it is important to take into account the full array of renewable energy sources. The neighbourhoods/districts are at a large enough scale to untap the full potential of renewable energy in terms of generation and storage of heat and electricity.

### Definitions: ‘on-site’ and ‘nearby’

The ‘nearby’ definition is aligned with SPEN geographical boundaries. The requirement to use a dedicated network within the neighbourhood and a dedicated connection to the energy production source means being limited to the low and medium-voltage grid. This is important for SPEN, since it aims to maximise self-consumption of locally produced renewable energy, using storage, demand-side flexibility and building automation and control systems. Remaining on the low and medium-voltage grid and peak shaving avoids costly investments in grid upgrades.

### Solar energy in buildings

Article 10 mandates the deployment solar energy installations in buildings, progressively starting with new public and non-residential buildings from 2026, then existing large public buildings from 2027, progressively lowering the size of public buildings to which it applies. **From 2027 it will apply to renovations of non-residential buildings, and finally from 2029 to all new residential buildings** and physically adjacent roofed carparks (with some conditions, such as feasibility). Technology neutrality is mentioned in the article; however, the requirement for solar energy installations may work against other renewable energy systems that could be more suitable for the local context. SPEN allows for a variety of solutions for thermal and energy installations, depending on the potential for renewable energy production and storage in the neighbourhood.

**Table 3:** EPBD Articles concerning renewable energy relevant for SPEN

Article	Provision	Drivers for SPEN approach	Barriers to SPEN approach
<p><b>Article 2</b></p> <p>DEFINITIONS <b>'on-site' and 'nearby'</b></p>	<p>54. 'on-site': the premises and the land on which the building is located and the building itself;</p> <p>55. 'energy from renewable sources produced nearby' means energy from renewable sources produced within a local or district level perimeter of the building assessed, which fulfils all the following conditions:</p> <p>(a) it can only be distributed and used within that local and district level perimeter through a dedicated distribution network;</p> <p>(b) it allows for the calculation of a specific primary energy factor valid only for the energy from renewable sources produced within that local or district level perimeter; and</p> <p>(c) it can be used on-site of the building assessed through a dedicated connection to the energy production source, that dedicated connection requiring specific equipment for the safe supply and metering of energy for self-use of the building assessed;</p>	<p>The definitions of 'on-site' and 'nearby' support the SPEN approach and incentivise local self-consumption of renewable energy, building automation and control systems, storage and demand-side flexibility.</p>	<p>Even if the definition of 'nearby' is in line with SPEN objectives, the 'on-site and nearby' production of renewable energy is not prioritised in the ZEB definition, and there is no minimum requirement for the share of renewable energy produced on-site and nearby as in the case of NZEBs. Thus, the implications of the 'nearby' definition are limited since other sources of renewable energy are allowed, such as renewable energy certificates and 'decarbonised energy sources'.</p>
<p><b>Article 2</b></p> <p>DEFINITIONS <b>'energy from renewable sources'</b></p>	<p>14. 'energy from renewable sources' means energy from renewable non-fossil sources, namely wind, solar (solar thermal and solar photovoltaic), <b>and</b> geothermal energy, ambient energy, tide, wave <b>and</b> other ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas, and biogas;</p>	<p>A variety of renewable energy sources are available for achieving ZEB and SPEN levels.</p>	
<p><b>Article 2</b></p>	<p>53. 'self-used' means part of on-site or nearby produced renewable energy used by on-site technical systems for EPB services;</p> <p>54. 'other on-site uses' means energy used on-site for uses other than EPB services, and may include appliances, miscellaneous and ancillary loads or electro-mobility charging points;</p>	<p>Relevant for calculating SPEN balance.</p>	<p>The EPBD considers only self-used renewable energy, while 'other on-site uses' are not quantified – thus there are no incentives to combine buildings' loads with other neighbourhood loads, which can offer flexibility and storage services to the grid.</p>

Article	Provision	Drivers for SPEN approach	Barriers to SPEN approach
<p><b>Article 10</b></p> <p><i>Solar energy in buildings</i></p>	<p>Member States shall ensure the deployment of suitable solar energy installations, <b>if technically suitable and economically and functionally feasible, as follows:</b></p> <p>(a) by 31 December 2026, on all new public and <b>non-residential</b> buildings with useful floor area <b>over 250 m<sup>2</sup></b>;</p> <p>(b) by 31 December 2027, on all existing public buildings with useful floor area larger than <b>2,000 m<sup>2</sup></b>;</p> <p>(c) by 31 December <b>2028</b>, on all <b>existing public</b> buildings <b>with useful floor area larger than 750 m<sup>2</sup></b>;</p> <p>(d) <b>by 31 December 2030, on all existing public buildings with useful floor area larger than 250 m<sup>2</sup></b>;</p> <p>(e) <b>by 31 December 2027, on existing non-residential buildings with useful floor area larger than 500 m<sup>2</sup>, where the building undergoes a major renovation or an action that requires an administrative permit for building renovations, works on the roof or the installation of a technical building system;</b></p> <p>(f) <b>by 31 December 2029, on all new residential buildings; and</b></p> <p>(g) <b>by 31 December 2029, on all new roofed carparks physically adjacent to buildings.</b></p>	<p>Mandatory solar on new constructions and existing buildings can contribute to SPEN scale-up.</p>	<p>The technology neutrality principle is infringed and only mentioned for exemptions. The focus on solar exclusively and the 'one solution fits all' approach can hinder the untapping of other potential solutions for renewable energy, heat and storage technologies which can adjust better to the local context.</p>

## Digital technologies and demand-side flexibility

ZEB is considered as an active part of the energy system, which can contribute to demand-side flexibility through 'demand management, electrical storage, thermal storage and distributed renewable generation to support a more reliable, sustainable and efficient energy system' (recital 23). SPENs offer additional opportunities to contribute to flexibility services with shared assets for energy and heat storage, which is not acknowledged for new constructions.

At the same time, the importance of **integration with sustainable mobility** is recognised in this regard. Article 14 mandates new residential buildings and major renovations with more than three car parking spaces to ensure pre-cabling charging stations for electric vehicles (EVs) and electrically power-assisted cycles, the installation of one charging point for each new residential building, and at least two bicycle parking spaces for every residential building unit. In a SPEN it is easier to plan and design the integration of buildings, the electrical grid and sustainable mobility, adjusting to local needs.

SPENs rely on energy monitoring and optimisation to maximise self-consumption and peak shaving. Article 13, on **technical building systems**, incorporates the requirements for building automation and control systems for new residential buildings, which is an important step in implementing the SPEN approach.

**Table 4:** EPBD articles regarding digital technologies and demand-side flexibility

Article	Provision	Drivers for SPEN approach	Barriers to SPEN approach
<u>Recital</u>	<p><i>(56) The Smart Readiness Indicator is particularly beneficial for large buildings with high energy demand. For other buildings, the scheme for rating the smart readiness of buildings should be optional for Member States.</i></p> <p><i>Where a digital building twin is available, it should be taken into account, in particular for the Smart Readiness Indicator.</i></p>	The promotion of the digital twin within the Smart Readiness Indicator is positive, since digital twins are useful in the design and operational phase of SPEN, to optimise the energy systems.	The Smart Readiness Indicator has limited impact in the market, and it is not known by the key private and public stakeholders involved in SPEN. The degree of management of flexibility assets present in a SPEN is a key element for an optimal interaction with the grid, which can be quantified with the Smart Readiness Indicator.
<u>Article 2</u>  DEFINITIONS <b>'pre-cabling'</b>	<p><b>34. 'pre-cabling' means all measures that are necessary to enable the installation of recharging points, including data transmission, cables, cable routes and, where necessary, electricity meters;</b></p>	Important for integration with EV charging points and contribution of buildings and SPEN to flexibility and storage.	
<u>Article 13</u>  <b>Technical building systems</b>	<p><b>Member States shall lay down requirements to ensure that, where technically, economically and functionally feasible, from [date of transposition], new residential buildings and residential buildings undergoing major renovations are equipped with the following:</b></p> <p><b>(a) the functionality of continuous electronic monitoring that measures systems' efficiency and informs building owners or managers in the case of a significant variation and when system servicing is necessary;</b></p> <p><b>(b) effective control functionalities to ensure optimum generation, distribution, storage, use of energy and, where applicable, hydronic balance;</b></p> <p><b>(c) a capacity to react to external signals and adjust the energy consumption.</b></p>	Building monitoring, automation and control systems are necessary for SPEN to function well; the obligation to install them in new buildings and renovations is positive for the SPEN approach.	

<p><b>Article 14</b></p> <p><b>Infrastructure for sustainable mobility</b></p>	<p>4. <i>With regard to new residential buildings with more than three car parking spaces and residential buildings undergoing major renovation with more than three car parking spaces, Member States shall ensure:</i></p> <p><i>(a) the installation of pre-cablings for at least 50% of car parking spaces and ducting, namely conduits for electric cables, for the remaining car parking spaces to enable the installation, at a later stage, of recharging points for electric vehicles, electrically power-assisted cycles and other L-category vehicle types;</i></p> <p><i>(aa) the installation of at least one recharging point for new residential buildings, and</i></p> <p><i>(b) at least two bicycle parking spaces for every residential building unit;</i></p>	<p>The integration of the building, renewable energy sources, and EVs and recharging stations is important for the storage and balancing of the system, and the neighbourhood/district scale is the right one on which to adjust the planning and design.</p>	<p>The integration of public transport or EV-sharing services within the district should also be considered.</p>
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## Financing, affordability and business models

SPENs require tailored finance solutions which acknowledge their multiple benefits for the residents and for society. The EPBD recast makes various mentions of the need for **financial incentives to overcome market barriers**, with a particular focus on **vulnerable households** and, where applicable, people living in social housing. Minimum energy performance standards are one of the tools listed in Article 9 that may help Member States to reach their target in terms of primary energy use in the residential building stock. They may be an important driver for renovating the worst-performing buildings; however, without the right public and private finance in place, the middle class and vulnerable households will not be able to perform renovations. Some of the public incentives mentioned in Article 17, such as loans or tax rebates, could fail to reach these categories and end up benefiting the upper income class. Other solutions, such as green mortgages and guarantee funds, may be relevant for SPENs, since these are more ambitious projects than business as usual and have higher investment costs.

Public-private partnerships may also be a solution with big SPEN projects, which require both public and private investments in renewable energy systems, storage or urban regeneration. Article 17 mentions that ‘Member States may also promote and simplify the use of public-private partnerships’. In general, there are still uncertainties about the availability of funding to implement the objectives of the EPBD, most of it usually being provided by Member States. It is also unclear how private finance will be mobilised. Several options do exist and will need to be explored: the setting-up of a public/collective guarantee that will attract private loans or bonds; the setting-up of energy performance contracts with third-party financing based on reliable consumption data; and the refinancing of public schemes using funds issuing ESG bonds. Failure to provide the necessary funding will result in increased costs of construction/renovation/operations that will have to be covered by SPEN stakeholders.



**Table 5:** EPBD articles regarding financing and affordability

Article	Provision	Drivers for SPEN approach	Barriers to SPEN approach
<p><b>Article 2</b></p> <p>DEFINITIONS <b>'vulnerable households'</b></p>	<p>28. 'vulnerable households' means households in energy poverty or households, including lower middle-income ones, that are particularly exposed to high energy costs and lack the means to renovate the building they occupy;</p>	<p>It is important that this recognises the fact that it is difficult for lower- and middle-class households to renovate, besides energy poverty.</p>	<p>Vulnerable households, besides being affected by high energy prices and the inability to renovate, have difficulties in accessing highly efficient new housing or in being part of SPEN projects. Housing and renovation policies should go hand in hand.</p>
<p><b>Article 2</b></p> <p>DEFINITIONS <b>'energy poverty'</b></p>	<p>27. 'energy poverty' means energy poverty as defined in Article 2(52) of <b>Directive (EU) 2023/1791</b>;</p>		
<p><b>Article 2</b></p> <p>DEFINITIONS <b>'mortgage portfolio standards'</b></p>	<p>39. 'mortgage portfolio standards' means mechanisms incentivising mortgage lenders to <b>establish a path to</b> increase the median energy performance of the portfolio of buildings covered by their mortgages <b>towards 2030 and 2050</b>, and to encourage potential clients to improve the energy performance of their property in line with the Union's decarbonisation ambition and relevant energy targets in the area of energy consumption in buildings, relying on the criteria for determining environmentally sustainable economic activities set out in Article 3 of Regulation (EU) 2020/852;</p>	<p>Harmonisation with the EU Taxonomy, plus it is important to contribute to sustainable finance, which may be beneficial for SPEN investments.</p>	
<p><b>Article 2</b></p> <p>DEFINITIONS <b>'pay-as-you-save financial scheme'</b></p>	<p>40. <b>'pay-as-you-save financial scheme' means a loan scheme dedicated exclusively to energy performance improvements, where a correlation is established in the designing of the scheme between the repayments on the loan and the achieved energy savings, taking into account as well other economic factors, such as the indexation of the energy cost, interest rates, increased asset value and loan re-financing;</b></p>	<p>Servitisation<sup>2</sup> of energy, acknowledgment of multiple benefits of energy efficiency improvements.</p>	

<sup>2</sup> Servitisation - the transformational processes whereby a company shifts from a product-centric to a service-centric business model and logic (Kowalkowski et al., 2017)



Article	Provision	Drivers for SPEN approach	Barriers to SPEN approach
<p><b>Article 9</b></p> <p><i>Minimum energy performance standards for non-residential buildings and trajectories for progressive renovation of the residential building stock</i></p>	<p>...Member States shall support compliance with minimum energy performance standards by all the following measures:</p> <p>(a) providing appropriate financial measures, in particular those targeting vulnerable households, people affected by energy poverty or, <b>where applicable</b>, living in social housing...</p> <p>(b) providing technical assistance, including through one-stop-shops <b>with a particular focus on vulnerable households and, where applicable, people living in social housing...</b></p> <p>(c) designing integrated financing schemes, <b>which provide incentives for deep and staged deep renovations, pursuant to Article 15;</b></p> <p>(d) removing non-economic barriers, including split incentives; and</p> <p>(e) monitoring social impacts, in particular on the most vulnerable <b>households.</b></p>	<p>The focus on financial measures for vulnerable households is important. Social engagement and co-design in neighbourhoods can be the right approach to ensure no one is left behind.</p>	
<p><b>Article 17</b></p> <p><i>Financial incentives, skills and market barriers</i></p>	<p>To support the mobilisation of investments, Member States shall promote the <b>effective development and use</b> of enabling funding and financial tools, such as energy efficiency loans and mortgages for building renovation, energy performance contracting, <b>pay-as-you-save financial schemes</b>, fiscal incentives, <b>for example reduced tax rates on renovation works and materials</b>, on-tax schemes, on-bill schemes, guarantee funds, funds targeting deep renovations, funds targeting renovations with a significant minimum threshold of targeted energy savings and mortgage portfolio standards. They shall guide investments into an energy efficient public building stock, in line with Eurostat guidance on the recording of Energy Performance Contracts in government accounts.</p>	<p>These financial mechanisms may reduce upfront investment costs for SPEN homeowners.</p>	<p>These may not be sufficient to get vulnerable or middle-class households on board, and there is the risk that public incentives go to upper class or big companies (Matthew Effect).<sup>3</sup></p>

<sup>3</sup> The Matthew Effect refers to a pattern in which those who begin with advantage accumulate more advantage over time and those who begin with disadvantage become more disadvantaged over time (Linda K. George et al., 2016)

Article	Provision	Drivers for SPEN approach	Barriers to SPEN approach
<u>Article 17</u> <i>Financial incentives, skills and market barriers</i>	<i>Member States may also promote and simplify the use of public-private partnerships.</i> <i>4b. The enabling funding and financial tools may include renovation loans or guarantee funds for energy performance renovations, including in combination with relevant EU programmes, where applicable.</i>	PPP and guarantee funds may be highly relevant for SPEN projects, which require high investments and regard both public and private spaces/assets.	
<u>Article 17</u> <i>Financial incentives, skills and market barriers</i>	Member States shall adopt measures that <b>promote</b> energy efficiency lending products for building renovations, <b>such as green mortgages and green loans, secured and unsecured, and ensure that they</b> are offered widely and in a non-discriminatory manner by financial institutions and are visible and accessible to consumers.	SPENs are more sustainable projects than business as usual, the stakeholders should benefit from green mortgages.	It is difficult for SPEN developers to prove compliance, and there is a lack of common assessment methods between the financial and construction sectors.
<u>Article 17</u> <i>Financial incentives, skills and market barriers</i>	<i>Member States shall incentivise sizeable programmes that address a high number of buildings, in particular the worst-performing buildings, such as through integrated district renovation programmes, and that</i> result in an overall reduction of at least <b>30%</b> of primary energy use with higher financial, fiscal, administrative and technical support, <b>according to the level of performance achieved.</b>	Integrated district renovation is a similar concept to SPEN.	There is a lack of financial incentives for more ambitious projects such as SPENs.
<u>Article 17</u> <i>Financial incentives, skills and market barriers</i>	<i>17. Without prejudice to their national economic and social policies and to their systems of property law, Member States shall address the eviction of vulnerable households caused by disproportionate rent increases following energy renovation of their residential building or building unit.</i>  <i>19. [...] Member States shall introduce effective safeguards, to protect in particular vulnerable households, including by providing rent support or by imposing caps on rent increases, and may incentivise financial schemes to tackle the upfront costs with renovations, such as on-bill schemes, pay-as-you-save schemes or energy performance contracting...</i>	It is important to avoid gentrification, and to acknowledge that housing policies should go hand in hand with renovation policies.	

## Renewable Energy Directive III

The Renewable Energy Directive (RED) has also been revised to reflect the increased targets of the [‘Fit for 55’ package](#) and the [REPowerEU plan](#). The [revised REDIII](#) entered into force on 20 November 2023, and increases the EU’s target for renewable energy to 42.5% by 2030 – an increase on the REDII target of 32% for 2030. The share of renewable energy in the building sector at EU level should be 49%. The current analysis maps the new provisions which are relevant for SPEN scale-up, as well as definitions such as ‘jointly acting renewables self-consumers’ and renewable energy community that remain unchanged from REDII.

### Energy performance and renewable energy in buildings

#### Mainstreaming renewable energy in buildings

Article 15 mandates that Member States should set an ‘indicative national share of renewable energy produced on-site or nearby as well as renewable energy taken from the grid in final energy consumption in their building sector’ consistent with the EU target of 49% for 2030. An increased renewable energy target for the building sector will contribute to renewable energy deployment in the built environment and can be more easily achieved with the SPEN approach. The words ‘on-site and nearby’ encourage local production and self-consumption, and the use of rooftops, roofed car parks, façades and other underused spaces in the built environment. However, allowing the option ‘and from the grid’ leaves space for off-site renewable energy sources, which goes against the SPEN approach of maximising local self-consumption and would mean high peaks in demand and costly upgrades.

The deployment of renewable energy in buildings should be supported ‘in combination with energy efficiency improvements that result in an increased number of “nearly zero energy buildings and buildings that go beyond minimum energy performance requirements”’. To go beyond ZEB is also required by SPEN to achieve a positive energy balance at the neighbourhood scale. REDIII mandates Member States to set up minimum requirements regarding renewable energy ‘produced on-site or nearby as well as renewable energy taken from the grid’ for new and renovated buildings, and to promote renewable heating and cooling and smart energy management. This differs from the ZEB introduced in the EPBD, which implies that 100% of the energy should be renewable. **Both in the EPBD and REDIII, the ‘on-site and nearby’ renewable energy should be prioritised over renewable energy from the grid, renewable energy communities, and ‘decarbonised energy sources’**. Thus, the minimum requirements for renewable energy for new constructions and renovations stated in REDIII and the EPBD should relate to ‘on-site and nearby’ renewable energy only.

The public sector should lead the way, for example, by ‘providing for the roofs of public or mixed private-public buildings to be used by third parties for installations that produce energy from renewable sources.’ This approach can be useful for SPEN projects, which usually require collaboration between public and private stakeholders and their assets.

Article	Provision	Drivers for SPEN approach	Barriers to SPEN approach
<u>Article 2</u> DEFINITIONS	<i>'energy from renewable sources' or 'renewable energy' means energy from renewable non-fossil sources, namely wind, solar (solar thermal and solar photovoltaic) and geothermal energy, osmotic energy, ambient energy, tide, wave and other ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas, and biogas;</i>	It is important that it also includes solar thermal, photovoltaic solar and other renewable energy sources, since many SPENs rely mostly on PV and do not explore other solutions.	
<u>Article 15a</u> <i>Mainstreaming renewable energy in buildings</i>	1. In order to promote the production and use of renewable energy in the building sector, Member States shall <b>determine</b> an indicative <b>national</b> share of <b>renewable energy produced on-site or nearby as well as renewable energy taken from the grid</b> in final energy consumption in their building sector in 2030 that is consistent with an indicative target of at least a 49 % share of energy from renewable sources in the building sector in the Union's final energy consumption <b>in buildings in 2030</b> .	The target of a 49% share of renewable energy in the building sector at the EU level can contribute to the SPEN approach, as can the wording of 'on-site or nearby'.	There is no renewable energy target for the building sector at Member State level, which allows for lower ambition and differences between Member States.  Allowing renewable energy from the grid with no differentiation for 'on-site or nearby' renewable energy goes against SPEN principles and does not contribute to a sustainable and decentralised deployment of renewable energy systems.
<u>Article 15a</u> <i>Mainstreaming renewable energy in buildings</i>	2. Member States shall introduce <b>appropriate</b> measures in their <b>national</b> regulations and <b>building</b> codes and, where applicable, in their support schemes, to increase the share of electricity and heating and cooling from renewable sources <b>both produced on-site or nearby as well as renewable energy taken from the grid in the building stock...</b> ...in combination with energy efficiency improvements relating to cogeneration and <b>major renovations which increase the number of nearly zero energy buildings and buildings that go beyond minimum energy performance requirements</b> .	Going beyond minimum energy performance requirements in renovation contributes to the SPEN approach.	Again the 'on-site or nearby' is not prioritised over renewable energy taken from the grid.
<u>Article 15a</u> <i>Mainstreaming renewable energy in buildings</i>	3. ...Member States may, among others, allow that obligation to be fulfilled by providing for <b>the roofs of public or mixed private-public buildings to be used by third parties</b> for installations that produce energy from renewable sources.	Allowing third parties to use the roofs of public buildings is useful for SPEN projects.	

## Renewable energy and energy communities

Legal frameworks which allow collective production of renewable energy are needed for SPEN development. The previous two definitions from REDII – ‘**jointly acting renewables self-consumers**’ and **renewable energy community (REC)** – remain unchanged. Member States have implemented these frameworks differently, as is shown in [Four factsheets policy recommendations for sustainable plus energy neighbourhoods and buildings](#). ‘Jointly acting renewables self-consumers’, or collective self-consumption in REDII and REDIII, is limited to a building or multi-apartment block. Some Member States, such as Spain, extended the range to 2km, which has enabled SPEN projects such as the syn.ikia demo in Barcelona. A renewable energy community requires a legal entity with many governance rules, which can be a significant barrier for bottom-up community initiatives. Often, the setting-up of a renewable energy community within a SPEN, or in a wider district including a SPEN, requires the involvement of local authorities – this can facilitate the inclusion of vulnerable households or social housing in the initiative.

### Renewables acceleration areas

Member States should designate specific areas, prioritising ‘artificial and built surfaces, such as rooftops and façades of buildings, transport infrastructure and their direct surroundings, parking areas, farms, waste sites, industrial sites, mines, artificial inland water bodies, lakes or reservoirs, and, where appropriate, urban waste water treatment sites, as well as degraded land not usable for agriculture’. This definition of renewables acceleration areas is a similar concept to SPEN, since both are located in the built environment and can be adjusted to the local context to untap the potential for renewable energy production and storage.

Article	Provision	Drivers for SPEN approach	Barriers to SPEN approach
<b>Article 2</b> DEFINITIONS	(15) ‘jointly acting renewables self-consumers’ means a group of at least two jointly acting renewables self-consumers in accordance with point (14) who are located in the same building or multi-apartment block	This article remains unchanged from REDII. The possibility of sharing energy between residents of an apartment block is positive; however, this is not in itself enough for SPEN developments.	It is limited to a building, while for SPEN development the possibility to share within the neighbourhood/district is needed. A good practice for implementation is to extend the distance to 2km, as has been done in Spain.
<b>Article 2</b> DEFINITIONS	(16) ‘renewable energy community’ means a legal entity: (a) which, in accordance with the applicable national law, is based on open and voluntary participation, is autonomous, and is effectively controlled by shareholders or members that are located in the proximity of the renewable energy projects that are owned and developed by that legal entity; (b) the shareholders or members of which are natural persons, SMEs or local authorities, including municipalities; (c) the primary purpose of which is to provide environmental, economic or social community benefits for its shareholders or members or for the local areas where it operates, rather than financial profits;	This article remains unchanged from REDII. The possibility of sharing energy between residents of an apartment block is positive; however, this is not in itself enough for SPEN developments.	The need to register a legal entity is a barrier for bottom-up initiatives, and renewable energy communities usually require the support of municipalities.

Article	Provision	Drivers for SPEN approach	Barriers to SPEN approach
<b>Article 2</b> DEFINITIONS	<i>'renewables acceleration area' means a specific location or area, whether on land, sea or inland waters, which a Member State designated as particularly suitable for the installation of renewable energy plants;</i>	Setting up a concept similar to SPEN contributes to the deployment of renewable energy.	
<b>Article 15c</b> <b>Renewables acceleration areas</b>	<i>1 By 27 months after the entry into force, Member States shall ensure that competent authorities adopt a plan or plans designating, as a sub-set of the areas referred to in Article 15b(1), renewables acceleration areas for one or more types of renewable energy sources. (i) give priority to artificial and built surfaces, such as rooftops and facades of buildings, transport infrastructure and their direct surroundings, parking areas, farms, waste sites, industrial sites, mines, artificial inland water bodies, lakes or reservoirs, and, where appropriate, urban waste water treatment sites, as well as degraded land not usable for agriculture;</i>	Renewables acceleration areas is a similar concept to SPEN if deployed in the city. Priority is given to artificial and built surfaces and land not usable for agriculture. This discourages big power plants on agricultural fields and encourages small renewable installations in the built environment.	

## Digital technologies and demand-side flexibility

As well as renewable energy sources, SPENs include shared assets of energy and heat storage facilities, thus the definition of **'co-located energy storage'** located within the same grid access point as the production of renewable energy contributes to the neighbourhood/district approach.

Article 15a, 'Mainstreaming renewable energy in buildings,' mentions energy efficiency measures to encourage energy storage, EV charging and other demand-side flexibility services, and building automation and control systems, which are part of the syn.ikia SPEN concept. However, no concrete measures in terms of requirements or financial incentives are provided for the residential sector. Storage and smart systems require additional investments in the SPEN compared to business as usual, and these are hard to monetise later because of difficulties for the SPEN in selling flexibility services.

Article	Provision	Drivers for SPEN approach	Barriers to SPEN approach
<b>Recital</b>	<i>(58) Member States should encourage self-consumers and renewable energy communities to actively participate in those electricity markets by providing flexibility services through demand response and storage including through batteries and electric vehicles.</i>	SPENs include energy storage, EV charging stations and demand-side flexibility and can contribute to flexibility services for renewable energy communities or the grid.	No concrete provisions to encourage business models for storage and building automation and control systems in the residential sector – the high upfront investment required for SPEN in this regard is difficult to monetise. Need to enable small market players such as SPENs and renewable energy communities to sell flexibility services.

Article	Provision	Drivers for SPEN approach	Barriers to SPEN approach
<b>Article 2</b> DEFINITIONS	<b>(44d) ‘co-located energy storage’ means an energy storage facility combined with a facility producing renewable energy and connected to the same grid access point;</b>	SPENs require a combination of renewable energy and energy storage.	
<b>Article 15a</b> <b>Mainstreaming renewable energy in buildings</b>	2. Member States shall introduce <b>appropriate</b> measures in their <b>national</b> regulations and <b>building</b> codes ... <b>This may include</b> national measures relating to substantial increases in renewables self-consumption, renewable energy communities, local energy storage, <b>smart and bidirectional charging, other flexibility services such as demand response, and</b> in combination with energy efficiency improvements relating to cogeneration...	Incorporation of renewable energy and energy efficiency in building codes should go hand in hand with building automation and control systems, EV charging and demand-side flexibility, which is a similar concept to SPEN.	
<b>Article 15a</b> <b>Mainstreaming renewable energy in buildings</b>	4. Member States shall promote the use of renewable heating and cooling systems and equipment <b>and may promote innovative technologies, such as smart and renewable-based electrified heating and cooling systems and equipment, complemented, where applicable, with smart management of energy consumption in buildings.</b>	Smart management, demand-side flexibility and maximising self-consumption are also part of the SPEN approach.	No concrete measures for implementation of smart management of energy, lack of public incentives or regulations for smartness make the business case for SPEN in the residential sector unattractive compared to business as usual.

## Financing, affordability and business models

The definition of ‘renewable energy community’ specifies its purpose as being to provide ‘environmental, economic or social community benefits... rather than financial profits’. This provision was transposed by Member States as the inability to sell between members of a renewable energy community, with only the possibility to share renewable energy and sell the surplus to the grid. As is pointed out [Identification, design and evaluation of business models](#), this poses important barriers to business models for SPENs. The same applies to the inability to sell flexibility services directly to the grid, without additional intermediaries such as aggregators.

Article 20a includes the requirement for distribution system operators to share aggregated and anonymised data, which is important for SPEN developers.



Article	Provision	Drivers for SPEN approach	Barriers to SPEN approach
<u>Article 2</u>	(16) 'renewable energy community' means a legal entity: ...(c) the primary purpose of which is to provide environmental, economic or social community benefits for its shareholders or members or for the local areas where it operates, rather than financial profits;	It is important to highlight the social, economic and environmental aspects of renewable energy communities, and SPENs contribute to these. Sharing the excess of energy from a SPEN with a wider renewable energy community located in the same district can contribute to social cohesion.	Financial profits are not listed as the purpose of renewable energy communities – however, this was transposed as an inability to sell energy between members of a renewable energy community, which is a barrier for SPEN business models. The energy can only be sold to the grid; however, this is usually done at lower prices than purchase prices.
<u>Article 15a</u> <i>Mainstreaming renewable energy in buildings</i>	<b>3 Where deemed relevant, Member States may promote cooperation between local authorities and renewable energy communities in the building sector, particularly through the use of public procurement.</b>	Cooperation between private and public stakeholders is also necessary for SPEN projects, and public procurement can be an effective approach. Renewable energy communities within SPEN demos are often driven by local authorities.	
<u>Article 19</u> <i>Guarantees of origin for energy from renewable sources</i>	<b>(ii) 'Simplified registration processes and reduced registration fees shall be introduced for small installations of less than 50 kW and for renewable energy communities.'</b>	Simplified registration for small installations and renewable energy communities can speed up SPEN development.	
<u>Article 20a</u> <i>Facilitating system integration of renewable electricity</i>	<b>If technically available, distribution system operators shall also make available anonymised and aggregated data on the demand response potential and the renewable electricity generated and injected to the grid by self-consumers and renewable energy communities.</b>	Data from distribution system operators is necessary for SPEN developers in the planning phase.	
<u>Article 15</u> <i>Mainstreaming renewable energy in buildings</i>	<b>15d Public participation (2) Member States shall promote public acceptance of renewable energy projects by means of direct and indirect participation in the projects by local communities.</b>	Local authorities play an important role in promoting SPENs and renewable energy communities, especially by including vulnerable households or social housing in the projects.	



## Energy Efficiency Directive

The EED recast entered into force in October 2023. It introduced a legally binding target for the EU to reduce final energy consumption by 11.7% by 2030, as compared to the projections of the 2020 EU Reference Scenario. Member States should progressively increase the annual energy savings obligation from at least 0.8% of final energy consumption in 2021-2023 to at least 1.9% in 2028-2030. The target for primary energy reduction of 11.7% is the same; however, it is not binding. Even though voluntary, the inclusion of a target for primary energy alongside a compulsory target for final energy contributes to renewable energy deployment and the reduction of peak demand with demand-side flexibility, which are among the benefits of SPENs. The analysis will detail the provisions and policies which are relevant for buildings and SPENs.

### Energy efficiency and demand-side flexibility

**‘Energy efficiency first’** is introduced as the fundamental guiding principle for planning, policy and major investment decisions in energy systems and non-energy sectors, such as buildings, transport, water, information and communications technology, agriculture and finance.

The public sector is expected to lead by example, with the obligation to renovate at least 3% of the total floor area of buildings that are owned by public bodies each year. Renovated buildings should be transformed into at least NZEBs or ZEBs, which is consistent with the EPBD.

Approaches involving the integration of district heating and cooling or sustainable mobility with building renewable energy sources can be optimally achieved within SPENs, and are mentioned in the revised EED.

Article	Provision	Drivers for SPEN approach	Barriers to SPEN approach
<u>Recital</u>	(89) Lower consumer spending on energy should be achieved by assisting consumers in reducing their energy use by reducing the energy needs of buildings and improvements in the efficiency of appliances, which should be combined with the availability of low-energy transport modes integrated with public transport, shared mobility and cycling.	Integration with sustainable mobility is a concept close to SPEN.	
<u>Recital</u>	(105) All the district heating and cooling systems should aim for improved ability to interact with other parts of the energy system in order to optimise the use of energy and prevent energy waste by using the full potential of buildings to store heat or cold, including the excess heat from service facilities and nearby data centres.	Integration of district heating and cooling with buildings and other energy systems can best be achieved within SPENs.	

Article	Provision	Drivers for SPEN approach	Barriers to SPEN approach
<b>Article 3</b> <i>Energy efficiency first principle</i>	In accordance with the energy efficiency first principle, Member States shall ensure that energy efficiency solutions, including demand-side resources and system flexibilities, are assessed in planning, policy and major investment decisions of a value of more than EUR 100 000 000 each or EUR 175 000 000 for transport infrastructure projects, relating to the following sectors:  (a) energy systems; and  (b) non-energy sectors, where those sectors have an impact on energy consumption and energy efficiency such as buildings, transport, water, information and communications technology (ICT), agriculture and financial sectors.	The inclusion of demand-side flexibility in the concept of energy efficiency first is positive for SPENs.	The threshold of EUR 100,000,000 is too high for SPENs and the buildings sector: only some SPEN investments will qualify.
<b>Article 6</b> <i>Exemplary role of public bodies' buildings</i>	... Member States shall ensure that at least 3% of the total floor area of heated and/or cooled buildings that are owned by public bodies is renovated each year to be transformed into at least nearly zero-energy buildings or zero-emission buildings...	The need to achieve at least NZEB or ZEB level enables the SPEN approach.	
<b>Article 23</b> <i>Heating and cooling assessment and planning</i>	Member States shall <b>ensure that</b> regional and local authorities prepare local heating and cooling plans at least in municipalities having a total population higher than <b>45.000</b> . <b>(da) assess the role of energy communities and other consumer-led initiatives that can actively contribute to the implementation of local heating and cooling projects;</b>	Important for strategic planning at municipal level involving renewable energy communities and other community initiatives, which can include SPENs.	

## Financing and affordability

The revised EED, as well as the rest of the initiatives for the energy transition, has a strong focus on vulnerable households and fuel poverty and, where applicable, social housing with the principle of 'leaving no one behind'. An important measure is listed in Article 24: to use revenues generated from the EU Emissions Trading System (ETS) of buildings to address fuel poverty through the Social Climate Fund and the national energy efficiency fund.

Article	Provision	Drivers for SPEN approach	Barriers to SPEN approach
<b>Article 2</b>  DEFINITIONS <b>(52) 'energy poverty'</b>	- a household's lack of access to essential energy services, where such services provide basic levels and decent standards of living and health, including adequate heating, hot water, cooling, lighting, and energy to power appliances, in the relevant national context, existing national social policy and other relevant national policies, caused by a combination of factors, including at least non-affordability, insufficient disposable income, high energy expenditure and poor energy efficiency of homes;	Access to energy services is considered at the same time as 'decent standards of living', thus energy policies should go hand-in-hand with housing policies.	
<b>Recital</b>	(96) In order to achieve the transparency of accounting for individual consumption of thermal energy, and thereby facilitate the implementation of sub-metering, Member States should ensure they have in place transparent, publicly available national rules on the allocation of the cost of heating, cooling and domestic hot water consumption in multi-apartment and multi-purpose buildings.	Submetering is important for SPEN business models too.	Difficulties in billing within SPENs requires new roles of energy managers, besides housing associations.
<b>Article 6</b>  <b>Exemplary role of public bodies' buildings</b>	Member States shall ensure that contracting authorities and contracting entities assess the feasibility of concluding long-term energy performance contracts that provide long-term energy savings when procuring service contracts with significant energy content.	This type of contract between SPENs and public authorities can contribute to SPEN business models.	
<b>Article 9</b>  <b>Energy efficiency obligation schemes</b>	6. ...To protect people affected by energy poverty, vulnerable customers and, where applicable, people living in social housing, Member States shall encourage obligated parties to carry out actions such as renovation of buildings, including social housing, replacement of appliances, financial support and incentives for energy efficiency improvement measures in accordance with national financing and support schemes, or energy audits...	Renovating social housing with the SPEN approach can be an effective policy measure.	

Article	Provision	Drivers for SPEN approach	Barriers to SPEN approach
<p><b>Article 6</b></p> <p><i>Empowering and protecting vulnerable customers and alleviating energy poverty</i></p>	<p>3. To support people affected by energy poverty, vulnerable customers, people in low-income households and, where applicable, people living in social housing, Member States shall, where applicable:</p> <p>(a) implement energy efficiency improvement measures to mitigate distributional effects from other policies and measures, such as taxation measures implemented in accordance with Article 10 of this Directive, or the application of emissions trading in the buildings and transport sector...</p>	<p>It is a positive step to use the ETS to tackle fuel poverty – it can provide resources for SPEN projects for social housing or vulnerable households.</p>	
<p><b>Article 30</b></p> <p><i>National energy efficiency fund, financing and technical support</i></p>	<p>The national energy efficiency fund may be financed with revenues from the allowance auctions pursuant to the EU ETS on buildings and transport sectors.</p>		
<p><b>Article 30</b></p> <p><i>National energy efficiency fund, financing and technical support</i></p>	<p>Member States shall adopt measures that promote energy efficiency lending products, such as green mortgages and green loans, secured and unsecured, and ensure that they are offered widely and in a non-discriminatory manner by financial institutions, and are visible and accessible to consumers. Member States shall adopt measures to facilitate the implementation of on-bill and on-tax financing schemes, taking into account the Commission guidance provided in accordance with paragraph 10. Member States shall ensure that banks and other financial institutions receive information on opportunities to participate in the financing of energy efficiency improvement measures, including through the creation of public-private partnerships. Member States shall encourage the setting up of loan guarantee facilities for energy efficiency investment.</p>	<p>Green loans, public-private partnerships and loan guarantees can contribute to financing SPENs.</p>	<p>On-bill and on-tax financing schemes may have limited impact for the large investments needed for SPENs, but they can cover part of the investments which require performance guarantees.</p>

# The EU Taxonomy

## Purpose and current state of implementation

The EU Taxonomy is a classification system that helps companies and investors to identify 'environmentally sustainable' economic activities when making sustainable investment decisions. Environmentally sustainable economic activities are described as those which 'make a substantial contribution to at least one of the EU's climate and environmental objectives, while at the same time not significantly harming any of these objectives and meeting minimum safeguards.'

The EU Taxonomy is not a mandatory list for investors. It does not set mandatory requirements on environmental performance for companies or for financial products, and investors are free to choose what to invest in. However, it is expected that over time the EU Taxonomy will have a substantial impact both on business models and on investment decisions within the building sector. It will encourage a transition towards sustainability, aligning with EU climate and environmental goals.

As a transparency tool, the EU Taxonomy also enables the comparison of companies and investment portfolios by revealing the proportion of their activities that align with environmental objectives. Financial companies can leverage the Taxonomy to create credible green financial products, while non-financial reporting directive (NFRD) companies had to report on sustainability using the EU Taxonomy list for the first time in 2022, for the 2021 fiscal year. The Corporate Sustainability Reporting Directive (CSRD) entered into force in January 2023.

In 2024, parties under the [Corporate Sustainability Reporting Directive \(CSRD\)](#) will also have to report using the EU Taxonomy. Almost all large companies and major stock market listed companies in Europe fall into this category. Companies must report if they meet at least two of the following criteria: over 250 employees, over €40 million in sales, or over €20 million on the balance sheet. Even small- and medium-sized businesses and non-financial institutions that are not required to report may voluntarily choose to do so.

**Additionally, some construction companies are required to report according to the EU Taxonomy – or they will need to start reporting on the request of their clients, or to qualify for favourable financing.** This will also affect the real estate sector, since the requirement to disclose environmental risks will contribute to accelerated value differentiation among assets – most likely with the depreciation in value of inefficient buildings, as the market will increasingly recognise that they present an increased economic and regulatory risk.

## Main categories of indicators in the EU Taxonomy

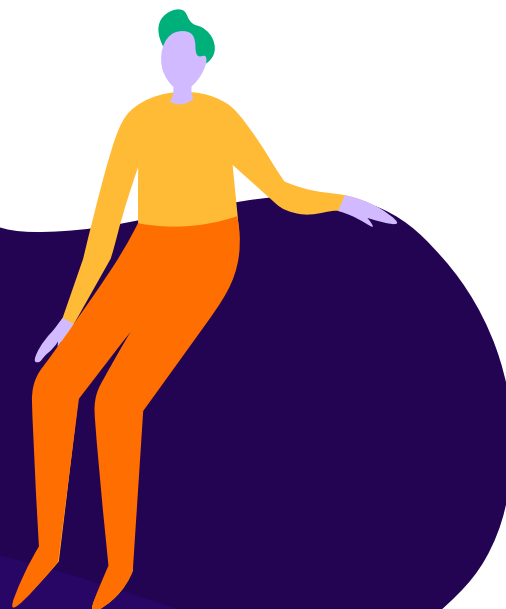
1. The taxonomy covers six environmental objectives (EC, 2023):
2. Climate change mitigation
3. Climate change adaptation
4. Sustainable use and protection of water and marine resources
5. Transition to a circular economy
6. Pollution prevention and control
7. Protection and restoration of biodiversity and ecosystems.

These objectives are applicable to multiple sectors, including construction and real estate. Currently, the climate mitigation and climate adaptation objectives are clearly formulated. Delegated Acts have been adopted to establish the technical screening criteria for climate change mitigation and adaptation, such as the [Commission Delegated Regulation \(EU\) 2023/2486](#). From the perspective of SPENs, the following sectors are of relevance:

- Construction and real estate
- Energy
- Manufacturing
- Transport
- Water supply, sewerage, waste management and remediation

### **Syn.ikia evaluation framework for SPENs**

Within the syn.ikia project, definitions were established for SPENs, as well as for positive energy buildings. The evaluation framework outlines the key performance indicators (KPIs) for energy and power performance, GHG emissions, smartness, flexibility, economic performance, indoor environmental quality, and social sustainability. This assessment framework contributes to the ongoing debate over the definition of what a positive energy district/neighbourhood is. The calculation method for the framework is detailed in (Salom & Tamm, 2020) and was applied to four syn.ikia demo projects to assess their sustainability in different design and operational phases. The data collected from demos can contribute to the definition of benchmarks and the setting-up of future threshold values for KPIs. At this point, the framework can be used to compare the environmental, social and economic performance of SPEN projects, which can guide green investment decisions. In the following section, the syn.ikia framework for SPENs is compared to the EU Taxonomy criteria, and syn.ikia demo projects are evaluated against both sets of criteria.



**Table 6:** Key performance indicators defined in the syn.ikia evaluation framework

Category	Sub-category	Key performance indicator
Energy and environmental performance	Overall performance	Non-renewable primary energy balance
		Renewable energy ratio
	Matching factors	Grid purchase factor
		Load cover factor/self-generation
		Supply cover factor/self-consumption
	Grid interaction factors	Net energy/net power
		Peak delivered/peak exported power
		Connection capacity credit
	Environmental balance	Total greenhouse gas emissions
	Economic performance	Capital costs
Share of investments covered by grants		
Operational costs		Maintenance-related costs
		Requirement-related costs
		Operation- related costs
		Other costs
Overall performance		Net present value
		Internal rate of return
		Economic value added
		Payback period
NZEB cost comparison		
Indoor environmental quality	Indoor air quality	Carbon dioxide
	Thermal comfort	Predicted mean vote
		Predicted percentage dissatisfied
		Temperature
		Relative humidity
	Lighting and visual comfort	Illuminance
		Daylight factor
	Acoustic comfort	Sound pressure level
Social performance	Equity	Access to services
		Affordability of energy
		Affordability of housing
		Democratic legitimacy
		Living conditions
	Community	Social cohesion
	People	Personal safety
		Energy consciousness
Smartness and flexibility	Flexibility	Flexibility index
	Smartness	Smartness Readiness Indicator (SRI)

## Comparison of the EU Taxonomy criteria with the syn.ikia framework for SPENs

This section explores the EU Taxonomy criteria<sup>4</sup> and compliance requirements for the buildings which are relevant for SPEN. The Taxonomy requirements are compared against the syn.ikia framework of KPIs for SPENs, and both are applied to the four syn.ikia demo projects. The demo projects are located in Spain, Austria, the Netherlands and Norway, each characterised by different building regulations, climates and markets. These differences are relevant factors for testing the applicability and effectiveness of the two frameworks in diverse contexts. Their compliance with the EU Taxonomy will be tested, to draw conclusions on the ambition of the requirements. The following economic activities of the EU Taxonomy regarding climate mitigation and adaptation are included in the analysis:

- Acquisition and ownership of buildings
- Construction of new buildings
- Renovation of existing buildings
- Installation, maintenance and repair of energy efficiency equipment
- Installation, maintenance and repair of instruments and devices for measuring, regulating and controlling the energy performance of buildings
- Installation, maintenance and repair of renewable energy technologies
- Installation, maintenance and repair of charging stations for electric vehicles in buildings (and parking spaces attached to buildings)
- Urban and suburban transport, road passenger transport
- Construction, extension and operation of wastewater collection and treatment

### **Acquisition and ownership of buildings**

The EU Taxonomy includes criteria to guide investments in sustainable real estate projects. Investors will seek lower-risk and future-proof real estate, compliant with the Taxonomy. If SPEN developments can align and prove compliance with these criteria they may become attractive investments, which would result in more finance flowing into SPEN developments.

**The EU Taxonomy uses EPC labels and requires class A to define ‘sustainable real estate projects that prioritise energy efficiency, renewable energy integration, and sustainable design’.** Alternatively, the buildings should be in the top 15% of the national or regional building stock, expressed as operational primary energy demand. However, one of the main challenges faced by Taxonomy users is that the EPC schemes of Member States are not currently harmonised, thus the labels of the four demo projects cannot be compared with each other. In the Netherlands and Austria (for some aspects of the label) the projects achieve class A++.

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<sup>4</sup> The analysis regards the Commission Delegated Regulation (EU) 2021/2139 of 4 June 2021 and does not include the environmental criteria Commission Delegated Regulation (EU) 2023/2486 of 27 June 2023.



The reliance on the EPC schemes of the EU Taxonomy criteria does not allow comparison of investments between Member States, as there are differences in the ranges of the label as well as in its calculation method. For example, the Spanish EPC label ranges from G to A, while the Dutch one ranges from G to A+++.

**The forthcoming 2024 EPBD recast includes measures to harmonise the EPC schemes by having the same classes A to G**, which is a positive step for the implementation of the EU Taxonomy. The letter A will correspond to ZEB levels and the letter G to the very worst-performing buildings; **however, significant differences in the calculation methods between national schemes remain**. Member States may define an A+ energy performance class corresponding to buildings with an energy demand which is at least 20% lower than ZEB.

On the other hand, the syn.ikia framework does not operate with EPC ratings, but uses a non-renewable primary energy KPI, which is not comparable with the primary energy demand indicator of the EU Taxonomy.

The non-renewable primary energy KPI uses kWh/(m<sup>2</sup>.y) as units and is calculated as follows:

1. It considers the building's uses of energy: heating, cooling, ventilation, domestic hot water and lighting.
2. In the framework of syn.ikia, weighting factors for exported energy should be selected based on the resources avoided from the external grid, which is equivalent to Step B in ISO-52000. This means that, for example, the values of the delivered and exported weighting factors for electricity are considered to be equal.
3. A negative value (<0) means a positive energy building.

All syn.ikia demo projects achieve a positive energy level at building scale, with values up to -22 kWh/(m<sup>2</sup>.y) for the Austrian demo.

The syn.ikia projects achieve classes from A to A++, and thus are also compliant at the building level with the EU Taxonomy's approach with EPC classes. The high energy performance at building level of the demos suggests that concerns that the neighbourhood approach will lower ambition at the building level are not justified, because the positive balance is mainly achieved by reducing demand.

**However, the EU Taxonomy does not differentiate between buildings rated A and more ambitious projects such as SPENs aiming for positive energy buildings. The inclusion of the A+ energy class into the EPC scheme in the 2024 EPBD recast may help to differentiate between business-as-usual projects which aim for minimum requirements and more ambitious projects which aim for positive energy buildings and can contribute to an easier implementation of the EU Taxonomy.**

Main activity EU Taxonomy	Sub-category activities EU Taxonomy	EU Taxonomy criteria		Application demo sites				
Acquisition and ownership of buildings	Investment in sustainable real estate projects that prioritise energy efficiency, renewable energy integration, and sustainable design.	For buildings built before 31 December 2020, the building has at least an Energy Performance Certificate (EPC) class A. As an alternative, the building is within the top 15% of the national or regional building stock expressed as operational Primary Energy Demand (PED) and demonstrated by adequate evidence, which at least compares the performance of the relevant asset to the performance of the national or regional stock built before 31 December 2020 and at least distinguishes between residential and non-residential buildings.  Where the building is a large non-residential building (with an effective rated output for heating systems, systems for combined space heating and ventilation, air-conditioning systems or systems for combined air-conditioning and ventilation of over 290 kW) it is efficiently operated through energy performance monitoring and assessment.	<b>syn.ikia SPEN framework KPIs</b>	Compliance with the EU Taxonomy and syn.ikia KPIs	ES demo	NL demo	AT demo	NO demo
	Incorporation of environmental, social and governance (ESG) criteria in real estate investment decisions.		<b>Non-renewable primary energy units: kWh/(m<sup>2</sup> y)</b>	EU Taxonomy compliance:  EPC class A achieved	● A	● A++	● A to A++	● A
			<b>Non-renewable primary energy units: kWh/(m<sup>2</sup> y)</b>	Syn.ikia SPEN KPI:  Non-renewable primary energy (NRPE) in kWh/(m <sup>2</sup> y)	-15.6	-1.8	-22.0	-7.1

### Construction of new buildings; building renovation

Three syn.ikia demo projects are new developments, while the Austrian one is a combination of new construction and renovation. The EU Taxonomy sets a series of criteria to define both. For sustainable new constructions the primary energy demand is at least 10% lower than the NZEB level. The NZEB thresholds are defined differently by the Member States depending on climatic zone and other factor; thus, as with the EPC labels, the comparison of buildings and investments across Member States is not possible. All syn.ikia new construction demo projects are compliant with this requirement, achieving in the case of the Spanish demo a reduction of more than 50% compared to NZEB levels. **The current EU Taxonomy fails to fully recognise the ‘additionality’ of SPENs over the ‘10% lower than NZEB’ criterion (which is in any case very close to the minimum requirements for new constructions and almost standard practice).** Such ambitious projects require significant additional investments compared to business as usual, which is not acknowledged by the EU Taxonomy, except for the airtightness test. Other aspects are included, such as the calculation of GWP. Primary energy demand and GWP are not included in the syn.ikia framework for SPEN KPIs.

The EU Taxonomy requires compliance with Directive 2010/31/EU, or alternatively a primary energy demand reduction of at least 30%. The EU Taxonomy does not require a 'deep renovation level', defined in Article 2 of the EPBD recast as a renovation **in line with the energy efficiency first principle and which focuses on essential building elements**, and which transforms a building or building unit:

(a) before 1 January 2030, into a NZEB;

(b) as of 1 January 2030, into a ZEB;

This criterion is not applicable to syn.ikia demos, which are new constructions or a combination of new construction and renovation.

Main activity EU Taxonomy	Sub-category activities EU Taxonomy	EU Taxonomy criteria	SPEN framework syn.ikia KPIs	Evaluation of syn.ikia demo projects				
				Compliance with the EU Taxonomy and syn.ikia KPIs	ES demo	NL demo	AT demo	NO demo
				Syn.ikia SPEN KPI: non- renewable primary energy in kWh/(m <sup>2</sup> y)	-15.6	-1.8	-22.0	-7.1
<b>Construction of new buildings</b>	Construction of energy-efficient buildings that meet specific sustainability standards.	Primary Energy Demand (PED) is at least 10% lower than the threshold set for NZEB requirements in national measures implementing Directive 2010/31/EU.	Primary energy demand is not computed in the syn.ikia demos.	EU Taxonomy compliance: Total primary energy consumption (<10% lower than NZEB)	● <55%	● <33%	● <0%	● <11%
	Adoption of responsible property management practices, including monitoring energy consumption, optimising resource use, and promoting occupant well-being.	Energy performance is certified using an EPC.		EU Taxonomy compliance: If EPC is available	●	●	●	●
	Design and construction of green buildings that meet recognised certification standards, such as LEED or BREEAM.	Larger than 5000m <sup>2</sup> : upon completion the building undergoes testing for airtightness and thermal integrity. Or as an alternative control processes are in place during construction.		EU Taxonomy compliance: If airtightness test is available	●	●	●	●
	Use of sustainable building materials, including recycled content, low-carbon materials, and materials with a reduced environmental impact.  Integration of green infrastructure features, such as green roofs, rain gardens, and permeable pavements.	Also, the GWP has been calculated for each stage. This information (including deviations) is disclosed to investors and clients. If compliance should be verified by an independent third party, this party published and transmits a report to the Commission every year, certifying the level of direct GHG emissions and other defined trajectories.		EU Taxonomy compliance: If GWP calculation is available	●	●	●	●
<b>Renovation of existing buildings</b>	Retrofitting existing buildings to decrease energy demand.	Building renovation complies with Directive 2010/31/EU. Alternatively, it leads to a primary energy demand PED reduction of at least 30%.		Primary energy demand reduction of at least 30%	n/a	n/a	n/a	n/a

## Installation, maintenance and repair of energy efficiency equipment

Besides setting an overall energy performance level for the building, the EU Taxonomy sets thresholds for investments in energy efficiency upgrades for individual building elements. These include U-values for roof, wall insulation, windows and doors. Syn.ikia demos located in colder climates – such as the Dutch, Austrian and Norwegian examples – comply with all the criteria except for doors, for which data is not available. The Spanish demo has a positive energy performance overall, thus, having the same U-values for all climates is a questionable approach, since these are different in the NZEB requirements.

Main activity EU Taxonomy	Sub-category activities EU Taxonomy	EU Taxonomy criteria	SPEN framework syn.ikia KPIs	Application demo sites				
				Compliance with the EU Taxonomy and syn.ikia KPIs	ES demo	NL demo	AT demo	NO demo
<b>Installation, maintenance and repair of energy efficiency equipment</b>	Improve energy efficiency through insulation upgrades, window replacements, and energy-efficient lighting.	Windows should have a U-value lower than or equal to 1.0 W/m <sup>2</sup> K.	No building element level KPI, only overall energy performance (non-renewable primary energy)	EU Taxonomy compliance: Windows U-value ≤1.0 W/m <sup>2</sup> K	●	●	●	●
		Doors should have an U-value lower than or equal to 1,2 W/m <sup>2</sup> K.		EU Taxonomy compliance: Doors U-value ≤ 1.2	n/a	n/a	n/a	n/a
		External wall systems should have an U-value lower than or equal to 0,5 W/m <sup>2</sup> K.		EU Taxonomy compliance: Walls U-value ≤ 0.5 W/m <sup>2</sup> K:	●	●	●	●
		Roofing systems should have an U-value lower than or equal to 0,3 W/m <sup>2</sup> K.		EU Taxonomy compliance: Roofs U-value ≤ 0.3 W/m <sup>2</sup> K	●	●	●	●
		Insulating products should have a lambda value lower than or equal to 0,06 W/m <sup>2</sup> K.		EU Taxonomy compliance: Insulation lambda ≤0.06 W/K	n/a	n/a	n/a	n/a

## Installation, maintenance and repair of renewable energy technologies; installation of devices for measuring, regulation and controlling energy performance of buildings

The integration of smart building technologies and energy monitoring systems is an important aspect of the SPEN concept, and requires significant additional investment. It is included in the EU Taxonomy criteria, as well as 'expert guidance on how to optimise energy use, such as an energy manager'. Another set of requirements regard the installation, maintenance and repair of renewable energy technologies, which are also implicitly needed to meet the overall energy performance requirements for new constructions and renovations we have previously discussed.

Main activity EU Taxonomy	Sub-category activities EU Taxonomy	EU Taxonomy criteria	SPEN framework syn.ikia KPIs	Application demo sites				
				Compliance with the EU Taxonomy and syn.ikia KPIs	ES demo	NL demo	AT demo	NO demo
<b>Installation, maintenance and repair of instruments and devices for measuring, regulating and controlling energy performance of buildings</b>	Implementation of smart building technologies and energy monitoring systems.  Integration of systems that measure, regulate and control the energy performance, e.g. smart meters or a digital twin.		As part of the syn.ikia framework, having monitoring systems and management systems is essential for efficient operation.	EU Taxonomy compliance: Integration of monitoring and control/management systems	●	●	●	●
				EU Taxonomy compliance: Energy manager	●	●	●	●
	Professional energy services to provide expert guidance on how to optimise energy use, such as an energy manager.		EU Taxonomy compliance: Solar PV systems	●	●	●	●	
			EU Taxonomy compliance: Solar thermal systems	●	●	●	●	
			EU Taxonomy compliance: Aerothermal heat pumps	●	●	●	●	
			Geothermal heat pumps	●	●	●	●	
<b>Installation, maintenance and repair of renewable energy technologies</b>	Installation of renewable energy systems, such as solar panels, energy storage systems, or geothermal heating.		No specific technologies are prioritised by the syn.ikia framework, only overall KPIs: the non-renewable primary energy and the renewable energy ratio.	EU Taxonomy compliance: Energy manager/maintenance contracts for renewables systems	●	●	●	●
	Implementation of energy-efficient technologies and practices in buildings to decrease energy demand, including efficient HVAC systems and smart lighting.							
	Maintenance and repair of the renewable energy technologies.							

## Sustainability mobility; waste water collection and treatment

For optimising control and management systems at SPEN level, integration with energy storage and smart mobility is crucial. The EU Taxonomy includes several criteria, such as EV charging stations and hydrogen distribution networks. Other criteria go beyond energy and storage aspects and concern sustainable mobility, such as bike lanes and pedestrian zones, which are also relevant for the SPEN concept. Other sustainability aspects at the neighbourhood level include sustainable water management practices such as rainwater harvesting systems or waste management strategies. These are not included in the syn.ikia framework, which has a focus on operational energy, so we lack data from the demos in this regard. However, the neighbourhood scale, with community involvement, can be optimal for finding solutions regarding water and waste, taking into account resilience and climate change adaptation strategies which go beyond a single building and require integration with urban infrastructure.

Main activity EU Taxonomy	Sub-category activities EU Taxonomy	EU Taxonomy criteria	SPEN framework syn.ikia KPIs	Application demo sites				
				Compliance with the EU Taxonomy and syn.ikia KPIs	ES demo	NI demo	AT demo	NO demo
Installation, maintenance and repair of charging stations for EVs in buildings (and parking spaces attached to buildings)	Encouragement of fossil-free transport by offering electrical charging and hydrogen refuelling stations.	EV charging stations	EV consumption and charging stations are not specifically part of the framework, but the demos include them and they are sometimes required for new constructions.	EU Taxonomy compliance: EV charging stations	● Pre-cabling	●	●	●
		Hydrogen distribution networks should convert to 100% hydrogen.	H2 not included	EU Taxonomy compliance: H2 Refuelling stations	●	●	●	●
Urban and suburban transport, road passenger transport	<p>Integration of sustainable urban planning principles, such as compact and mixed-use development, pedestrian-friendly design, and access to green spaces.</p> <p>Promotion of sustainable transportation options, including public transit, cycling infrastructure, and walkability.</p> <p>Development of sustainable and resilient infrastructure. This includes both green transportation networks and a renewable energy infrastructure for the distribution of heat, cool, and power.</p>	<p>Pavements, bike lanes and pedestrian zones.</p> <p>The infrastructure is dedicated to the operation of vehicles with zero tailpipe CO<sub>2</sub> emissions: electric charging points, electricity grid connection upgrades, hydrogen fuelling stations or electric road systems (ERS)</p> <p>The infrastructure and installations are dedicated to urban and suburban public passenger transport, including associated signalling systems for metro, tram and rail systems.</p>	<p>Core KPI: Access to services Complementary</p> <p>KPIs: Access to amenities</p> <p>Sustainable mobility</p> <p>Accessible or universal design</p>	Data from demos not yet available	-	-	-	-
Construction, extension and operation of waste water collection and treatment	<p>Implementation of waste management strategies, including recycling programs and waste reduction measures.</p> <p>Adoption of sustainable water management practices, such as water-efficient fixtures and rainwater harvesting systems.</p>	Maximum water flow of 6 L/min, attested by an existing label in the Union market.	Not addressed in the syn.ikia framework	Data from demos not available	-	-	-	-

## 4.

# Incorporating the SPEN approach into building policies

## Policy recommendations

### EPBD implementation

The 2024 EPBD recast acknowledges for the first time the benefits of the neighbourhood/district approach for renovations and makes a shift from viewing buildings in isolation to considering their interaction with the urban infrastructure. Multiple benefits of a neighbourhood approach are acknowledged, such as cost efficiency through industrial or serial-type renovations, and the possibility to **'address issues such as energy, mobility, green infrastructure, waste and water treatment and other aspects of urban planning and may take into account local and regional resources, circularity and sufficiency'**. The reference to sufficiency is important, since SPENs offer various possibilities for investing in collective renewable energy, energy storage and HVAC systems, instead of in individual ones at the unit or building scale. Smart systems and energy optimisation reduce the overall demand. Besides shared assets, SPENs can offer community spaces and services such as shared electric bikes or EVs, or enable access to public transport.

In the National Building Renovation Plans, Member States will have to implement and report progress on 'district and neighbourhood approaches and integrated renovation programmes at district level'. Financial incentives are proposed in Article 17: 'Member States shall incentivise sizeable programmes that address a high number of buildings, in particular the worst-performing buildings, such **as through integrated district renovation programmes**, and that result in an overall **reduction of at least 30% of primary energy use** with higher financial, fiscal, administrative and technical support, according to the level of performance achieved.'



The reference to a 30% reduction in primary energy use is in line with the EU Taxonomy; however, it fails to encourage ambitious renovations leading to SPENs, which also require positive energy buildings.

**Even if the integration of the neighbourhood and district approach into the EPBD is an important first step, it is limited solely to renovations and fails to acknowledge the added value of this approach for new constructions.** Sufficiency measures such as shared spaces, services and energy systems can be best achieved in the early design phase of new developments, since renovations often bring additional constraints. The Syn.ikia demo projects are good examples of how the design of new developments can integrate SPEN principles from an early phase until the exploitation phase.

There are other important provisions in the EPBD recast which are relevant for scaling up SPENs, as well as for their level of ambition. The shift in the minimum level of requirements for new constructions from NZEB to ZEB from 2030 will have an impact on the SPEN energy balance. The minimum thresholds proposed by the Commission were removed and will be implemented by Member States following the guidelines of a Delegated Act. Many other provisions also allow flexibility for Member States, so implementation in the coming years will be crucial in defining the level of ambition of various measures, such as minimum energy performance standards. For ZEB, again there is a shift from the building to a larger scale. NZEB required a minimum share of renewable energy to be produced on-site, while ZEB requires 100% renewable energy – however, various energy sources are allowed. Along with ‘on-site and nearby’, it allows efficient district heating and cooling, energy from renewable energy communities, or ‘decarbonised energy sources’. The integration of efficient district heating and cooling is positive, in line with the SPEN concept of adjusting to the local context to untap various solutions. Even if the addition of renewable energy community may contribute to their deployment, a contract to be part of a renewable energy community can be terminated at any time, thus it is not something inherently linked with the building itself. Also, this option depends on the implementation of the renewable energy community from RED, which can vary in geographical boundary country by country.<sup>5</sup> SPENs require local renewable energy production and self-consumption, which bring various benefits to the grid. **Thus, renewable energy produced ‘on-site and nearby’ should be prioritised over other renewable energy sources.**

An important aspect that makes the link with green finance is contained in Article 15: ‘the Commission shall adopt a Delegated Act in accordance with Article 29 supplementing this Directive in order to effectively encourage financial institutions to increase volumes provided for energy performance renovations, by means of a comprehensive portfolio framework for voluntary use by financial institutions that supports lenders to targeting and increasing lending volumes provided in accordance with the Union’s decarbonisation ambition and relevant energy targets. The actions set out in this framework shall cover increasing lending volumes for energy renovations and shall include suggested safeguards to protect vulnerable households through blended funding solutions. The framework shall describe best practices to encourage lenders to identify and act upon the worst-performing buildings within their portfolios.’ **This provision will incentivise banks to supply loans for highly energy-efficient projects, including SPENs.**

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<sup>5</sup> [Factsheets Policy Recommendations for Sustainable Plus Energy Neighbourhoods and Buildings](#)



Finally, the EPBD will have a stronger focus on energy poverty by urging Member States to set up financing schemes to target vulnerable households, energy-poor households and, where applicable, people living in social housing. It also asks Member States to address potential evictions following a rent increase after a renovation (Article 17). Ambitious SPEN developments include the risk of increased property prices, and thus gentrification. Policy measures to tackle fuel poverty should go hand-in-hand with housing policies: three syn.ikia demo projects are good examples in this regard, since they include social housing. Many public incentives benefit higher income classes, who are able to invest up front or take out loans. The EPBD recommends a series of **'schemes to tackle the upfront costs with renovations, such as on-bill schemes, pay- as-you-save schemes or energy performance contracting'**, however, their design should consider income aspects.

#### Key recommendations for EPBD implementation:

- In the renovation of the worst-performing buildings, follow the recommendation of scaling up renovation through an integrated neighbourhood/district approach, while keeping the ambition set by the minimum requirements for major renovations at the building level.
- Extend the neighbourhood/district approach recommended to renovations also to new constructions, considering interactions with the energy, water, mobility and green infrastructure, and implementing circularity and sufficiency principles.
- In ZEB implementation, prioritise 'on-site and nearby' renewable energy sources, to avoid costly grid upgrades.
- In the implementation of the common guidelines for the recalibration of EPCs, consider the need to ensure more comparability, transparency and consistency for validating and demonstrating alignment with the requirements of the EU Taxonomy.
- Implement the recommended A+ class in the harmonised EPC scheme for buildings with 20% lower energy demand than ZEB buildings (class A).
- Provide public incentives and enable green loans for projects with higher ambitions than minimum requirements for new construction (A+ buildings) and renovations.
- Provide public incentives based on income, tailoring them for vulnerable households (e.g. prioritise grants over tax rebates). Encourage access to private finance for lower-income households by providing additional guarantees and longer payback periods for loans.

## REDIII implementation

The increase in ambition of REDIII to have 49% of renewable energy in the EU building sector for 2030 is supportive for the scale-up of the SPEN approach. To achieve this target, REDIII requires Member States to designate specific areas, prioritising 'artificial and built surfaces, such as rooftops and façades of buildings' and other underused urban spaces over natural and agricultural fields. **These renewables acceleration areas are a similar concept to SPEN, since both are located in the built environment and aim to maximise local production and self-consumption of renewable energy.** This approach to renewable energy deployment requires less investment in grid upgrades and in the protection of natural areas and biodiversity. However, this approach should be reinforced by other provisions, for example those regarding renewable energy communities.

The definitions of collective self-consumption ('jointly acting renewables self-consumers') and renewable energy community remain unchanged from REDII, and have the goal of enabling small actors such as individuals and SMEs to play an active part in the energy transition. Their implementation by Member States is crucial for SPEN scale-up, because they enable collective investments in renewable energy and storage. In REDIII, collective self-consumption is a framework which allows an apartment block to self-consume renewable energy without being registered as a legal entity. However, the grid charges remain in place in some Member States: these are a significant barrier, and put users at a disadvantage compared to individual self-consumers in detached houses. Spain now allows collective self-consumption beyond the level of an individual building, extending it to a 2km range, and has removed grid tariffs: this is an ideal framework for bottom-up SPEN initiatives.

A renewable energy community, on the other hand, requires a legal entity to be set up, and has governance requirements. **According to RED, members or shareholders of a renewable energy community can only be 'natural persons, SMEs or local authorities, including municipalities'. Member States should set up a supervising authority for implementation, in order to avoid corporate capture.**

Given that the range of a renewable energy community extends further geographically than that of a SPEN, there are two possible scenarios. One is that a SPEN coincides with a renewable energy community and enables energy sharing among residents. Another is that energy is shared within a SPEN through collective self-consumption, and any excess is used to offer flexibility services to a renewable energy community. The definition of renewable energy community in Article 2 includes **'the primary purpose of which is to provide environmental, economic or social community benefits for its shareholders or members or for the local areas where it operates, rather than financial profits'**, which is currently transposed to make it impossible to sell energy between members of a renewable energy community. The possibility of selling energy or flexibility services would allow for additional business models, where only a share of members invest in renewable energy and storage. With the current regulations, a renewable energy community can only sell excess energy to the grid.

To make it possible to sell energy to the members of a renewable energy community, it should be registered as a utility, which provides additional bureaucratic obstacles for bottom-up initiatives. However, the environmental and social community benefits are very much in line with the SPEN concept.

REDIII promotes smartness, demand-side flexibility and smart management of energy consumption in buildings; however, no public or financial incentives are provided for projects in the residential sector which implement them – such as SPEN – so these bring additional investment costs.

REDIII refers to NZEBs with a minimum share of renewable energy – this is not consistent with the EPBD recast, which mandates that ZEBs should cover their low energy demand entirely with renewable energy.

## **Green finance/EU Taxonomy**

The first SPEN pilot projects rely heavily on public funding because they implement technological and social innovations. The replication of SPENs in the private and social housing sectors will require significant private financing. SPENs usually require additional investments compared to business-as-usual projects; however, they also provide multiple added social, economic and environmental benefits. At a societal level, they contribute to lower GHG emissions, leading to lower mortality and morbidity rates. Improved accessibility to public and cycling infrastructure contributes to physical and mental health, as well as inclusion and affordability. At an individual level, improved indoor environmental quality yields health and productivity benefits for the dwellers. The EU Taxonomy encourages sustainable investments in real estate. Investors, asset managers and policymakers need evidence-based and commonly accepted methodologies to assess the level of ambition of projects in terms of climate mitigation and adaptation.

The Taxonomy criteria requires projects to achieve “at least 30% energy savings or complies with minimum energy performance requirements for major renovation of existing buildings”. However, some projects such as SPEN aim for a deep renovation, and to achieve positive energy buildings. The lower threshold of the EU Taxonomy criteria does not differentiate between projects which only comply with the minimum requirements for renovation and ambitious deep renovations, with deployment of renewable energy to achieve a positive energy balance. In the near future, the EU Taxonomy requirements may be updated to be aligned with the increased ambition of the Fit for 55 package, while SPEN projects are already futureproof to these upcoming changes because of their initial high ambition.

The EU Taxonomy does not require a ‘deep renovation level,’ defined in Article 2 of the EPBD recast as a renovation which transforms a building:

- (a) before 1 January 2030, into a NZEB;
- (b) as of 1 January 2030, into a ZEB;

The Taxonomy shows a similar low ambition for new constructions. For sustainable new constructions it requires the primary energy demand to be at least 10% lower than the NZEB level. All syn.ikia demo projects are compliant with this requirement, achieving in the case of the Spanish demo a reduction of more than 50% compared to NZEB levels. Thus the EU Taxonomy again falls short in differentiating projects which are slightly better than NZEB level (10% better) from positive energy buildings or SPEN projects. These more ambitious projects require significant additional investments compared to business as usual, and provide additional multiple benefits for society and residents which are not acknowledged by the EU Taxonomy. SPEN projects represent a safer investment because they are futureproof and long-term aligned with Paris Agreement decarbonisation pathways. However, this is not currently reflected in the process of accessing financing. Also, neither the Taxonomy nor the syn.ikia framework show alignment with decarbonisation pathways to achieve Paris Agreement targets.

The same applies to investments in real estate, which require only class A to be considered as 'sustainable real estate projects that prioritize energy efficiency, renewable energy integration, and sustainable design'. Again, the EU Taxonomy does not differentiate the buildings labelled A from more sustainable projects, such as positive energy buildings labelled A+ according to the upcoming implementation of the EPBD recast.

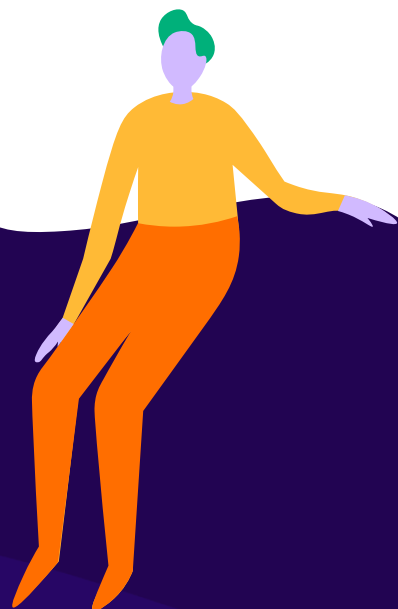
The EU Taxonomy reinforces the use of EPC schemes as a means to evaluate buildings which are not yet harmonised across Member States. Thus, sustainable investments cannot be compared across EU countries. The EPBD recast acknowledges the need for a harmonisation of the EPC, which is also the view of the EU Taxonomy:

'(48b) The EU Green Taxonomy relies on the use of energy performance certificates and accentuates the need to improve their comparability. Introducing a common scale of energy performance classes and a common template should ensure sufficient comparability between energy performance certificates across the Union.'

The implementation of common guidelines for the recalibration of EPCs should also be driven by the need to ensure more comparability, transparency and consistency for validating and demonstrating alignment with Taxonomy requirements.

The NZEB thresholds are defined differently by Member States depending on climatic zone and other factors, which means that for new constructions the comparison of buildings and investments across Member States is not currently possible. As of January 2030, ZEB will replace NZEB in the minimum requirements for new constructions. The EU Taxonomy needs to adapt to this shift, and to incorporate embodied carbon considerations such as global warming potential. The implementation of the common general framework for the calculation of energy performance of buildings for ZEBs (Annex I of the EPBD) will contribute to a harmonisation of ZEB standards across Member States, and thus will support the comparability of investments in new constructions.

Finally, the existing Delegated Acts of the EU Taxonomy do not incorporate aspects regarding social sustainability and governance, which are part of some green building certifications such as BREEAM and the syn.ikia SPEN framework. More attention should be paid to the useability of the Taxonomy: proposed criteria should be such that financial institutions and real estate market actors are able to use it right away. If compliance is not feasible, e.g. due to a lack of data and robust benchmarks, there is a risk that the means to finance climate mitigation will not be available.



## 5. Conclusions

SPENs are more than neighbourhoods with a positive energy balance. Conceptualising new buildings that are integrated into the urban infrastructure and engaging local communities in decision-making can yield multiple economic, environmental and social benefits.

This report presents an in-depth analysis of how the main European policies on energy efficiency and renewable energy in the built environment (EPBD, REDIII and EED) incorporate the district/ neighbourhood approach, as well as the key principles of SPEN. The analysis is preceded by the syn.ikia definition of SPEN and its boundaries.

The increased targets for energy efficiency and share of renewable energy in the building sector of the Fit for 55 package can potentially be a driver for the SPEN approach if the right policies and enabling conditions are in place. For the first time the EPBD explicitly mentions the district and neighbourhood approach for renovation; however, it falls short in acknowledging the added value of this approach for new constructions. A holistic approach to new developments which considers buildings' interactions with the urban infrastructure by engaging the local community in co-design can help adapt technological and financial solutions to the local context. The neighbourhood approach, as opposed to the building-by-building approach, can be a more effective way for municipalities to decarbonise the building stock and scale up renovations or increase the ambition of new constructions. ZEB will become the building standard for new construction in 2030. However, not using 'on-site and nearby' renewable energy sources goes against the SPEN principle, and does not contribute to the local deployment of small-scale renewable energy systems in the built environment. Allowing renewable energy from renewable energy communities or 'decarbonised energy sources' could require costly grid upgrades in the long term.

REDIII, on the other hand, prioritises the deployment of renewable energy in the built environment by introducing ‘renewable acceleration areas’. The definitions for collective investments and sharing of renewable energy, collective self-consumption and renewable energy communities remain unchanged since REDII. However, the implementation of these definitions varies considerably across Member States, with some best practices and many barriers to business models. Enabling collective self-consumption beyond the building into the neighbourhood, removing grid tariffs if collective self-consumption takes place within the low-voltage grid, and removing double taxation for energy storage are key elements to enable the business case for SPENs. Collective investments in renewables and storage with neighbours within a SPEN can be an effective way to encourage individuals and SMEs to be active players in the energy transition.

EPBD, REDIII and EED contain important provisions towards empowering and protecting vulnerable households and alleviating energy poverty. The design of public incentives is key to overcoming the Matthew Effect, when those who are better off accumulate more advantages over time and have easier access to public funds, especially tax rebates. Again, implementation is key, to enable not only public but also access to private funding.

A first exploratory analysis of the EU Taxonomy of sustainable activities is provided in comparison to syn.ikia KPIs, by applying both frameworks to the four syn.ikia demo projects. The level of ambition of the EU Taxonomy criteria is not in line with the EPBD and the Paris Agreement decarbonisation targets. The criteria for new constructions fall short in differentiating projects which are slightly better than NZEB level (10% better) from positive energy buildings or SPEN projects. These more ambitious projects require significant additional investments, while at the same they provide additional multiple benefits for society and residents. Since they are future-proof with a low risk for investors, they should be leveraged by green finance.

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