Policy developments in the EU and strategies for P4P business models

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Smart Energy Services to Improve the Energy Efficiency of the European Building Stock

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This report presents integrated strategies for rolling-out pay-for-performance (P4P) schemes in the European Union. We consider how the current policy environment and upcoming regulatory developments in the building sector may become risks or opportunities. We also suggest recommendations for adapting to potentially unfavourable developments.

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List of Abbreviations

Abbreviation	Description
BE	Belgium
DE	Germany
FR	France
GR	Greece
IND	Energy Industry
IT	Italy
POL	Policymakers
SCI	Scientists & Consultants
UK	United Kingdom
USA	United States of America

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List of Acronyms

Acronym	Description
AEU	Avoided Energy Use
AFID	Alternative Fuel Infrastructure Directive
B2G	Business-to-Government
BPIE	Buildings Performance Institute Europe
DBL	Digital Building Logbook
DSO	Distribution System Operator
EASME	Executive Agency for Small and Medium-sized Enterprises
EC	European Commission
EED	Energy Efficiency Directive
EEOS	Energy Efficiency Obligation scheme
EPBD	Energy Performance of Building Directive
EPC	Energy Performance Contracting
ESCO	Energy Service Company
ETD	Energy Taxation Directive
ETS	Emissions Trading System
EU	European Union
GHG	Greenhouse Gas
MRV	Monitoring, Reporting and Verification
MUSH	Municipalities-Universities-Schools-Hospital
P4P	Pay-for-Performance
RED	Renewable Energy Directive
SME	Small and medium-sized enterprises
SRI	Smart Readiness Indicator
SWOT	Strengths-Weaknesses-Opportunities-Threats
TSO	Transmission System Operator
WP	Work Package

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Executive summary

Meeting ambitious targets

European Union (EU) leaders recently agreed a more ambitious 2030 climate target which, among other things, means at least doubling the annual overall energy renovation rate of 1%. In this context, intensified actions to rapidly accelerate the decarbonisation of the building sector are needed. However, retrofit actions are hindered by barriers at different stages: from the initial decision to renovate, to financing and completing energy efficiency projects. In the residential building sector, the lack of simple, attractive and easily accessible public renovation incentives, or mainstream financing products, are often cited as a barrier. In the non-residential sector, the lack of funding for publicly-owned buildings or suitable financial incentives for commercial buildings are two of the most relevant obstacles.

To overcome these barriers, it is necessary to act on different fronts to foster better use of EU and national public funds and mobilise a greater share of private funds. EU and national public funds should be better communicated and target end-users more effectively. This can be done by making it easier to blend various sources of financing, making the level of support proportional to performance, strengthening technical assistance and promoting synergies with market-based mechanisms. The SENSEI project focuses on the development of innovative pay-for-performance (P4P) schemes, in which payments for energy efficiency are based on proven and measured savings.

Risks and opportunities

This report focuses on ways that policy and regulatory developments in the EU may become risks or opportunities for P4P schemes. In particular, the main goal of this study is to analyse the directives, policies and measures already adopted, as well as those under consideration by the EU. This will help devise strategies for either exploiting opportunities that may emerge for P4P schemes or adapting to unfavourable developments. Based on a comprehensive literature review, a Strengths-Weaknesses-Opportunities-Threats (SWOT) analysis, interviews with key stakeholders from the field, and an EU-wide online survey, we identify regulatory opportunities considering the different policy measures and market uptakes.

Our work highlights that the main problem hindering adoption of P4P schemes in the EU is not technology (or even engineering). It's the failure of the energy efficiency market to promote innovative solutions and business models. In this context, participating stakeholders picked out the policies, regulations and market forces that are most conducive to implementing P4P schemes, prioritising strengths and opportunities, and highlighting weaknesses and threats, that may jeopardise their development.

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Main findings of the SWOT analysis

Strengths

- EEOSs have been the main driver for P4P schemes in the USA.
- Annex V of the EED foresees metered savings.
- The EPBD requires to link financial measures for renovation to the achieved energy savings.
- P4P programmes in the US using smart-meter data reduce MRV costs.

Weaknesses

- Market conditions/ legislative frameworks are not supportive.
- Limited use of "metered savings" methodologies in the EU.
- The structure of the capacity markets does not currently favour P4P schemes.
- Low renovation rates in the EU and lack of accessible data on buildings operational performance.

Opportunities

- Recognising energy efficiency as a resource for energy supply and distribution systems.
- Obligation to include demand-side resources in capacity mechanisms would allow P4P to offer efficiency as a cost-effective grid resource.
- Encouraging the use of metered methodologies.
- Energy Performance Contracting business models can be enhanced by P4P schemes and aggregators.

Threats

- Reluctance to put obligations on energy providers/ distributors.
- Accounting barriers and limited technical capacity and experience with new business models and financing options.
- Consumers' skepticism towards energy companies and new, unknown, business models.
- Unavailability of standard contracts and processes for energy efficiency aggregators.

Key stakeholder quotes

"*The energy system in the EU is not similar to the U.S. To ensure the successful implementation of P4P schemes, either further policy/ regulatory/ market developments should take place, or the P4P business model should be designed in a way that fits the EU.*"

"P4P schemes pay contractors in a way that is directly linked to the outcome of a project, so I agree that [the scheme] could only be implemented meaningfully as part of a regulated programme, so it's policy-led and it's regulated. I can't really imagine how [the P4P concept] could be brought in any other way. I can't imagine contractors volunteering to approach in that way especially in energy efficiency where, according to my experience, there is some bad practice in terms of either overengineering or overpricing the work."

"In order to promote P4P schemes and make them attractive to both ESCOs and final users the current energy market elements should change: the current problem is not an engineering problem but a market failure. There is major asymmetry of information between the seller and the buyer. Energy efficiency should be treated like power generation – if you do not deliver it you do not get paid for it."

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Strategies for rolling-out P4P schemes in the EU

Finally, based on insights from all the different parts of our work, we devise and present ten (10) integrated strategies for rolling-out P4P schemes in the EU. We consider existing regulatory frameworks and upcoming developments, the exploitation of opportunities that may emerge and adaptation to potentially unfavourable developments.

1. Exploiting economic stimulus packages

Economic stimulus packages can help facilitate innovative business models that support actual/ metered performance, such as P4P schemes. They can enhance the Energy Performance Contracting business model through the presence of aggregators to target "hard to reach" sectors (e.g., residential sector, small and medium commercial buildings, etc.).

2. Establishment of demanding energy performance requirements

Stricter energy performance requirements for new and existing buildings should be established for all parts of the building stock along with timebound compliance deadlines.

3. Strengthening the role of energy efficiency market players

The role of energy market actors like Energy Service Companies, aggregators, contractors, etc., should be strengthened to ensure their participation in renovation processes and their inclusion in the residential sector.

4. Recognising and valuing energy efficiency as a resource

Utilities and Distribution System Operators should be required and incentivised to make use of energy efficiency as a viable resource providing services to the energy system. In addition, the "metered savings" methodology (EED, Annex V) should be incentivised or partially required as a step toward performance-based schemes.

5. Promoting metered methodologies to increase accuracy and transparency

Although monitoring, reporting and verification rules of energy savings improved during the last revision of Article 7, they should be further strengthened to increase transparency and accountability.

6. Increasing ambition on public buildings

Additional requirements should be placed on public buildings (e.g.. expand renovation obligations beyond central government buildings to all public buildings, etc). The increased need for renovation should be complemented with increased requirements for actual/ metered savings and the inclusion of energy efficiency service providers.

7. Increasing ambition on Small and Medium Enterprises

Additional requirements should be placed on Small and Medium Enterprises (e.g., mandatory audits and implementation of the recommendations, etc.) complemented by increased requirements for actual/ metered savings.

8. Ensuring stakeholders' involvement

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Ensuring stakeholders' involvement in all the individual steps of the design process is necessary for successfully implementing P4P schemes in the EU.

9. Establishing standards and promoting capacity building activities

Training and capacity building activities should be promoted to facilitate adaptation and implementation of P4P schemes along with establishing standards, template contracts and procedures.

10. Raising awareness and empowering citizens

The concept of the energy efficiency aggregator should be promoted at national level and final users/ consumers need to be aware of P4P schemes' benefits and potential.

Overall, by exploiting the opportunities and adaptation strategies identified, our work will further inform the SENSEI engagement activities of third party investors in P4P schemes. It will serve as regulatory guidelines to further explore potential synergies with "smart building" technologies and elements that may be looked at with suspicion by building owners and consumers.

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1. Introduction

1.1. Background

The building sector is the largest energy consumer in the European Union (EU), responsible for approximately 40% of energy consumption (European Court of Auditors, 2020) and 36% of CO_2 emissions (European Commission, 2019d). The majority of the available buildings have been constructed with considerably low energy performance requirements (Spyridaki et al., 2020)– 75% are considered energy inefficient (European Commission, 2019c). Reducing energy consumption in the building sector through energy efficiency interventions can negate a significant amount of CO_2 emissions (Stavrakas & Flamos, 2020). Estimates show 75-90% of the current building stock will still exist by 2050 (BPIE, 2017). So increasing energy efficiency improvements in EU building stock could be a main driver towards the EU's vision to make Europe the first climate-neutral continent by 2050 (European Commission, 2019b).

Energy efficiency in the building sector could heavily reduce CO_2 emissions. However, the current weighted annual energy renovation rate in the EU is still low at 1%. Reports show that between 2012 and 2016 the annual renovation rate both for residential and non-residential buildings in the EU was close to 1%. There was only a 0.2% annual deep renovation rate in residential buildings and 0.3% in non-residential buildings respectively (Esser et al., 2019). To reach the long-term vision of climate neutrality, the annual renovation rate in the EU needs to at least double in the next ten years (European Commission, 2020d).

One of the main reasons for such a low renovation rate has been the lack of available capital to finance retrofit investments due to the high upfront costs of energy efficiency interventions. To achieve climate neutrality, it is estimated that around €325 billion needs to be invested annually in building renovations: approximately €250 billion for residential buildings and €75 billion for public buildings (The Coalition for Energy Savings, 2020). This amount cannot be sourced from the public sector alone– substantial investment needs to come from the private sector (European Commission, 2020g). In this respect, new and innovative business models and financing schemes need to be developed to attract investors and leverage private funding.

Innovative solutions can be found in performance-based schemes, like pay for performance (P4P), which have been used to engage both energy and third-party service providers in North American energy efficiency projects (Santini et al., 2020). In P4P schemes, financial flows between the parties involved are linked to the actual/ metered and weather-normalised energy savings produced by the retrofit project. P4P schemes also rely on energy efficiency aggregators, which group buildings together into an energy savings portfolio. The energy efficiency aggregator usually acts as the intermediary

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between the client and the programme implementer and is compensated for delivering energy savings (Vavallo, 2018).

The structure of P4P schemes is very similar to Energy Performance Contracting (EPC) (see **Figure 1)**. EPC exists in the EU, especially in the public sector (e.g., in hospitals and universities, etc.), and to a lesser extent in the industrial and commercial sectors. Yet its application in smaller buildings and the residential sector is very limited. Partly because of high transaction costs, it has only been trialled in the residential sector for large building blocks (Labanca et al., 2015; Laffont-Eloire et al., 2020). On the other hand, P4P schemes use metering technologies to calculate energy savings. They are being piloted in small and medium commercial and residential applications using the aggregator model and large building portfolios (Santini et al., 2020).

Despite the benefits that P4P models may provide, they have not yet been adopted in the EU. In this context, the objective of the European Commission (EC)-funded Horizon 2020 project SENSEI[1] is to develop a business model that will combine P4P schemes with EPC. This aims to introduce performance-based programmes in the EU market, while simultaneously expanding the use of EPC. The SENSEI business model will reward energy savings derived from energy efficiency improvements as an energy system resource. This will allow energy efficiency projects to be turned into investable assets. This could leverage private financing, so increasing the renovation rate in the EU building sector. Overall, the SENSEI project aims to design and test innovative transaction models that enable energy efficiency upgrades in buildings, so they offer value through:

- Incentive schemes that steer energy efficiency interventions towards measures that are beneficial for both the building owners and the power grid.
- Capacity mechanisms that compensate energy efficiency to permanently reduce power consumption, positively affecting peak capacity requirements and ramping reserves.
- Removing the risk of paying for unrealised savings under energy efficiency financing programmes.

[1] https://senseih2020.eu/

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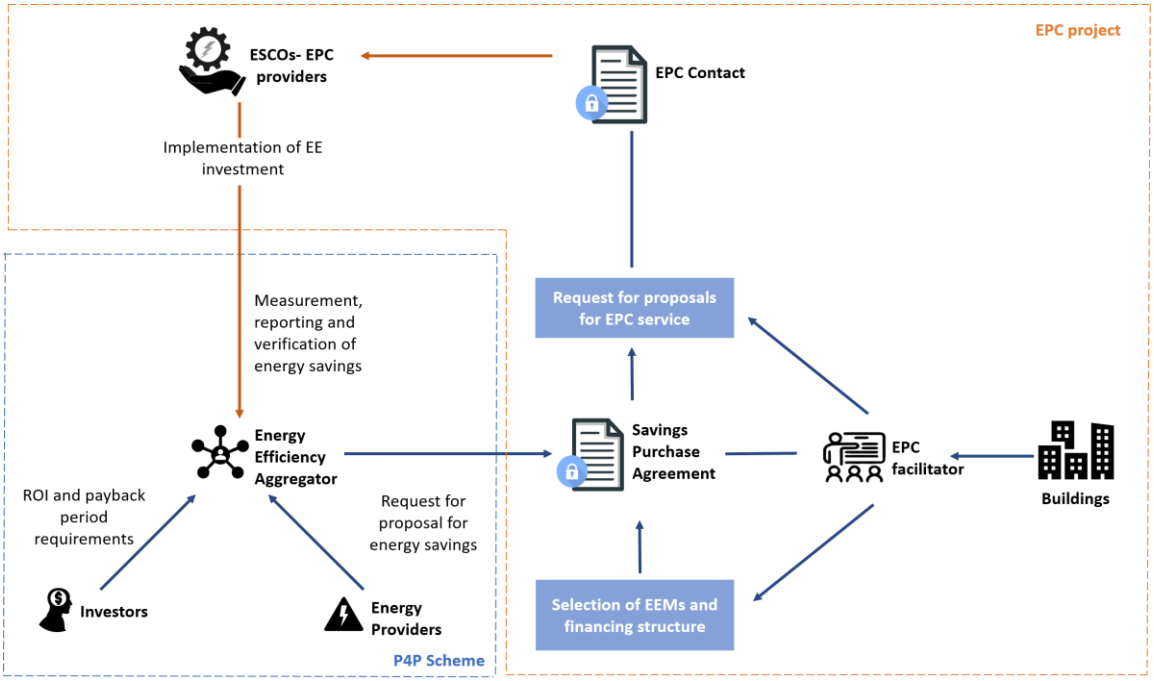

Figure 1. The interplay between P4P schemes and EPC projects.

1.2. Objectives and scope of this deliverable

This report is the first of three deliverables under the SENSEI Work Package 8. It explores how the current policy environment and upcoming regulatory developments in the EU may become risks or opportunities for P4P schemes. Specifically, it looks at how the implementation of the Clean Energy for All Europeans package, the European Green Deal and the Renovation Wave could affect the viability of P4P schemes. Our ultimate goal is to devise and present integrated strategies for rolling-out P4P schemes in the EU. To meet these objectives, we followed a participatory multi-method approach based on literature review, stakeholder engagement and a qualitative decision-making technique. In particular:

1. We conducted an extensive review of the most recent and relevant EU policies, regulations and directives that could affect the roll-out of P4P schemes.
2. Based on insights from our review, we identified potential policy pathways based on recent regulatory developments. We then analysed different policy mechanisms, considering potential developments, using a Strengths-Weaknesses-Opportunities-Threats (SWOT) analysis.
3. We conducted bilateral online interviews with key stakeholders and experts from research, industry and policymaking to reflect on, and refine, the insights from our SWOT analysis. We also designed an online survey to collect opinions from a larger sample of stakeholders. This added an extra layer of validation to our work, helped

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evaluate the accuracy of our findings, and make the results more policy-relevant and meaningful to decision-makers and other end-users.

4. We came up with specific recommendations and strategies on how the roll-out of P4P schemes could be facilitated in the EU, acknowledging opportunities, while suggesting measures to mitigate potential risks.

Overall, the unique contribution of our study is that we formulated a comprehensive approach, which combines a SWOT analysis and uses domain knowledge embedded in stakeholders to delve into how P4P schemes could be integrated into existing EU regulation. Our work aims to inspire further research in this area and serve as a reference point for policy developments and adjustments that will facilitate the design of performance-based energy efficiency financing schemes.

Finally, by exploiting the opportunities and adaptation strategies identified in this report, our work aims to further inform SENSEI engagement activities of third party investors in P4P schemes. It will serve as regulatory guidelines to further explore potential synergies with "smart building" technologies and aspects that may be looked on with suspicion by building owners and consumers.

1.3. Structure of this report

The remainder of this deliverable is structured as follows:

Section 2 presents the participatory multi-method approach we followed to come up with a robust set of recommendations and strategies for the roll-out of P4P schemes in the EU.
Section 3 provides a detailed overview of the current EU regulatory and market framework with relevance to P4P schemes and identifies potential policy gaps.
Section 4 identifies and analyses the proposed and upcoming policy developments according to their relevance to P4P schemes to derive the items that will be analysed.
Section 5 categorises these items to formulate our SWOT analysis.
Section 6 presents insights from our interviews with key stakeholders and the online survey that we conducted to measure the relative importance of the SWOT items.
Section 7 presents ten (10) integrated strategies for the successful roll-out of P4P schemes in the EU, as derived from our work.
Section 8 provides conclusions and briefly highlights main areas for further research.

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2. Methods

This section presents in detail the methodological approach we used to reach the objectives and the overall goal of this study. The approach consists of five main methodological steps, as visualised in **Figure 2**.

Figure 2. The overarching methodological approach we followed to come up with recommendations and strategies for rolling-out P4P schemes in the EU.

2.1. Step 1: Review of the current energy efficiency policy framework and energy market conditions with a focus on P4P schemes

As a first step, we did extensive desk research to review the existing legislative framework in the EU. The material we reviewed consisted of policy and regulatory documents, academic papers and grey literature. The key topics that we focused on were:

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- The existing EU regulatory environment, disaggregated by areas.
- The relevance of P4P schemes and the associated regulatory environment behind EU policy developments.
- Identifying and analysing legislative/ policy and implementation gaps.

2.2. Step 2: Formulation of potential policy pathways based on regulatory developments

Our desk research was followed by a comprehensive overview of the recent policy developments in the EU building sector. These were separated into different potential policy pathways, based on indications from the respective EC documents (e.g., the Renovation Wave, the EU Green Deal, the 2030 Climate Target plan, etc.). Pathways were broken down to an adequate policy level (e.g., articles, annexes, etc.), and were analysed by the SWOT method to reflect on the future of P4P schemes in the EU.

2.3. Step 3: SWOT analysis

SWOT analysis has some important advantages and disadvantages. On one hand, it is a simple method that can be easily used without specialised knowledge or technical assistance from third parties to develop and implement long-term strategies (Bull et al., 2016). On the other, it has some limitations, mainly around the fact it captures a static snapshot at a specific moment in time (Nikolaou & Evangelinos, 2010). Nevertheless, we believe a SWOT analysis is the proper starting point for identifying and assessing the main characteristics of the current EU policy framework and latest developments that could affect the establishment of P4P schemes.

Our SWOT analysis presents the potential policy and regulatory opportunities and barriers that could foster or hinder the wide exploitation of P4P schemes in the existing EU regulation. It clearly explores the strengths and weaknesses, suggesting how to exploit opportunities and mitigate threats (**Figure 3**).

For the purposes of our work, we studied each SWOT segment for several EU directives and their articles (e.g., Energy Efficiency Directive (EED), Energy Performance of Building Directive (EPBD), etc.) as well as their expected developments (i.e., potential policy pathways). For each segment, we focused on the effects of the potential integration of P4P schemes and their features. By doing so we extracted more functional and reachable insights, tailored to each policy pathway.

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Figure 3. Questions answered by the SWOT analysis applied in the context of this study

2.4. Step 4: Stakeholder consultation

To increase the robustness of our SWOT analysis and identify the most relevant policy pathways we added an extra layer of validation by conducting a two-phase stakeholder consultation process. This process was based on online interviews with key stakeholders (**Section 6.1**) and an online EU-wide survey (**Section 6.2**). Our main objective was to collect feedback from a large sample of stakeholders in the building sector (e.g., energy efficiency experts, policymakers, programme managers and administrators, etc.). We did this to validate our SWOT findings, prioritise policy pathways and formulate strategies towards the adaptability of P4P schemes in the EU.

2.5. Step 5: Strategies for ensuring the adaptability of P4P schemes under potential policy pathways

In this final step, outcomes from the SWOT analysis and stakeholders' insights/ considerations were further analysed and synthesised into strategies that could offer resilience to implementing P4P schemes in the EU.

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3. Existing policies and regulatory developments in the EU

3.1. Energy efficiency: A key element of the EU's energy strategy

The initial targets of the 2030 Climate and Energy Framework were:

- **40%** reduction in greenhouse gas (GHG) emissions compared to 1990 levels.
- **32%** share of renewable energy in final energy consumption[2].
- **32.5%** target for energy efficiency in terms of primary and final energy consumption against 2007 energy projections[3].

However, in September 2020 the EU Commission proposed to increase the GHG emission reduction target to 55% of net emission cuts. The European Parliament voted for a 60% reduction in October 2020, but the Council and the Parliament settled on the 55% target in April 2021 (Council of the European Union, 2021). The Commission has analysed the actions required across all sectors, including increased energy efficiency and renewable energy shares.

The main target of the European Green Deal, presented in December 2019, was transitioning to a climate-neutral economy by 2050. It proposed a roadmap towards this goal. As the production and use of energy accounts for more than 75% of the EU's GHG emissions, there is an essential need to prioritise energy efficiency and increase the share of renewable energy to meet this climate neutrality goal. On 14 July, the European Commission launched the Fit for 55 package to meet its ambitious target of a 55% reduction in greenhouse gas emissions by 2030, relative to 1990 levels, aligning EU policy with the ambitious political mandates of the Green Deal and EU Climate Law. One key mechanism that has undergone a revision under Fit for 55 is the EU Emissions Trading Systemin (ETS) which introduces a globally unprecedented carbon border adjustment mechanism for pricing imported carbon. It also includes a major overhaul of the Emissions Trading System to extend carbon pricing to shipping, aviation, transport, and buildings. The emission reduction obligation for ETS sectors has therefore increased from 40% to 61% by 2030 based on 2005 levels, as well as the phasing out of free allowances in aviation from 2023 – 2025 (European Commission, 2021).

Over the past years, the Commission has developed an EU legal and financial energy efficiency framework (**Figure 4**) that we will elaborate on in **Section 3.2**. Placing energy efficiency first is a key component of the Clean Energy for All Europeans package, while special emphasis is also given to the energy performance of the building sector. The main

[2] Directive (EU) 2018/2001.

[3] Directive (EU) 2018/2002.

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legislative actions considering energy consumption in the building sector are the EED and the EPBD (Filippidou et al., 2017) while other regulations act in a complementary manner.

In the following sub-sections, we present the current EU policy, regulatory and market framework as well as its relevance to P4P schemes. This is to identify potential policy gaps and developments that could facilitate the roll-out of performance-based schemes in the EU.

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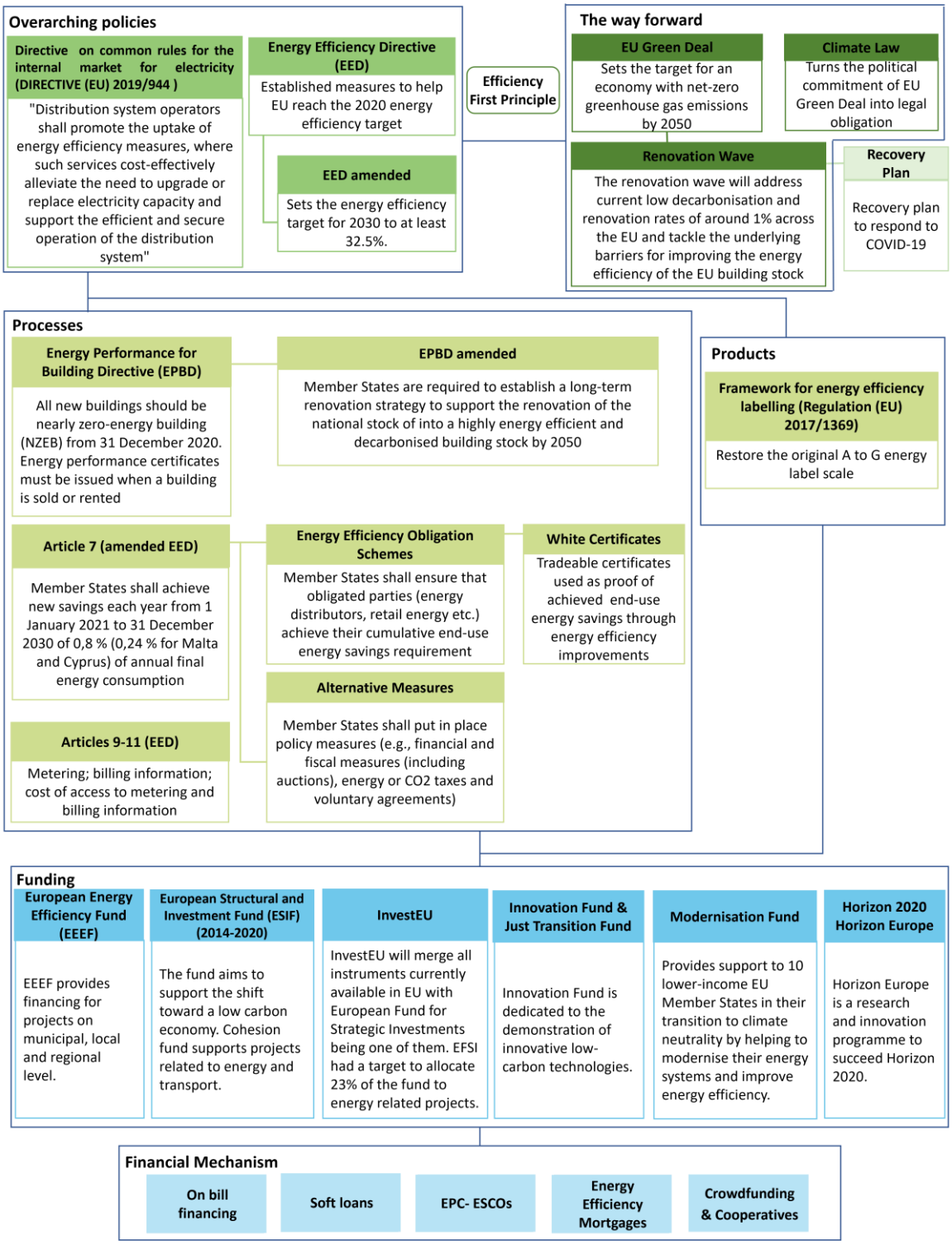

Figure 4. Legal and financial energy efficiency framework in the EU as adapted from (Deloitte Conseil, 2016).

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3.2. Energy efficiency policies relevant to P4P schemes in the EU

P4P schemes can be implemented in the context of both 'efficiency' and 'efficiency first' policies. This is because they allow promoting energy efficiency and valuing the services that buildings can provide to the energy system (Santini et al., 2020). In **Sections 3.2.1** to **3.2.5** several groups of policy measures, classified by policy instrument, are examined in more detail due to their relevance and potential impact on developing P4P schemes in the EU.

3.2.1. Energy Efficiency Directive

Energy savings obligation on Member States

The EU adopted the Energy Efficiency Directive (European Union, 2012) and revised it in 2018 (European Union, 2018a), Since then Member States have had an obligation to achieve a minimum amount of end-use energy savings from energy efficiency policy measures. This obligation is set under Article 7 of the Directive. Member States have to achieve a cumulative energy savings target over a certain period. The first period ran from 2014 until 2020, the second period covers 2021 to 2030.

In this context, Member States must put in place solid measurement, control and verification systems (European Union, 2018a)[4]. Several methods are allowed to calculate energy savings, including determining savings ex-post by "*recording the actual reduction in energy use, taking due account of factors such as additionality, occupancy, production levels and the weather which may affect consumption.*" (European Union, 2018a)[5]. This is called the "*metered savings*" methodology.

Box 1. Relevance of Article 7 of the Energy Efficiency Directive to pay-for-performance schemes.

Article 7 is relevant for the roll-out of P4P schemes in the EU as it leads governments to put in place effective energy efficiency policies (in the form of EEOS or Alternative Measures) and allows for **savings** to be **counted** by using energy metering technologies.

Energy efficiency obligation schemes

As of 2019, 16 Energy Efficiency Obligation Schemes (EEOS) were in place in Europe in the context of Article 7 (Broc & Reidlinger, 2020). This makes it one of the most popular policy instruments to achieve energy savings requirements. Under EEOS, regulators require obligated parties (e.g., energy companies, energy distributors or

[4] Article 7a 5 and Article 7b 2., Directive (EU) 2018/2002.

[5] Annex V, 1. (b), Directive (EU) 2018/2002.

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suppliers/retailers, etc.) to carry out a defined level of activity delivering energy savings, but leave it to the utilities to find the best ways to achieve this (Rosenow et al., 2018).

Box 2. Relevance of Energy Efficiency Obligation Schemes to pay-for-performance schemes.

Article 7 allows **obligated parties** to count towards their obligation **certified energy savings** achieved by **energy service providers** or other **third parties** (European Union, 2018a)[6]. This is relevant for the emergence of **aggregators** which are often involved in P4P schemes. In the USA, EEOS have been the main driver for developing P4P schemes.

Methodological requirements for accounting for savings

Member States can count energy savings stemming from policy measures for the purpose of Article 7 of the EED only if they comply with a set of conditions. These are outlined in Annex V of the Directive, and further explained in the guidance note released by the European Commission on this topic (European Union, 2019a). For Member States to value savings from a policy measure under Article 7, they have to demonstrate that their action is the origin of the savings (materiality requirement). They also have to isolate the impact of the intervention from the energy savings that would have occurred in the absence of the measure because of other policies or factors. This includes behavioural and technological changes (additionality requirement).

Member States have to express the amount of energy savings required of each obligated party in terms of primary or final energy consumption. The selected method to express the amount of energy savings required must also be used to calculate the savings claimed by obligated parties (Article 7a 4, Directive EU 2018/2002). Annex IV of the EED presents the conversion factors which need to be used.

Box 3. Relevance of methodological requirements for accounting for energy savings to pay-for-performance schemes.

The rules on energy savings accounting inform the elements that P4P scheme managers should consider when developing **guidelines** on how to set up an energy consumption **baseline**. Indeed, P4P programmes usually provide **instructions** (*i.e.*, guidelines, rules and/ or detailed methodology) on how to establish the baseline on which energy savings are calculated[7].

[6] Article 7a 6. (a), Directive (EU) 2018/2002.

[7] Establishing a baseline or a 'counterfactual' allows comparing the energy consumption after an intervention with the energy consumption that would have happened in the absence of the policy measure. This difference is the energy saved by the project.

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Obligation on central government buildings

The EED[8] sets out energy saving requirements for central government buildings. Every year, Member States must renovate at least 3% of the total floor area of buildings owned and occupied by the central government. As an alternative to renovation, EU countries may choose an approach that results in at least an equivalent amount of energy savings. This alternative approach may include measures such as behavioural change or deep renovations that go beyond the minimum energy performance requirements.

Box 4. Relevance of the obligation on central government buildings, as specified by the Energy Efficiency Directive, to pay-for-performance schemes.

The **measurement systems** promoted in the context of P4P schemes could help assess the **impact** of renovation and behavioural measures, especially if they are combined.

Obligations facilitating energy efficiency improvements of buildings in the private sector

Article 8 of the EED requires Member States to promote, and ensure the use of, energy audits and energy management systems. It covers large as well as Small and Medium-sized enterprises (SMEs). While large enterprises are subject to regular energy audits[9], SMEs are not, and are only encouraged to undertake energy audits and implement the resulting recommendations.

Box 5. Relevance of the obligations on audits to pay-for-performance schemes.

P4P schemes could support the follow-up of **audit recommendations** through **monitoring** the operation of private buildings.

Articles 9, 10 and 11 of the Energy Efficiency Directive

Articles 9, 10 and 11 of the EED 2012/27/EU, which were amended by Directive (EU) 2018/2002, cover issues related to metering and billing individual consumption of energy.

Article 9 introduces specific requirements concerning metering systems. Member States are required to ensure that electricity and natural gas customers are provided with competitively priced individual meters. These need to accurately reflect their actual energy consumption and provide information on the time of use, when this is technically possible, financially reasonable and proportionate in relation to the potential energy savings (European Union, 2018a).

In addition, Article 9 defines requirements for Member States when introducing smart metering systems. This covers information provided to customers about their energy

[8] Article 5, Directive (EU) 2012/27/EU.

[9] Since December 2015 and at least every four years thereafter.

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consumption, security of data communication and advice and information that must be given to the final customers at the time of installation.

Article 10 relates to billing information for electricity and natural gas. It states that, when no smart meters are installed, the billing information should be reliable, accurate and based on actual consumption. When smart meters are installed the billing information should be provided based on actual consumption. The final customers should be able to access complementary information on their own historical consumption (European Union, 2012)[10].

In the amended directive an obligation on billing and consumption information for heating, cooling and domestic hot water was introduced. This states that, where meters or heat cost allocators are installed, Member States shall ensure that billing and consumption information is reliable, accurate and based on actual consumption or heat cost allocator readings (European Union, 2018a).

Final consumers should receive their bills and billing information for energy consumption and have access to their consumption data free of charge (European Union, 2012)[11]. According to the amended directive this should also apply to bills, billing information and consumption data for heating, cooling and domestic hot water. Costs resulting from sub-metering services implemented to provide billing information for the individual consumption of heating, cooling and domestic hot water in multi-apartment and multi-purpose buildings may be passed onto final customers. But only to the extent that such costs are reasonable (European Union, 2018a)[12].

Box 6. Relevance of Articles 9, 10 and 11 of the Energy Efficiency Directive to pay-for-performance schemes.

Articles 9, 10 and 11 of the EED could be combined with P4P schemes as they use **metered data** to calculate the respective payments according to the **achieved savings**. Although smart meters are not mandatory for the monitoring and verification process of P4P schemes a **reliable** set of **meter readings** is required.

Article 18 of the Energy Efficiency Directive on energy services

Article 18 of the EED (European Union, 2012) requires Member States to promote the energy services market while ensuring SMEs have access to these markets. To achieve this Member States should make available and easily accessible all relevant information concerning available types of energy service contracts, financing instruments and relevant

[10] Article 10(2) Directive 2012/27/EU.
[11] Article 11, Directive 2012/27/EU.
[12] Article 1 (10) Directive (EU) 2018/2002.

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incentives that promote energy efficiency service projects. To ensure customers' access to information Member States should provide a continuously updated list of the available qualified and/ or certified energy service providers and their qualifications and/ or certifications. Promoting these channels of information/ contact points, introducing an independent mechanism, such as an ombudsman and enabling independent market intermediaries, will support the proper function of the energy services market (European Union, 2012)[13].

Article 18 also states that Member States shall support take-up of energy service offers by the public sector, focusing on building refurbishment as an attempt to promote the energy services market.

Box 7. Relevance of Article 18 of the Energy Efficiency Directive to pay-for-performance schemes.

The development of the energy services market has been identified as a key driver on the adoption of P4P schemes in the U.S. (Santini et al., 2020). Using standard methods for calculating normalised metered energy consumption can lower transaction costs in the residential sector. Thus, the use of standardised metered savings methods could support the development of the aggregator business model in the residential sector, where the provision of energy services has been hindered by high transaction costs. This can contribute to the promotion of energy services markets required under Article 18 of the EED.

3.2.2. Energy Performance of Buildings Directive

The Energy Performance of Buildings Directive on buildings' certificates

Energy Performance Certificates are a core element of the EPBD (European Union, 2018b)[14]. They were first introduced in Article 4 of the original EPBD back in 2002[15]. In the 2010 recast of the directive, additional guidelines were introduced for Energy Performance Certificates in building units.

Article 11 of the EPBD states that "*Member States shall take the necessary measures to establish a system of certification of the energy performance of buildings*" and makes these certificates mandatory when a building is constructed, sold or rented to a new tenant. In addition, Energy Performance Certificates are required for buildings occupied by public authorities, and which are frequently visited by the public. In the 2002 version of the Directive, this obligation was applied to buildings with a total useful floor area over 1,000m^2. In the 2010 recast of the directive, this threshold was decreased to 500m^2, and

[13] Article 18 (2), Directive 2012/27/EU.
[14] Directive (EU) 2018/844.
[15] Directive 2002/91/EC.

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further decreased to 250m^2 on the 9 July 2015. Energy Performance Certificates are expected to be placed in a prominent place in such buildings in order to be visible to anybody (European Union, 2019b)[16].

Energy Performance Certificates aim to provide information on the energy performance of buildings and reference values to help tenants or buyers compare and assess it. They also include recommendations on cost-effective ways to improve the energy performance of buildings, the required steps to implement the recommendations and other information concerning energy audit and available financing instruments and incentives for energy efficiency measures. The recommendations can be distinguished in measures that can be implemented within a major renovation of the building envelope or technical building system(s) and measures for individual building elements (European Union, 2010).

Box 8. Relevance of Energy Performance Certificates to pay-for-performance schemes.

Energy Performance Certificates are considered an important policy instrument that will facilitate the improvement of energy performance of buildings and also an important **source of information** concerning the energy performance of the building stock. Energy Performance Certificates also contribute to the **increase** of the demand for energy efficiency solutions in the building sector (Arcipowska et al., 2014), since they influence the "rent" or "buy" decision and promote the implementation of energy renovations (Charalambides et al., 2019). This may be considered a key opportunity for the development of P4P schemes as building owners search for business models that will provide them with **increased benefits** derived from energy retrofit projects.

Obligations that facilitate the procurement of energy efficiency buildings and renovations

The EPBD (European Union, 2010)[17] requires that all new buildings are nearly zero-energy by the end of 2020 (2018 for new public buildings).

Member States also had to put in place cost-optimal minimum energy performance requirements for new buildings (built before 2020), existing buildings undergoing major renovation, and for the replacement or retrofit of building elements like heating and cooling systems, roofs and walls (European Union, 2019b)[18].

Box 9. Relevance of obligations that facilitate the procurement of energy efficiency buildings and renovations to pay-for-performance schemes.

P4P schemes can provide financing options through new business models such as the energy efficiency aggregator. They can also complement renovations by ensuring

[16] Article 12, Directive 2012/27/EU.
[17] Article 9, Directive 2010/31/EU.
[18] Article 4, Directive 2010/31/EU.

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monitoring of buildings' operation and enable renovations by establishing favourable avenues for financing through new business models (e.g., an energy efficiency aggregator, etc.).

3.2.3. Energy Taxation Directive

The Energy Taxation Directive (ETD) (European Union, 2003)[19] establishes EU rules on taxation of energy products and electricity. It applies to products used as motor or heating fuels (to run engines or to produce heat) and electricity. The ETD establishes minimum levels of taxation and allows Member States to set their national rates as they see fit.

The objective of the ETD is to ensure that the internal market functions effectively and to avoid double taxation or serious distortions of trade and competition between different energy sources or consumers and energy suppliers. The excise framework has led to the convergence of national laws of EU Member States, but still faces several structural challenges. In particular, these challenges concern creating a level playing field in the single market and circulating energy products in the EU.

There is a wide gap between European taxation and the most recent climate and decarbonisation objectives. Achieving the EU's climate neutrality goal for 2050 requires revision of the ETD to:

a) align the taxation of energy products and electricity with existing energy and climate policies, to contribute to EU energy targets for 2030.

b) preserve the EU single market by updating the scope and structure of tax rates and streamlining the use of voluntary tax exemptions and reductions.

This taxation framework was evaluated in 2019. The corresponding report, published by the Commission, highlights the overlaps, gaps and inconsistencies between the directive and the EU's energy and environment, climate change and transport objectives (European Commission, 2019a). The ETD doesn't adequately promote reductions in GHG emissions. The Directive will be revised in June 2021 as part of the European Green Deal to ensure alignment with these objectives.

An Inception Impact Assessment (European Commission, 2020h) was carried out in March 2020 by the EC. It notes that well-designed taxes can play a direct role by sending the right price signals and providing the right incentives to encourage sustainable practices from producers, users and consumers. Currently, the wide range of exemptions and reductions (e.g., fossil fuel subsidies, etc.) are not in line with the objectives of the European Green Deal.

[19] Directive 2003/96/EC.

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Current taxation mechanisms don't reward sustainable energy consumption. No significant distinctions are made depending on the environmental consequences of the different types of fuel in terms of GHG produced. This is because taxation is based more on the quantity of consumption rather than on the environmental consequences of the different energy sources (Liobikiene et al., 2019).

Box 10. Relevance of the Energy Taxation Directive to pay-for-performance schemes.

Considering that the **taxation** of energy products can impact consumers' **behaviour** and also **incentivise** them to invest in more efficient appliances, the ETD could be employed as an environmental instrument that will enhance energy efficiency and support the roll-out of P4P schemes.

3.2.4. Electricity Market Rules

The new electricity market rules (European Union, 2019c) require both transmission system operators (TSOs) (European Union, 2019b)[20] and DSOs (European Union, 2019b)[21] to consider demand-side resources in their network planning. Member States must put in place regulatory frameworks to ensure that DSOs (European Union, 2019b)[22] and TSOs (European Union, 2019b)[23] are able to procure demand-side resources. They must promote energy efficiency measures, where these services alleviate, in a cost-effective way, the need to upgrade or replace electricity capacity and secure the safe and efficient operation of distribution and transmission systems.

The new market rules also added that Member States with adequacy concerns should submit Market Reform Implementation Plans that will enable demand-side measures and energy efficiency (European Union, 2019b)[24]. If they are implemented, capacity mechanisms must be open to demand-side management resources (European Union, 2019b)[25].

The gas market is regulated by a third energy package. The gas regulatory framework is expected to be revised in the coming years, with a proposal expected in 2021 (European Commission, 2020e).

[20] Article 51 3. Directive (EU) 2019/944.
[21] Article 32 3. Directive (EU) 2019/944.
[22] Article 32 1. Directive (EU) 2019/944.
[23] Article 40 5. Directive (EU) 2019/944.
[24] Article 20 3. (e), Regulation (EU) 2019/943.
[25] Article 22 1. (h), Regulation (EU) 2019/943.

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Box 11. Relevance of obligations that facilitate the procurement of energy efficiency resources in energy markets to pay-for-performance schemes.

If implemented properly, these obligations on energy market actors could **improve** market conditions for energy efficiency interventions. By putting the focus on **monitoring**, **evaluation**, and **verification (MRV)**, P4P schemes could enhance the role of energy efficiency as an energy system (grid) **resource**.

3.2.5. European Strategy for Data

The European Strategy for data, which was under consultation from February to May 2020, aims to create a single market for data that will ensure Europe's global competitiveness and data sovereignty. Common European data spaces will ensure that more data is available for use in the economy and society, while maintaining control over the companies and individuals that generate this data.

According to the European Strategy for Data, data will redefine the way we produce, consume and live, generating perceptible benefits in every single aspect of our life, such as more conscious energy consumption (European Commission, 2020c). Data-driven applications can benefit citizens and businesses by improving sustainability and energy efficiency, among other benefits.

As part of the data strategy, the EC has published a report on Business-to-Government (B2G) data sharing. The report contains a number of policies, legal and funding recommendations that will contribute to making B2G data sharing in the public interest a scalable, accountable and sustainable practice in the EU.

Despite its economic potential, data sharing between companies is struggling to spread on a sufficient scale (European Commission, 2020c). This is due to:

- the lack of economic incentives
- fear of losing competitive advantage
- the lack of mutual trust between economic operators in the use of data in compliance with contractual agreements
- imbalances in negotiating power
- fear of data misappropriation by third parties
- a lack of legal clarity as to who can do what with the data (e.g., for co-generated data, especially digital data, etc.).

The EU should address in a concerted manner issues ranging from connectivity to data processing and storage, from computing power to cybersecurity. It will also need to

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improve its governance structures for data management and expand its quality data pools available for use and reuse.

Box 12. Relevance of data collection and sharing legislative actions to pay-for-performance schemes.

Data collection is useful for carrying out an energy **diagnosis** of buildings and for identifying **priority** interventions.

Access to data is crucial in the context of P4P schemes. Aggregators use data shared by building owners to evaluate buildings and energy efficiency plans. Meanwhile, building owners use data shared by aggregators to identify opportunities to participate in energy-saving portfolios that can be offered through purchase agreements to energy providers and third-party investors.

Big data could enable **accurate** and **dynamic** measurement and verification of energy savings and flexible consumption and could also be used to ex-ante identify and develop business opportunities.

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4. Formulation of potential policy pathways

In April 2021, EU legislators agreed to increase the emissions reduction target from 40% to 55% (Council of the European Union, 2021). The revisions and initiatives linked to the European Green Deal climate actions and in particular the climate target plan's 55 % net reduction target are presented under the "Fit for 55 package". The main documents that offer indications on the expected proposals, and which we use to develop alternative policy pathways, are:

– *2030 Climate Target Plan*[26] and the accompanying Impact Assessment (published in September 2020)[27]

– *Renovation Wave for Europe – greening our buildings, creating jobs, improving lives*[28] (October 2020)

– *Study on the Development of a European Union Framework for Digital Building Logbooks*[29]" (December 2020).

After reviewing these documents, and the existing policy framework relevant to P4P in **Section 3**, we identified upcoming policy developments.

This section provides an overview of the policies in the EU building sector, with a focus on proposed and upcoming policy developments. The analysis of legislation and other policy initiatives provided the basis for formulating alternative policy pathways, to which we applied the SWOT analysis presented in **Section 5**.

4.1. 2030 Climate Target Plan

In the 2030 Climate Target Plan, the Commission proposed the increase of the greenhouse gas emissions reduction target to 55% below 1990 levels by 2030 (European Commission, 2020f). To achieve this, several measures must be taken, including revising the main legislation that defines the European legal framework on energy and climate change. Key instruments of this legislation are ETS[30], Renewable Energy Directive (RED), EED, ETD, EPBD, and Alternative Fuel Infrastructure Directives (AFID). The 2030 Climate Target Plan is accompanied by an impact assessment that shows how all sectors of the economy and society can contribute and sets out the policy actions required to achieve the new emissions reduction target.

[26] https://ec.europa.eu/clima/policies/eu-climate-action/2030_ctp_en
[27] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020SC0176
[28] https://ec.europa.eu/commission/presscorner/detail/en/IP_20_1835
[29] https://ec.europa.eu/growth/content/study-developing-eu-framework-digital-logbook-buildings_en
[30] Directive 2003/87/EC.

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4.2. Renovation Wave

Despite the important contribution that the building sector can have towards climate neutrality only 1% of buildings undergo energy renovation every year (European Commission, 2020d). The Renovation Wave is a strategy published by the Commission in October 2020 that aims to boost renovation and improve the energy performance of buildings. Its objective is to double the annual energy renovation rates in the next ten years.

These renovations will enhance the quality of life for people living in and using the buildings, reduce Europe's GHG emissions, and create up to 160,000 additional green jobs in the construction sector. The strategy prioritises actions decarbonising heating and cooling, tackling energy poverty and worst-performing buildings, and renovating public buildings such as schools, hospitals, and administrative buildings. The Commission has recognised the potential of P4P schemes to accelerate building renovation in the Renovation Wave strategy, stating that "*Member States can reduce risk perception and scale-up market incentives such as energy-saving tariffs, pay-per-performance public support schemes and energy-saving tenders to attract private intermediaries and aggregators.*" (European Commission, 2020d).

4.3. Energy Efficiency Directive

The EED, already presented in **Section 3**, constitutes a cornerstone of the EU energy efficiency policy towards carbon-neutrality by 2050. The amended 2018 EED, which sets a 32.5% energy efficiency target, is expected to be revised. So we present some of the key possible amendments in the Directive's articles that could be relevant to rolling-out P4P schemes.

4.3.1. Renovation of Public Buildings

Public buildings, including privately-owned social infrastructure, such as cultural institutions, schools, hospitals and healthcare facilities, public administrative buildings and social housing can be flagships for the renovation process. Currently, Article 5 of the EED is addressed only to buildings owned and occupied by the central government, so covers only 4.5% of all public buildings (European Commission, 2020d). The Commission is expected to extend its scope to all public administrative levels. These actions would be complemented by the phased introduction of minimum energy performance standards as part of the revision of the EPBD by the end of 2021. Mobilising funding can be challenging, especially at local and regional level. Available public funds are often limited and difficult to combine– usually due to legislative barriers and lack of technical capacity in public administrations.

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4.3.2. Energy Efficiency Obligation schemes

The Commission is considering an increase in the energy efficiency obligation on Member States set out in Article 7 of the EED (European Commission, 2020b).

4.3.3. Energy Audits

Energy audits are currently mandatory for large enterprises, with at least 250 employees, or annual revenues that exceed €50 million and an annual balance sheet that exceeds €43 million. In addition, Member States must set up programmes to encourage SMEs to carry out energy audits. However, implementing audit recommendations is not obligatory. As the Impact Assessment (European Commission, 2020a) mentions, more in-depth analysis would be needed to determine the role of measures aiming to bridge the gap between company audit results and the implementation of the respective recommendations. In addition, energy audits can be strengthened by broadening the scope of the mandatory requirements to more types of enterprises or different economic actors. Also, by providing financial and regulatory support to boost the implementation of energy efficiency recommendations that could be mandatory for cost-effective energy efficiency measures. The Commission is expected to consider expanding energy audit requirements to larger and more complex non-residential buildings such as hospitals, schools and offices.

4.4. Energy Performance of Buildings Directive

As mentioned in the previous section, the EPBD constitutes another policy instrument of high importance towards achieving broader sustainability goals. Proposals on this Directive are expected at the end of 2021.

4.4.1. Energy Performance Certificates

Inadequate information on buildings' existing energy and resource profile, and the possible benefits of renovation, lack of confidence in real energy savings, and split incentives among owners and tenants are the most significant barriers to individual decisions on energy efficiency improvements (Economidou & Bertoldi, 2015). As stated in the Renovation Wave, Energy Performance Certificates can be a great source of information as they document energy performance, the share of renewables and energy costs. Making EPCs available in accessible databases can improve transparency of the building stock's performance. This could be crucial for identifying worst-performing buildings at the district, regional, national, or Union level. They can also be used to assess performance before and after upgrades and help connect financing with high-quality renovation.

Despite the value that Energy Performance Certificates can have, the EPBD currently requires them only in cases of construction and when a building unit is sold or rented to a new tenant. In cases of buildings occupied by public authorities, the requirement applies to those that are frequently visited. Additionally, quality, and fair pricing is also a

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problem, and only a small proportion of the Energy Performance Certificates are based on physical energy audits. They also do not reflect the interconnectivity and "smart readiness" of buildings. All these issues erode trust in this tool. So, the Commission will recommend updating the Energy Performance Certificate framework, taking into consideration the increasingly available solutions to manage energy performance during the use of the buildings and the emerging energy performance metering technologies. They will also look at a uniform EU machine-readable data format for the certificates and more stringent provisions on the availability and accessibility of databases and federated digital repositories for Energy Performance Certificates.

The Study on the Development of a European Union Framework for Buildings' Digital Logbook and the Renovation Wave mention that DBLs could be combined with existing policies and instruments like the Smart Readiness Indicators (SRI), Energy Performance Certificates and material passes/ passports. This would ensure data compatibility and integration throughout the renovation journey (Volt & Toth, 2020). The European Building Stock Observatory will be examined as a possible central European repository for reliable building-related data.

4.4.2. Minimum energy performance standards

Setting minimum standards is one of the most efficient ways to increase energy efficiency in buildings. This ensures that buildings that do not meet a certain level of efficiency will no longer be deemed appropriate for rental and/or sale. In addition, buildings can be required to meet a certain performance level by a given deadline. Putting in place performance standards should be accompanied by financial and technical support as well as tailored advice. This will allow fair deals for owners, occupants and public investors.

By the end of 2021, the Commission aims to propose the introduction of mandatory minimum energy performance standards in the context of the revised EPBD. This would be accompanied by an impact assessment that will examine the scope, timeline and phasing of the gradual adoption of such requirements, as well as the need for additional supporting policies. This will facilitate linking specific national, regional and local incentives and support compliance with these minimum standards.

The 2030 Climate Target Plan also highlights the potential introduction of mandatory requirements for buildings that perform the worst as well as strengthening the minimum energy performance requirements as tools towards improving the building stock. Additional measures will be identified to remove existing barriers to building renovation and reinforce existing drivers for faster and deeper renovations.

4.4.3. Digital Building Logbooks

The construction sector is currently inadequately developed in terms of digitalisation and data application. Building-related data is limited, of unreliable quality and difficult to

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obtain. Also, the absence of a shared data repository results in increased costs and inefficiencies, as well as stifled innovation and increased risk. This negatively affects investor trust. The development of a European Union Framework for Digital Building Logbooks (DBL) aims to position the use of DBLs as common repositories for all building data. This will facilitate data transparency while increasing data availability among property owners and/ or occupants, financial institutions, public agencies and all relevant market players. Increased transparency and availability can also result in better-informed decision making (Volt & Toth, 2020).

4.5. Energy Taxation Directive and Emissions Trading System

The ETD, which establishes the rules for taxation of energy products in the EU, has not changed since 2003. As already mentioned in **Section 3**, it is outdated and not aligned with the objectives of the European Green Deal. As mentioned in the Impact Assessment and the 2030 Climate Target Plan, the Commission will propose a revision of the ETD and the introduction of a Carbon Boarder Adjustment mechanism as part of a much broader tax reform.

The EU ETS sets a cap on emissions from a number of industrial plants. It covers 30% of total buildings emissions: emissions from large fossil fuelled district heating, electric heating and electricity used by heat pumps. The ETS caps these emissions and creates a carbon price in these sectors through trading.

As mentioned in both the Renovation Wave and the 2030 Climate Target Plan the Commission will consider a further expansion of the ETS to cover the road transport and additional emissions from the building sector as part of the upcoming revision in July 2021. According to the Commission, covering all emissions from burning fossil fuels and incorporating them into the EU ETS will result in significant gains in terms of effectiveness. The Impact Assessment mentions that one way to broaden the role of carbon pricing would be to extend the scope of the existing EU ETS to fossil fuel use in non-ETS sectors, such as buildings and road and maritime transport. Another option could be establishing a separate EU-wide ETS for the new sectors (or national ETS for specific sectors) or carbon taxation. This last option is currently being considered by the Commission.

4.6. Internal Market for electricity: smart meters

A study on benchmarking smart meters' deployment published in 2019 mentions that by 2024, almost 225 million smart meters for electricity and 51 million for gas will have been installed in the EU. This is a potential investment of €47 billion. Nearly 77% of European consumers are expected to have a smart meter for electricity (approximately 44% for gas smart meters). Smart meters may provide energy savings ranging from 2% to 10%. They are anticipated to lead to annual savings of €230 for gas and €270 for

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electricity per metering point (e.g., distributed among customers, retailers, DSOs, etc.) (Tounquet & Alaton, 2019).

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5. Strengths, Weaknesses, Opportunities and Threats

In this section, we analyse each of the policy instruments presented in **Sections 3** and **4** using SWOT analysis to identify how they could affect the implementation of P4P schemes in the EU.

In particular, we identify factors that are favourable (strengths and opportunities) and unfavourable (weaknesses and threats) on each policy instrument when it comes to P4P schemes' development and implementation. For each policy instrument we present relevant characteristics as a short descriptive statement, followed by the SWOT analysis and discussion of findings.

5.1. Energy Efficiency Directive

5.1.1. Article 5 (Exemplary role of public bodies' buildings)

Article 5 under the EED puts an energy savings obligation on buildings owned and occupied by central governments. It requires Member States to encourage other public bodies to adopt an energy efficiency plan, an energy management system and use energy service companies (ESCOs) and energy performance contracting.

Strengths

- Renovation of public buildings can spearhead the renovation wave, serving as **flagships** for the renovation of other buildings and the development of new business models.

Weaknesses

- Energy savings obligation under Article 5 is **limited** to a share of buildings owned and occupied by central governments.

Opportunities

- The Commission is looking into the possibility to **extend** Article 5 to additional public buildings and social infrastructure.
- P4P schemes can **reward** projects mixing behavioural, operational and physical interventions.
- Local authorities could implement innovative business models to also **mobilise** private investments, such as P4P programmes, to renovate their buildings. For example, this P4P programme developed by a local authority and a regional energy agency: www.bayren.org/

Threats

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- Legislative and accounting barriers **inhibit** the deployment of energy efficiency investments.
- Pressure on public authorities (especially less experienced ones) without clear implementation guidelines may lead to **lack of** innovative programmes or poorly designed programmes.
- Limited technical capacity in **local**/ **regional** public authorities.
- Limited information about new business models and financing options.

Article 5 of the EED is a strong candidate for the enforcement of P4P schemes, as there is a huge potential to increase energy efficiency in public buildings. However, currently Article 5 is limited only to public buildings owned by central governments, not buildings owned by regional or local ones. If the Commission extends the obligation to more public buildings (as is expected) this could be an opportunity for public buildings to make a significant contribution to achieving national objectives.

Nevertheless, a common barrier hindering public buildings' renovation, especially at the local level, is the lack of financing. Innovative business models, such as P4P programmes, could be used to mobilise private investments for renovating public buildings. These schemes have been successfully rolled-out in North America targeting Municipalities-Universities-Schools-Hospital (MUSH) buildings. Renovating public buildings through new business models, like P4P schemes, can enhance the buildings and promote further development of the business model in other sectors.

In most cases, the building stock is old, unrenovated, and building users (eg administrative, cleaning and maintenance staff, visitors) are not familiar with energy management practices or are not required to make behavioural changes. The latter is related to another common barrier to energy saving in such workplaces: the lack of financial benefit from adopting energy saving practices. This is because the bill is paid by the employer, not the office worker. So behavioural and energy management programmes in the public sector could be promoted, and further enhanced, through the P4P business model, if building users are engaged properly.

Another challenge for the public building sector is that, under certain circumstances, the accounting treatment of such schemes (e.g., Energy Performance Contracting, etc.) affects the ability of the public sector to account for the projects as off-balance sheet investments. A further restricting factor concerns the inclusion of aggregators in the business model since proper legal frameworks are not yet established in many countries. Alongside these barriers, public authorities are plagued by limited technical capacity and information on new business models and financing tools. This, in combination with the absence of specific guidelines for public authorities, can lead to poor and rash design of energy efficiency programmes.

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5.1.2. Article 7 (Energy Efficiency Obligation schemes)

Article 7 under the EED puts an energy savings **obligation** on **Member States**. Member States can **achieve** this obligation by introducing EEOS.

Strengths

- Article 7 has led to the multiplication of EEOS in Europe. Four Member States use EEOS to fulfil all their Article 7 obligations, and eleven use EEOS in combination with alternative measures. EEOS have been the **main driver** for P4P schemes in the USA.
- Annex V of the EED requires Member States to accurately calculate the **impact** of EEOS, which is a **feature** required for the successful implementation of P4P schemes.
- Article 7 allows obligated parties to count towards their obligation **certified** energy savings achieved by **energy service providers** or **other third parties**. This opens the door for **aggregators**, which are often one of the main entities involved in a P4P scheme.

Weaknesses

- Annex V does not favour the use of metered savings methodologies, which are needed to enable the roll-out of P4P schemes. The use of metered savings has been mainly **limited** to projects in industrial installations.
- Energy companies usually promote energy efficiency through compliance-only strategies instead of **developing** and **enabling** new energy service business models.
- Only in very **mature** markets would it be possible for an energy supplier to put in place an innovative and profitable energy efficiency business model.

Opportunities

- **Regulators** can ask obligated parties to look for innovative solutions to **improve** the **impact** and **cost-effectiveness** of energy efficiency measures. P4P schemes can help with this.
- P4P schemes can reward **multi-measure, behavioural**, and/ or **operational** changes, allowing obligated parties to capture savings from complex projects.
- Requiring utilities to fulfil their obligations through P4P schemes would simultaneously **promote the energy service market** as required under Article 18 of the EED.

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- The Commission could **encourage** the use of **metered methodologies** in buildings by launching a process similar to CalTrack[31] in the USA.

Threats

- Consumers are sceptical of energy companies. Under current market conditions, consumers doubt the motivation of energy companies to offer services that actually save energy – so reducing their revenues from energy sales (Apajalahti et al., 2015).

Alternative policy pathway

Article 7 of the EED puts an energy savings **obligation** on **Member States**. Member States can achieve this obligation by introducing **policy measures other** than EEOS (alternative measures).

Strengths

- Article 7 has led to the **intensification** of energy efficiency policies in the EU. The continuation of the obligation after 2020 could lead governments to look for innovative solutions to **improve** the impact of their energy efficiency policies to reach objectives while keeping costs down.
- Annex V of the EED requires Member States to accurately **calculate** the impact of their obligations. Governments can use metered savings methodologies, which are needed to put in place P4P schemes.

Weaknesses

- Annex V does not favour the use of metered savings methodologies, as so far its use has been mainly **limited** to projects in industrial installations.

Opportunities

- P4P schemes can **reward** multi-measure, behavioural and/ or operational changes, allowing governments to capture savings from complex projects.
- Possibility to use EU funding to develop P4P schemes.

Threats

- Until now there's been **limited** development of P4P schemes by governments. This has led to limited know-how on development and implementation of these schemes.

[31] https://www.caltrack.org/ CalTRACK is a set of methods for estimating avoided energy use (AEU), related to the implementation of one or more energy efficiency measures, such as an energy efficiency retrofit or consumer behaviour modification.

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Our SWOT analysis shows that, although there are certain strengths and opportunities regarding the establishment of P4P schemes through EEOS and alternative measures, significant barriers need to be overcome. Member States are compelled to define policy measures to meet their energy saving obligations set under Article 7. While EEOS sets an obligation on energy companies to achieve energy saving targets with the goal to boost energy efficiency services, Member States can opt for alternative (or complementary) measures and mechanisms (e.g., regulation/ standards, taxation schemes, energy efficiency funds, etc.). So far, Article 7 has led to the multiplication of energy efficiency policies across the EU delivering a large share of the savings that the EED should achieve. The continuation of the obligation after 2020 could lead governments to look for innovative solutions to improve the impact of their energy efficiency policies and reach objectives while keeping costs down.

There are clear indications that regulation on this matter enables the adoption of P4P schemes since EEOS are the main driver of P4P schemes in the USA. The rules on energy savings accounting, the possible openings to aggregators, due to the ability of obligated parties to account for savings achieved by third parties, and the capability to use EU funds for energy savings programmes create a positive outlook for the enforcement of P4P schemes. Furthermore, P4P programmes can support obligated parties to improve, in a more innovative way, the impact and profitability of their energy efficiency measures. They also open the door to more composite energy efficiency projects due to their capacity to reward multi-measure, behavioural, and/ or operational changes.

The main challenge for the implementation of P4P programmes in the context of Article 7 is that the use of metered savings, which are essential for the implementation of P4P schemes, is not promoted/incentivised by the current EU legislation. In the context of Article 7 the use of metered savings is mainly limited to projects in industrial installations. However, diverse opportunities can emerge if the Commission launches processes similar to CalTrack, which could encourage the use of metered methodologies in the building sector. Finally, customers' mistrust of energy companies can weaken the successful implementation of P4P programmes. This is because under the current market conditions consumers doubt the motivation of energy companies to offer services that actually save energy and so reduce their revenues from energy sales.

5.1.3. Article 8 (Energy Audits and energy management systems)

Article 8 of the EED requires Member States to **promote** energy audits and to put in place an **obligation** for enterprises that are not SMEs to carry out regular energy audits.

Strengths

- Audits can **increase** awareness of the energy efficiency potential and **create** a market for energy services.

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Weaknesses

- Energy audits are currently **mandatory only for large enterprises**, limiting the impact of the provision.
- It is **not compulsory** for companies to follow up on audit recommendations.

Opportunities

- The Commission is considering an **extension** of the parties subjected to the energy audit requirements and an **obligation** to follow up on audit recommendations.
- If the implementation of cost-effective energy efficiency measures becomes **mandatory**, new business models combining audits and energy services can emerge. Examples from the USA have shown that P4P programmes have been successfully implemented and are becoming a popular option for SMEs.

Threats

- **Reluctance** to put obligations on companies may lead to keeping Article 8 as it is.

Energy audits and management can be useful tools to promote innovative energy efficiency financing models. Indeed, energy audits can raise awareness about the energy efficiency potential and support the creation of energy service markets, which are both necessary for the enforcement of P4P schemes. Energy management encourages a focus on the operation of the building, therefore ensuring that energy savings are sustained over time.

Nevertheless, under the current legislative framework, only large enterprises are obligated to conduct energy audits, without being required to implement its recommendations, limiting the impact of Article 8 of the EED. The Commission is investigating the potential to extend the obligation for energy audits to more parties, and to propose an obligation to comply with audit recommendations. However, hesitance to put new obligations on companies may keep Article 8 as it is. Space would be created for new business models like P4P programmes if the enforcement of profitable energy efficiency measures becomes compulsory and the need for renovation is increased. The latter becomes clear when analysing applications from the USA, proving that P4P programmes have been successfully tested with SMEs (Santini et al., 2020).

5.1.4. Article 18 (Promoting energy service markets)

Article 18 of the EED **requires** Member States to **promote the energy services market** and **support** its proper functioning.

Strengths

- The implementation of Article 18 by Member States could **facilitate** the emergence of actors (e.g., ESCOs, aggregators, contractors, etc.) that are needed for the development and further deployment of P4P schemes.

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- The promotion of P4P schemes by Member States could **support** the development of new energy service markets.

Weaknesses

- Even though companies and business models are flourishing in the EU right now, **market conditions** and **national legislative** frameworks may not be as supportive or effective as they could be.

Opportunities

- The EPC business model could be enhanced by P4P schemes and the presence of aggregators.

Threats

- Every business model, and especially innovative programmes like P4P, should be **designed** and **developed** considering individual characteristics of national and local regulatory frameworks, unless their implementation could prove unsuccessful.
- Final users not properly **informed** about new business models, such as P4P schemes.

Article 18 could significantly support the enforcement of P4P schemes as it promotes the emergence of different actors, like ESCOs, aggregators, contractors, etc., that are essential for the development and the further deployment of P4P schemes. Furthermore, the enforcement of P4P schemes will drive the development of new energy service markets. On the other hand, although there has been great progress in the field of new energy companies and business models in the EU so far, more favourable market conditions and national legislation are needed to establish P4P schemes.

In this context, the adoption of P4P programmes could also enhance the EPC model and expand the energy services market to new "hard to reach" sectors (e.g., residential sector, small and medium commercial buildings, etc.) thanks to the aggregator model. However, even if a P4P programme is launched, it will not be successful if proper stakeholder engagement has not been conducted. Finally, while designing and implementing innovative business models like P4P schemes, it is important to consider the regulatory needs at national and local levels, so they are in line with the needs of final costumers and national conservation targets.

5.2. Energy Performance of Buildings Directive

The EPBD covers a broad range of policies and supportive measures that help national EU governments boost the energy performance of buildings and improve the existing building stock.

Strengths

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- The EPBD requires Member States to put in place energy performance **requirements** for new buildings and for buildings undergoing major renovations.
- The EPBD participates in improving **knowledge** of the building stock performance, which can be used to identify target buildings for P4P programmes.
- The EPBD requires Member States to **link financial measures** for renovation to the targeted or achieved energy savings.

Weaknesses

- **Limited** renovation rates in the EU.
- The availability of Energy Performance Certificates is still limited.
- Lack of information about **operational performance** and no requirement to run physical energy audits to obtain Energy Performance Certificates.

Opportunities

- The Commission is considering introducing additional mandatory **minimum energy performance standards for renovation**.
- The upcoming **review of Energy Performance Certificates** and SRI could provide a more robust and reliable indication of buildings' operational performance.
- The availability of Energy Performance Certificates in accessible **databases**.
- Digital building logbooks could boost the **availability of information** for a number of purposes to a broad range of market players.

Threats

- Risks related to digital logbooks like high costs, legal concerns, quality and reliability issues.

The EPBD constitutes a proper background for the adoption of P4P schemes. It obliges Member States to set energy performance requirements for new buildings and buildings that are majorly renovated. It also improves knowledge of the building stock performance, which can be used to identify target buildings and benchmark them for P4P programmes. The EPBD requires Member States to relate the financial measures needed for the renovation with the energy savings expected or reached. This could be improved by linking financial measures to a credible assessment of the buildings' energy performance.

Nevertheless, there remains some barriers in the EPBD for the enforcement of P4P schemes. The main risk is that the EPBD does not drive a sufficient number of renovations, as shown by the limited renovation rates in the EU. Setting minimum standards is one of the most effective ways to improve the energy performance of buildings. The Commission is investigating the potential of proposing additional mandatory energy performance standards for renovation based on trigger points and/or compliance dates. By doing so, the demand for renovation will be increased.

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Another restricting point concerns the low coverage of Energy Performance Certificates in the EU. Several Member States have less than 10% of the building stock covered. Furthermore, the Energy Performance Certificates framework needs further development as very few Energy Performance Certificates reflect the interconnectivity and smart readiness of buildings. Work is underway by the Commission to update Energy Performance Certificates and SRI. These can further improve the transparency of the performance of the building stock. An update of the Energy Performance Certificates framework, considering metering technologies, along with enhancement of its accessibility, can also facilitate the implementation of P4P schemes.

Similarly, digital building logbooks could foster the availability of information on different aspects of the building to a wide range of market players, including property owners, tenants, investors, financial institutions and public administration. Other information like energy bills, water and waste management, maintenance recommendations/ requirements as well as insurance and ownership obligations could be included. This could also simplify the enforcement of P4P schemes by minimising bureaucratic obstacles and decreasing the time required to gather all the information needed about a building. However, there are several risks related to digital logbooks. These include high operation and maintenance costs of the supporting digital environment, legal concerns (data protection rights, liability questions for false data), uncertainty on how to assure high quality and reliability of data and potential data breaches. To overcome these, certain developments need to take place to ensure an affordable business model and data safety.

5.3. Carbon pricing measures (Energy Taxation Directive and EU Emissions Trading System)

Taxes account for a **significant share** of the final prices that consumers pay for energy around the EU and can have a **strong impact** on consumption and investment patterns, the type of energy consumed, and their uses. Ensuring that taxation is **aligned** with climate objectives is essential. To this end, the Commission intends for a revision that would focus more on environmental issues.

The ETS was established to create a **market mechanism** to achieve high reductions in carbon emissions from energy intensive industries. It relies on a **system of credits** with a monetary value that are traded in an open carbon market among designated parties. Currently the Commission aims for an extension of the EU ETS or the creation of a separate ETS for the building and transport sector.

Strengths

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- The EU ETS currently **covers** electricity used in buildings and district heating installations above a **certain threshold**, putting a price on carbon emissions related to this energy use in buildings and therefore creating increased need for renovation and innovative business models.

Weaknesses

- At present, a wide range of sectoral **tax** exemptions and reductions in the ETD are de facto forms of fossil fuel subsidies, which are not in line with the objectives of the European Green Deal. In addition, the Energy Taxation Directive does **not foster** energy efficiency measures and new market uptakes (eg implementing innovative schemes, such as P4P).

Opportunities

- **Reinforcing** the role of carbon pricing tools can send a signal to building owners to **decarbonise** and **increase** the uptake of energy efficiency support schemes, including P4P schemes.
- Carbon pricing can **raise** revenues for governments that can be reinjected into a fair energy transition and support the development of innovative schemes, such as P4P.

Threats

- Carbon pricing in the building sector can help overcome **economic** barriers. But to bring innovation into the energy market and facilitate the development of business models such as P4P schemes, non-economic barriers and market transformation are needed.
- Extending the ETS to the building sector **entails** a high risk of introducing more administrative complexity. This will delay action on building renovation and so delay market transformation and development of innovative business models like P4P schemes.

Revising the ETS could contribute to decreasing GHG emissions from the building sector by using carbon revenues to fund renovation programmes. Dedicating carbon revenues to energy efficiency can deliver seven to nine times greater emissions reduction than relying on the carbon price alone and can lower consumers' energy bills in the process (Cowart et al., 2008). Examples can be found in Czechia or France (Sunderland, 2019). The revision of the ETS is an opportunity to include mandatory provisions on revenue recycling. Directing carbon revenues to building renovation programmes can support the introduction of innovative financing schemes, such as pay-for-performance programmes. Nevertheless, extending the ETS to the buildings sector can be both an opportunity and a threat as it also entails a high risk of introducing more administrative complexity. This will delay action on building renovation and so delay energy savings and the reduction of GHG emissions in the buildings sector.

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5.4. Electricity Market Rules

An integrated EU electricity market is the most cost-effective way to ensure secure and affordable electricity to EU citizens[32]. Through common electricity **market rules** and **cross-border infrastructure**, electricity can be produced in one EU country and delivered to consumers in another.

Strengths

- Obligation to include energy efficiency in **capacity mechanisms** could allow the exploitation of efficiency as a reliable and cost-effective grid resource that should be considered comparable to generation resources. Energy efficiency resource providers (typically utilities, third-party energy efficiency companies, or governmental agencies) would **bid** resources into the auction and be **awarded** contracts for reducing demand for capacity levels of the specified delivery year. Energy efficiency aggregators and/ or ESCOs could use P4P schemes in this context to participate in the capacity mechanisms.

Weaknesses

- Not **common** practice **yet** in the EU, so there's limited know-how on setting up such mechanisms and exploiting P4P programmes.

Opportunities

- The Commission will publish guidelines on the Energy Efficiency First principle in 2021. By applying the principle of Energy Efficiency First in capacity markets, percentages of energy efficiency resources in the total capacity would **increase**. This way energy efficiency would be recognised and procured as a **viable resource** for the energy supply and distribution systems, and the use of P4P schemes could be further promoted.

Threats

- The **structure** of the capacity markets and the **method** by which energy efficiency resources are compensated need attention for the capacity markets' administrator to accurately **forecast** the load and **estimate** monetary savings.

Although energy efficiency provides value to energy systems in many ways, these diverse value streams are often not recognised, with energy efficiency providers under-rewarded for the services they provide. Among these benefits, energy efficiency reduces energy costs, avoids the need for costly capacity levels, lowers carbon emissions enabling environmental standards to be met more cheaply, avoids or defers the need for costly

[32] https://ec.europa.eu/energy/topics/markets-and-consumers/market-legislation/electricity-market-design_en

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network upgrades and allows heating and cooling systems to be used more flexibly. Capacity markets are not a 'first best solution' to the challenges of electricity system adequacy and reliability. Where they are in place, energy efficiency is often excluded either explicitly or implicitly from being involved.

Capacity markets enabling energy efficiency to compete on a level playing field could be an opportunity for energy efficiency to be deployed as a resource and for achieving more energy savings. The capacity markets in New England[33] and PJM Interconnection LLC (PJM)[34] areas in the USA are examples of markets where energy efficiency is allowed to be bid into auctions, with increasing amounts cleared over the course of the last 10 years (Liu, 2017). However, the rules associated with the participation of energy efficiency need to be carefully designed to ensure a level playing field.

If network operators were regulated to align their incentives with societal goals, they could reward energy efficiency for the benefits it provides. However, many network operators currently face a disincentive to reduce load, as their revenues are not decoupled from throughput. This could be addressed if performance-based regulation were set so that network utilities are just as likely to invest in equivalently priced demand-side resources as supply-side equivalents. A key challenge for the energy efficiency industry would then be to produce energy efficiency-based demand reductions that system operators and network utilities can rely upon.

The adoption of the Energy Efficiency First principle by the EU puts the onus on the energy efficiency industry to prove its value. As the energy sector and National Regulatory Authorities begin to implement the new elements of the Fourth Energy package[35], distribution network plans provide: "*transparency on the medium- and long-term flexibility services needed … (and also) include the use of demand-response, energy efficiency, energy storage facilities or other resources that [the] distribution system operator is using as an alternative to system expansion*" (European Union, 2019b). P4P and energy efficiency auction-based schemes could be deployed for compliance making energy efficiency a viable resource for the supply side and distribution systems.

5.4.1. Internal market for electricity: smart meters

Directives 2009/72/EC and 2009/73/EC on the internal market for electricity and gas, as well as the Energy Efficiency Directive 2012/27/EU, require Member States to roll out

[33] https://www.iso-ne.com/markets-operations/markets/forward-capacity-market/

[34] https://www.pjm.com/markets-and-operations/rpm.aspx

[35] The Fourth Energy package introduces new electricity market rules to meet the needs of renewable energies and to attract investment. It provides incentives for consumers and introduces a new limit for power plants to be eligible to receive subsidies as capacity mechanisms.

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smart metering. Where there was a positive cost benefits analysis for smart meters for electricity, at least 80% of households had to be equipped with smart metering systems by 2020.

Strengths

- The envisaged **80% penetration** of smart meters (where the corresponding cost-benefit analysis is positive) will **facilitate** the implementation of energy efficiency measures using P4P schemes based on metered savings.

Weaknesses

- Cybersecurity issues (e.g., cyberattacks, cybersecurity incidents, etc.) **may jeopardise** the security of energy supply and the privacy of consumer data.

Opportunities

- Although smart meters are **not mandatory** for the monitoring and verification process of P4P schemes, their adoption could **facilitate** the roll-out of innovative energy performance-based programmes.
- In the USA, P4P programmes, using smart-meter data, **reduce** the costs of MRV processes, while improving effectiveness in terms of energy savings.

Threats

- About **one third** of Member States will roll-out smart meters by 2030 or later, as results from their latest cost-benefit analysis are **still negative**.
- Smart-grids and smart meters **may** have an **impact** on personal data and privacy, which is why the EU has taken a series of measures to uphold **data protection rules**.

Increasing the use of smart meters is a policy objective that can support the implementation of P4P programmes. Smart meters would facilitate the use of metered saving methodologies, and so the implementation of P4P programmes. In the USA, P4P schemes using smart meters are piloted with the objective to reduce MRV costs and maximise energy savings. Nonetheless, it seems that the roll-out of smart meters in almost one third of the EU Member States will not be done before 2030, due to present negative results from their cost-benefit analyses.

Consumers' personal data is protected by the EU rules on data processing and free movement. Smart-grids and high penetration of smart meters raise issues regarding personal data and privacy, which is why the EU has already taken legal precautions related to their protection (Tounquet & Alaton, 2019). In addition to data protection and privacy, cybersecurity has increasingly become an issue, especially around the possibility that smart-grids and smart meters threaten the energy system's security and stability. Although there is a comprehensive overall legal framework for cybersecurity, the energy sector presents certain elements that require special attention.

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6. Eliciting knowledge and preferences embedded in stakeholders

To verify and evaluate our SWOT analysis we conducted a two-round stakeholder consultation process to collect feedback and insights from key experts from the energy efficiency field. In the first round (**Phase I**: Online interview meetings), key stakeholders were interviewed using a semi-structured questionnaire that we developed based on insights from our review and the SWOT analysis. In the second round (**Phase II**: Online survey) the interview questionnaire was restructured into an online survey, which was distributed to all interested parties across the EU through the SENSEI project's communication channels.

6.1. Phase I: Online interview meetings

We reached out to key experts from the fields of:

– policymaking (abbr. '**POL**')

– energy industry representatives: focusing on energy efficiency programme managers and administrators (abbr. '**IND**')

– scientists, researchers and analysts working in academia or consultancies (abbr. '**SCI**').

Overall, we managed to conduct eight (8) online interviews with eleven (11) stakeholders from these three fields (**Table 1**). Our aim was to collect feedback on our work and discuss their views on the potential integration of P4P schemes into the current EU regulatory framework.

Our interviews followed a semi-structured format, which was tested and revised within our project's consortium. We addressed questions like:

- *Do you think that the current regulatory framework and market conditions in the EU allow for the development of P4P schemes? If yes, why? If not, why?*
- *In your opinion, which sector is the most appropriate for P4P pilots to target at the beginning?*
- *How could energy market actors (e.g., aggregators, ESCOs, etc.) facilitate the implementation of the first P4P pilots in the EU?*

We divided the semi-structured questionnaire into four different thematic sections, as derived from our review and the SWOT analysis: **(i). General policy and regulatory issues**, **(ii). Target sector**, **(iii). Energy services** and **(iv). Market uptakes**. In each section, different questions were listed according to their relevance. The interviews were recorded, transcribed and anonymously synthesised, as presented in the sub-sections below. We have presented selected insights verbatim in quotation marks, using the code presented in **Table 1**, so that they are linked to the different stakeholders' background. The full questionnaire is included in **Appendix A**.

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Table 1. Stakeholder groups interviewed during Phase I of our consultation process

Country	Policymakers ("POL")	Energy Industry ("IND")	Scientists & Consultants ("SCI")
Greece ("GR")	-	1	-
Germany ("DE")	1	-	-
Belgium ("BE")	-	2	2
United Kingdom ("UK")	-	2	-
France ("FR")	-	-	1
Italy ("IT")	-	2	-

6.1.1. General policy and regulatory issues

This category focused on the interviewees' perspectives of the usefulness of P4P schemes in the EU, on the changes required in the existing policy and regulatory framework, and how a P4P business model could be implemented (e.g., administrator, different actors that must be involved, etc.).

When it comes to the usefulness of P4P schemes interviewees stated that:

> *"P4P schemes are preferred compared to traditional energy efficiency programmes, not only because of the accountability of savings, but also because of the monitoring of other benefits for buildings (e.g., thermal comfort, etc.). [The] P4P approach adds a **continuousness in the implementation process** (constant monitoring and reporting of savings and benefits, or of possible problems), rather than [people] being content to install new equipment and print invoices."* (GR_IND).

Interviewees highlighted the importance of EEOS in promoting P4P schemes. One researcher dealing with EU policies mentioned that:

> *"If you look at the EU regulatory framework at the moment, the **Article 7** of the **EED**, as you know, it does **not** really **create** an **incentive** for Member States to **promote** P4P or more generally approaches that would meter energy savings, because you can choose between deemed savings, scaled savings and metered savings. So, obviously, most of the Member States prefer to go for deemed savings because it is less costly in terms of administrative costs. However, there are examples like **Italy** where most of the savings in the Italian white certificate schemes are based on methods that use **metered savings**. In a sense that is **close** to P4P, because ESCOs get the certificates directly based on what they can demonstrate in terms of metered savings. So, some obligation*

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*schemes could create favourable conditions for P4P, but that's not the most common way.**"*** (FR_SCI).

This statement is in line with findings from the experience of P4P schemes in North America, where P4P schemes were mainly policy-driven by specific requirements in EEOS (Santini et al., 2020). A further suggestion from an energy efficiency expert was that:

"…*Obligated Parties should be required through Article 7 to* ***shift away*** *from* ***deemed energy savings*** *to a* ***metered savings approach*** *and use that sort of a* ***requirement*** *as a first step to evolve. Then, you could say that beyond just the measurement approach, there could be a requirement or obligation on power and gas utilities and local regulators to create* ***frameworks for P4P schemes*** *and to share experience, so that EU cooperation between regulators in energy markets is further evolved.**"*** (UK_IND#1).

Interviewees stressed the importance of well-designed and regulated programmes that would demand metered methods for energy savings. Specifically, one energy efficiency expert underlined this issue by saying that:

"*My focus has been on the metering of energy savings as an enabler for P4P programmes, in a similar way like the CalTrack method that is used in California or in other parts of the United States.* ***I think that there are applications for that protocol and that approach to empirical measurement of savings that don't require regulatory or policy drivers.*** *However, P4P schemes pay contractors in a way that is directly linked to the outcome of a project, so I agree that [the scheme] could be only implemented meaningfully as part of a regulated programme, so it's policy-led and it's regulated. Because I can't really imagine how [the P4P concept] could be brought in any other way.* ***I can't imagine contractors volunteering to approach in that way especially in energy efficiency where, according to my experience, there is some bad practice*** *in terms of either overengineering or overpricing the work.**"*** (UK_IND#2).

Interviewees' perspectives of P4P business models in the EU differed. Some of them argued that P4P schemes should be promoted through Obligated Parties (e.g., energy companies, energy distributors, etc.). Others believe that, in the EU, such models could be successfully promoted through energy communities and regions that are in transition,

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using the "Just Transition[36]" funds. In particular, one of the interviewees stated the following:

> ***"****P4P schemes* ***could be implemented by DSOs because there will be need to support the energy system and increase the capacity of the grid*** *particularly now that we are electrifying heating. Such schemes can support homeowners and the grid during different times of the day.* ***I do not see a specific role for energy utilities as they see energy efficiency as tax rather as an opportunity."*** (BE_IND#1).

An industry representative mentioned that:

> ***"****The energy system in the EU is not similar to the one in the U.S. Thus, in order to ensure the successful implementation of P4P schemes, either further policy/ regulatory/ market developments should take place, or the* ***P4P business model should be designed in a way that fits in the EU****, by exploring, for example, the potential of energy communities and their characteristics."* (GR_IND).

Other stakeholders expressed hesitation on this approach:

> ***"****Energy communities are pioneering, and they are important,* ***but they are not gonna be the majority of the building stock*** *[..] it would be a bit weird to call for a third party to verify the impact of what energy communities do but they could be probably interested in the approach themselves. Of course, it depends on the type of energy community."* (FR_SCI).

Overall, the need for policy and market changes was highlighted by all the stakeholders in order to ensure a successful roll-out of P4P schemes in the EU. Consideration and integration of savings through metering methodologies through EEOS was a critical issue raised during discussions.

6.1.2. Target sector

P4P schemes in North America have been used in MUSH-type buildings, large and medium commercial buildings, and, SMEs and the residential sector (Santini et al., 2020). Through the questions in this category, we tried to identify which sector is considered the most appropriate for the first P4P pilots in the EU. We did this according to the

[36] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/actions-being-taken-eu/just-transition-mechanism_en

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perspectives of the interviewees, and also considering the current regulatory framework and upcoming policy developments.

In general, most of the interviewees don't see public buildings as the most suitable target for the first P4P pilots in the EU. They say that the residential sector would be a good opportunity for such innovative business models – also considering the high demand for investments needed to achieve the ambitious targets for renovation and decarbonisation. Stakeholders also highlighted that the most appropriate target sector will be defined based on the upcoming policy developments, as currently it is hard to identify which sector the regulatory and market framework will facilitate. One representative underlined the latter by saying:

> ***"****Ideally, P4P schemes could be rolled-out by targeting public and MUSH buildings first, as it is easier to monitor their savings compared to the residential sector, but at the moment all sectors are considered attainable.* ***Upcoming opportunities for the business model, the policy and market developments and the market actors involved will define the target sector."*** (GR_IND).

On the other hand, another industry representative stated that:

> ***"****I believe* ***the focus should be on the residential sector****, seeing also examples implemented in California. However, there is also a need in the non-domestic sector too (e.g., SMEs). […]there is a need for better measurement of outcomes and more holding contractors to account in the non-domestic sector, but the metered savings aspect of it, is more difficult for obvious reasons, as there are different energy usage drivers and great variation and heterogeneity across the population of businesses. So, it would require a different type of the same approach that we are looking for the residential sector.* ***At the moment, based on the way I've seen grant schemes being dispersed for non-residential buildings, there is very little emphasis on measurement of outcomes, which I think is mainly the problem."*** (UK_IND#2).

Furthermore, another energy efficiency expert stated that:

> ***"****I don't think that P4P pilots should start with municipal buildings.* ***It is difficult to connect municipal buildings to the energy market as the investments required in this sector are heavily dependent on grants.*** *People in these areas are not financial people, they are not financial experts, they don't have the expertise, they mostly rely on grants and grant applications"* (UK_IND#1).

On the other hand, all the interviewees agreed that the social housing sector could be an excellent opportunity for P4P schemes because of the high share of buildings it has and

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the particularities that it presents. One of the stakeholders underlined the importance of the housing sector:

> ***"****Housing is 75% of the number of buildings and that's where the biggest challenge is* ***because of the number of buildings and by also considering the roll-out of smart meters."*** (UK_IND#1).

Another industry representative mentioned that:

> ***"****I think the social housing example is an interesting one,* ***because a social housing provider is almost a kind of a regulated portfolio of homes anyway.*** *So, they could set the terms of [savings] delivery across their portfolios and use a P4P type approach to incentivise good outcomes."* (UK_IND#2).

6.1.3. Energy services

The questions in this category deal with the ways P4P schemes could become attractive to energy service providers and final users, and therefore broadly accepted and used in the energy market. As stated by one industry representative:

> ***"****In order* ***to promote P4P schemes and make them attractive to both ESCOs and final users the current energy market elements should change, the current problem in not an engineering problem but a market failure****. There is major asymmetry of information between the seller and the buyer. Energy efficiency should be treated like power generation: if you do not deliver it you do not get paid for it. In order for people to trust P4P schemes, a central EU certification system for metering methods should be established and performance should be incentivised using something like feed-in-tariffs for energy efficiency as in renewable energy****."*** (BE_IND#1).

Another interviewee mentioned that it is difficult for people to trust innovative business models. So stricter obligations will be needed both on energy providers and on final users. The interviewee underlined this by saying:

> ***"ESCOs are doing a good job approaching customers, but there must be a problem in order to offer the solution."*** (DE_POL).

Finally, some interviewees stated that P4P schemes should be well-designed and standardised in order for energy service providers to participate and that they should also be in line with the specific national regulations of each country. Indicatively, an expert from the field of research stated that:

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> *"Well, in general, I think that it's in the interest of ESCOs, as they are mainly providing energy management services, to focus more on real energy performance. […]then, I think that* ***in more practical terms, it will be necessary to see what these schemes will require in terms of implementation processes as they should also fit in the national regulations,*** *because, of course, you have different procurement rules, so it really depends on the national level as well."* (BE_SCI#1).

6.1.4. Market uptakes

This final category includes questions regarding upcoming technological developments relevant to P4P schemes such as the roll-out of smart meters and the development of digital logbooks. Interviewees agreed that both digitalisation and the smart meters' broad deployment can facilitate the development of P4P schemes by providing easy access to available and accurate information. In particular, one industry representative mentions that:

> *"Accurate digital information regarding energy performance and energy efficiency of different buildings* ***can be used as a metric for benchmarking and comparison****. Classification of buildings into similarly performing groups can help to narrow down the focus on problematic units. Sometimes it can also help in understanding the good practices applied by certain consumption units that have improved their energy efficiency performance."* (GR_IND).

Another industry representative states that:

> *"Digital technologies allow to draw important benefits from the* ***monitoring of results*** *and the* ***analysis of the performance achieved."*** (IT_IND#1).

However, some interviewees believe that the potential of these technological tools should be fully exploited if they are to become useful for P4P schemes– but doubt this will be the case in practice. As one interviewee states:

> *"Smart devices, like smart meters, produce large volumes of data in different formats, and this data needs to be collected, stored and analysed. Extracted results from the post-analysis of this data needs to be easily understandable and visualised to be properly exploited. The challenge gets even tougher when data needs to be collected and analysed in real time.* ***In order to effectively use data from smart meters, a highly scalable and flexible data analysis platform is required."*** (GR_IND).

Furthermore, another stakeholder mentions:

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> ***"****These tools are like political branding: to make them seem like sexy (which they are!)* ***We are doing all these smart meters, while we are not making full use of the benefits of all this data coming from them.*** *It could be a good thing to estimate the amount of data that is rolling off from smart meters, to expose how many GB, or TB from smart meters are not used. Smart meters, connection of energy markets to retrofits, renovation wave, digitalisation, etc., are a bunch of keywords included in the directives to start the technical debate within them.****"*** (UK_IND#1).

Other interviewees also highlighted the need for other technological developments that should be considered when it comes to P4P schemes. For example:

> ***"****Clearly it is difficult to imagine any other alternative than using smart meters. But what other data do we need for this? I think that there will be a need for a very low-cost, affordable in-home census that can monitor just a few parameters of the indoor environment. Particularly, temperature, but also maybe humidity and* CO_2 *concentration. That's an indicator of the indoor quality of life, and I think that the need for that is particularly acute where you have a very poor housing stock and real problems with damp and mould that result in health problems. So that's the long way of saying that* ***the data needed goes beyond digital logbooks and smart meters, although those are also very important.****"* (UK_IND#2).

Interviewees raised the issue of data protection, which hinders access to information. It limits the capacity of these tools and their purpose, questions the accuracy of data and whether these tools will be able to deliver innovative business models in the short term:

> ***"If you start talking about access to smart-meter data, you are very very quickly getting into a discussion about GDPR, confidentiality, all sorts of stuff around data privacy.*** *I am somebody that takes data confidentiality very seriously, but I do not know how on earth* ***we have ended up in a situation where we are rolling-out smart meters while we can't realise many of the use cases that they were originally intended for.*** *Let alone any new, innovative ones that we might come up with.* ***We have managed to just trap ourselves into a corner where we can't access the data.*** *That's the number one challenge and I don't know what to do about it.****"*** (UK_IND#2).

Finally, one energy policy expert expressed the following consideration:

> ***"****In the short term,* ***I don't think these tools will help, because it will take time before you have something reliable****. If you think about energy performance certificates, they have been initiated by the first EPBD back in 2002, but until 2010, and the revision of the EPBD, many countries had not even started their energy performance certificates*

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scheme. ***It takes years because you need to have enough assessors – and assessors that are good enough and honest enough."*** (FR_SCI)

6.2. Phase II: Online survey

The second round of the stakeholder consultation process included an EU-wide online survey to get feedback from a larger sample of experts and interested parties and gain data for statistical analysis. The initial survey template was structured based on the SWOT findings and the original interview questionnaire, while the final template was enriched with insights from the online interviews.

A final pool of 42 items was included in a random order, under four different sections, each one representing a SWOT factor, as presented in **Table 2**. For each item we collected two types of data:

a. the degree of agreement on each SWOT item, measured using a five-point Likert scale (1 = strongly disagree, 5 = strongly agree), and

b. the measure of the overall importance of a particular item for the future of the P4P schemes in the EU, measured again on a five-point Likert scale (1 = not important at all, 5 = extremely important). This second measure aimed at prioritising the most important factors affecting the roll-out of P4P schemes, and therefore providing greater insights into the dynamics of the relevant policies in the building sector.

Additional questions in the online survey included demographic information such as age, education, and position. We designed the questionnaire as an online survey to minimise costs and maximise the probability of peer-to-peer forwarding to increase the sample size. The questionnaire was implemented with the 'Alchemer[37]' tool and is included in **Appendix B**.

Our survey population was based on a non-probability sampling– meaning it was sent via various channels to potentially interested stakeholders. In total, the survey was distributed among national, European, and international organisations and representatives from politics, business/ industry and science. We used a diverse set of private and public distribution channels, including:

- Emailing established stakeholder contacts and SENSEI consortium networks.
- Emailing the SENSEI Community, a database of stakeholders interested in the project's news and results (the database has approximately 100 subscribers).

[37] https://www.alchemer.com/

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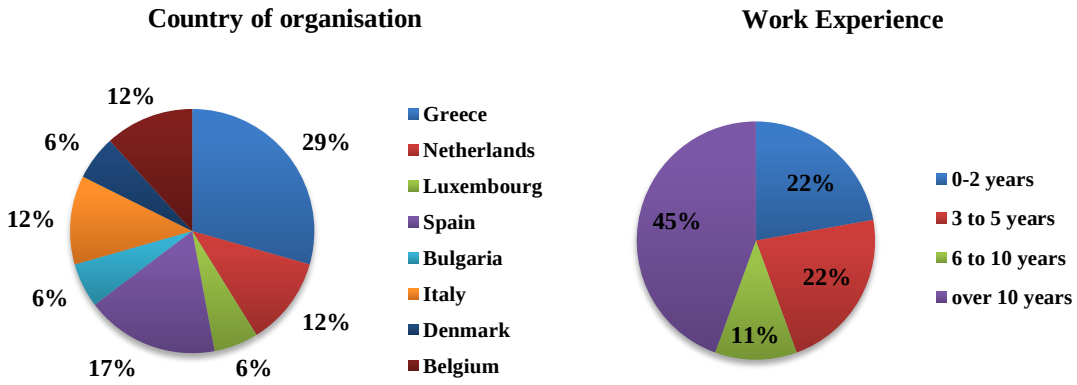
- Emailing SENSEI's sister projects. We requested partners further distribute the survey.
- Uploading on the BUILD UP website[38] – the European portal for energy efficiency in buildings, funded and managed by the Executive Agency for Small and Medium-sized Enterprises (EASME) on behalf of the European Commission. The portal has 16,249 members worldwide. The survey announcement on BUILD UP has so far been read over 320 times.
- Sharing through the project's/ partners' websites and social media (e.g., Twitter, LinkedIn, etc.).

6.2.1. Preliminary results

This section presents the preliminary results[39] from eighteen (18) responses provided in May 2021 when the survey came online. On the demographics of the respondents (**Figure 5**): survey participants can be characterised as energy efficiency experts interested in the European energy transition and financing energy efficiency projects. Stakeholders from eight (8) EU countries participated in the survey, most of them working for organisations in Greece (29%) and Spain (17%). Many participants have an extensive background in energy efficiency with 56% working in the field longer than six years. Fifty-five per cent of respondents are men.



[38] https://www.buildup.eu/en/explore/links/sensei-survey-pay-performance-p4p-schemes-energy-efficiency-measures

[39] Additional analysis is foreseen in the context of scientific publications of the SENSEI project.

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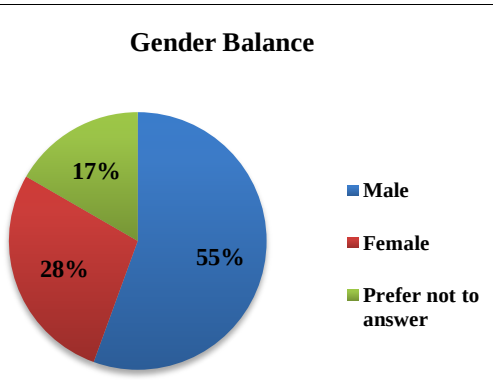

Figure 5. Demographics of the survey respondents: **a)** In which country is your organisation operating? **b)** How long have you worked in this field? **c)** What is your gender?

The initial focus of the survey questions was to determine the level of agreement with the SWOT segments. Therefore, respondents were asked to rate the degree to which they agreed that a statement represents a strength, a weakness, an opportunity, or a threat according to their perspectives. The distribution of the SWOT items for each category, ranked according to the degree of consensus, are presented in **Table 2**. The first column shows each segment's mean average. A score closer to five indicates a higher consensus, while the second column shows the segment's level of importance. To simplify the importance of the factors, we have a third column showing the rank of importance. In this, scores of 4.01 to 5 correspond to 1 (**high importance**), 3.01 to 4 correspond to 2 (**medium importance**) and those below 3 correspond to 3 (**low importance**).

Table 2. Evaluation of the SWOT items.

	Agreement Factor		Importance Factor		
	Mean	**SD**	**Mean**	**SD**	**RANK**
STRENGTHS					
Economic stimulus packages could be used for the development and implementation of energy efficiency innovative business models, such as P4P schemes, and stimulate jobs and economic opportunities across economic sectors (e.g., construction, industry, services, information technology, etc.).	4.00	0.91	4.00	0.77	2
Renovation of public buildings could serve as a role model increasing the renovation rate and the development of new business models like P4P schemes.	4.17	0.99	3.83	0.79	2
Supporting the development of energy market actors like energy service companies (ESCOs), aggregators, contractors, etc., is needed for the establishment of P4P schemes.	4.22	0.73	3.94	1.00	2
Allowing Obligated Parties of Energy Efficiency Obligation schemes (EEOs) to count towards their obligation certified energy savings achieved by third parties (e.g., aggregators, etc.) could strengthen the implementation of P4P schemes.	3.83	0.99	3.78	1.00	2
Establishing a standardised method for evaluating the performance of retrofit projects in terms of the energy savings achieved and the outcomes delivered, based on building-specific measured data, would facilitate the adoption of the P4P concept in energy efficiency schemes.	4.11	1.18	4.11	0.83	1
The requirement to link financial measures for energy efficiency to energy performance, by using standard values or by another transparent and proportionate method is an important step towards the	4.11	0.76	3.89	0.83	2

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implementation of P4P schemes.					
Expanding audits obligation can raise awareness about the energy efficiency potential and create a market for innovative business models like P4P schemes.	3.61	1.20	3.50	1.20	2
Improving the knowledge of the performance of the building stock is useful for targeting buildings under P4P schemes.	4.17	0.86	3.89	1.02	2
Requiring obligated utilities in Energy Efficiency Obligation schemes (EEOs) to deliver some of their targets using innovative approaches would have a positive impact on the adoption of P4P schemes.	3.83	0.92	3.61	1.14	2
The establishment of demanding energy performance requirements for new buildings and undergoing major renovations in buildings is important for the development of new services or products related to energy efficiency, such as P4P schemes.	4.39	0.61	4.28	0.67	1
Including energy efficiency in capacity mechanisms would make energy efficiency a resource comparable to generation resources and would be an important step towards performance-based energy efficiency, and, therefore, the deployment of P4P schemes.	4.00	0.91	3.89	1.08	2
WEAKNESSES					
Energy efficiency obligation on public buildings is limited to buildings owned and occupied by central governments, limiting the development of national best practices and the public sector to serve as a visible example for a wider public.	3.83	1.15	3.67	0.84	2
Energy audits are currently mandatory only for large enterprises, limiting their impact on the roll-out of innovative business models, like P4P schemes.	3.72	1.18	3.72	1.07	2
The use of “metered savings” methodologies is not favoured in the EU, negatively affecting the roll-out of P4P schemes.	3.94	1.06	3.83	1.20	2
The predominant delivery mechanism of energy savings through energy efficiency measures concerns mainly upfront fiscal/ financial incentives, leaving less space for P4P schemes.	3.83	0.99	3.67	1.14	2
Only in very mature markets, would it be possible for energy suppliers/ distributors to put in place innovative, profitable performance-based business models for energy efficiency.	3.06	1.21	3.44	1.04	2
Smart meters and digital information are vulnerable to cybersecurity issues that can jeopardise the security of energy supply and the privacy of consumers' data.	3.56	1.20	3.61	1.24	2
Lack of available information about operational performance and smart readiness of buildings is hindering building owners to benefit from demand-response, while ensuring that the goal of improved energy efficiency comes first (performance-based energy efficiency).	3.94	1.06	3.67	0.97	2
Companies are not obliged to follow audit recommendations, thus, their need for innovative financing schemes and business models, such as P4P, is restricted.	3.67	1.03	3.50	1.15	2
Expanding emissions’ trading to buildings could be used by Member States as a reason to reduce their dedicated efforts on energy efficiency, and to further neglect the creation of innovative financing schemes to decarbonise the building stock.	3.72	1.02	3.50	0.86	2
OPPORTUNITIES					
P4P schemes can reward multi-measure, behavioural, and/ or operational changes, allowing obligated parties to capture savings from complex projects and exploiting the multiple benefits of energy efficiency.	3.78	1.11	3.44	1.10	2
Revenues from emissions’ trading in buildings could contribute to funding innovative renovation schemes and business models.	3.94	0.87	3.50	1.15	2
P4P schemes and the presence of aggregators can enhance the Energy Performance Contracting (EPC) business model and target “hard-to-reach” sectors (e.g., residential sector, small and medium commercial buildings, etc.).	4.17	0.92	3.94	1.11	2
Smart meters are not mandatory for P4P schemes, nevertheless, their wide adoption could facilitate the roll-out of P4P schemes.	3.94	1,06	3,78	1.22	2
Encouraging or incentivising the “metered savings” methodology plays an important role in establishing performance-based schemes like P4P.	4.00	1.19	3.94	1.16	2
Revising Energy Performance Certificates and the Smart Readiness Indicator (SRI) could provide a	3.67	0.97	3.56	1.04	2

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more robust and reliable indication of the buildings' operational performance.					
Digital building logbooks (DBLs) boost the availability of information for a wide range of stakeholders and enhance the development of P4P schemes by providing easy information and minimising bureaucratic obstacles.	3.78	0.88	3.56	1.10	2
Introducing additional mandatory minimum energy performance standards for renovation increases the demand for renovation, and, therefore, the need for innovative financing mechanisms.	4.50	0.62	4.39	0.70	1
Recognising energy efficiency as a viable resource for energy supply and distribution systems, along with the right regulatory incentives, would put utilities in a strong position to fund energy efficiency.	4.33	0.97	4.17	0.99	1
Social housing systems rest within complex political and economic environments, and, although, there is huge potential for energy savings, innovative financing schemes, as P4P, are needed to address the retrofit investments' financial gap.	3.89	0.96	3.78	1.06	2
Energy communities are emerging around Europe, thus, P4P schemes could be implemented as community energy business models, placing citizens and communities at the heart of the future energy systems.	4.06	1.16	3.61	1.33	2
Just transition funding sources could be exploited to finance innovative business models that support the energy system.	3.83	1.15	3.72	1.07	2
THREATS					
P4P schemes may prove unsuccessful unless they are designed and developed according to the national and local energy market conditions to satisfy the needs of final customers and achieve the targeted energy savings.	4.17	0.99	4.22	0.81	1
Limited information and technical capacity to put in place innovative business models and financing schemes pose a problem for the deployment of P4P schemes.	3.94	1.06	3.89	0.96	2
Reluctance to put obligation on energy providers/ distributors has an obstructing role in implementing P4P schemes.	4.22	0.88	3.83	0.99	2
The lack of standard contracts and the lack of standards and processes for energy efficiency aggregators is a barrier hindering innovative business models in the EU.	4.00	1.08	3.89	1.02	2
Several risks related to digital books, such as high costs, legal concerns, uncertainty on the quality and reliability of data, etc., hinder the availability of data for use under P4P schemes.	2.94	1.21	2.83	1.10	3
Regularly, smart meters are not deployed to tackle issues like fuel poverty or to support energy efficiency, except for some countries with high risk of fuel poverty.	3.39	1.04	3.00	1.14	3
About one-third of the Member States will roll-out smart meters by 2030 or later, as recent cost-benefit analysis remains still negative.	3.17	1.10	3.50	1.10	2
Depending on the Member State, the regulatory framework may prevent the development of public/ private partnerships and threaten the implementation of an energy efficiency aggregation model.	3.83	0.86	3.67	0.97	2
The tight deadlines for the implementation of the obligations represent a challenge for the majority of the Member States forcing a "first in first served" solution.	3.83	0.71	3.50	1.10	2
Expanding emissions' trading to the building sector introduces more administrative complexity, causes delays in buildings' renovation, and, therefore, delays energy savings and reduction of GHG emissions.	3.61	1.04	3.33	1.03	2

Preliminary results of the analysis show these experts agree that there are two strengths they see as highly important for the future of P4P schemes in the EU. These are: adaptation of a standardised method for evaluating the performance of retrofit projects based on building-specific measured data, and demanding energy performance requirements for new and major renovations in buildings. Likewise, economic stimulus packages are seen as a critical factor to bring innovation, through programmes like P4P to stimulate jobs and economic opportunities across different economic sectors (e.g., construction, industry, services, information technology, etc.). In addition, participants

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agree on the importance of supporting the development of energy market actors like ESCOs, aggregators, contractors, etc., to ensure the successful implementation of P4P schemes in the EU.

The limited use of metered savings methodologies in the EU is considered one of the most significant market weaknesses, negatively affecting the roll-out of P4P schemes. Plus, the fact that energy audits are currently mandatory only for large enterprises, and that energy efficiency obligation on public buildings only concerns buildings owned and occupied by central governments, are considered factors preventing the development of innovative business models. Currently, the predominant delivery mechanism of energy savings through energy efficiency measures concerns mainly upfront fiscal/ financial incentives, while there is also a lack of available information about operational performance and smart readiness of buildings. These issues are also important weaknesses regarding the P4P schemes' implementation according to a consensus among the participants.

Survey participants are of the opinion that recognising energy efficiency as a viable resource for energy supply and distribution systems, along with the right regulatory incentives, would put utilities in a strong position to fund energy efficiency programmes. This would make energy efficiency 'the first fuel' in practice. Introducing additional mandatory minimum energy performance standards for renovation is seen as a key step for the roll-out of innovative business models like P4P schemes. Despite all the requirements currently in place, stricter standards will be needed to effectively promote decarbonisation efforts, and so increase the need for innovative financing schemes.

EPC projects have been successfully implemented in large commercial and MUSH-type buildings. Yet all participants unanimously agree that the financing model needs to be enhanced through energy efficiency aggregators and P4P schemes to target "harder-to-reach sectors" such as residential and SMEs. Another opportunity of high consensus and importance is incentive mechanisms. Encouraging and incentivising metered methodologies is considered essential for establishing P4P schemes by the survey participants.

Despite their importance, P4P schemes may prove unsuccessful unless they're designed and developed to fit the national and local energy market conditions and to satisfy the needs of final customers. The latter statement is perceived as the most important threat according to the survey representatives. Another issue reported as an important threat is the limited information and technical capacity when it comes to innovative business models and financing schemes. People hesitate to trust new business models and often go for traditional upfront incentives and subsidies. So, proper dissemination, training and consultation must take place to ensure high and successful participation in P4P schemes. The lack of standard contracts and standards and processes for energy efficiency aggregators are also defined as big setbacks hindering innovative business models in the

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EU. Finally, participants don't consider that risks related to digital logbooks pose a threat for P4P schemes. But they agree that the reluctance to put obligations on energy providers/ distributors has an obstructing role in implementing P4P schemes in the EU.

Our analysis shows that the factor with the highest importance is "strengths" (4.16), followed by "opportunities", "threats" and "weaknesses", as shown in **Figure 6**. It is apparent that respondents prioritised the strengths of the EU regulatory and market framework. They also emphasised the importance of using the opportunities for developing P4P schemes in the EU, while handling threats from the external environment and supplementing the weaknesses of the current policy framework.

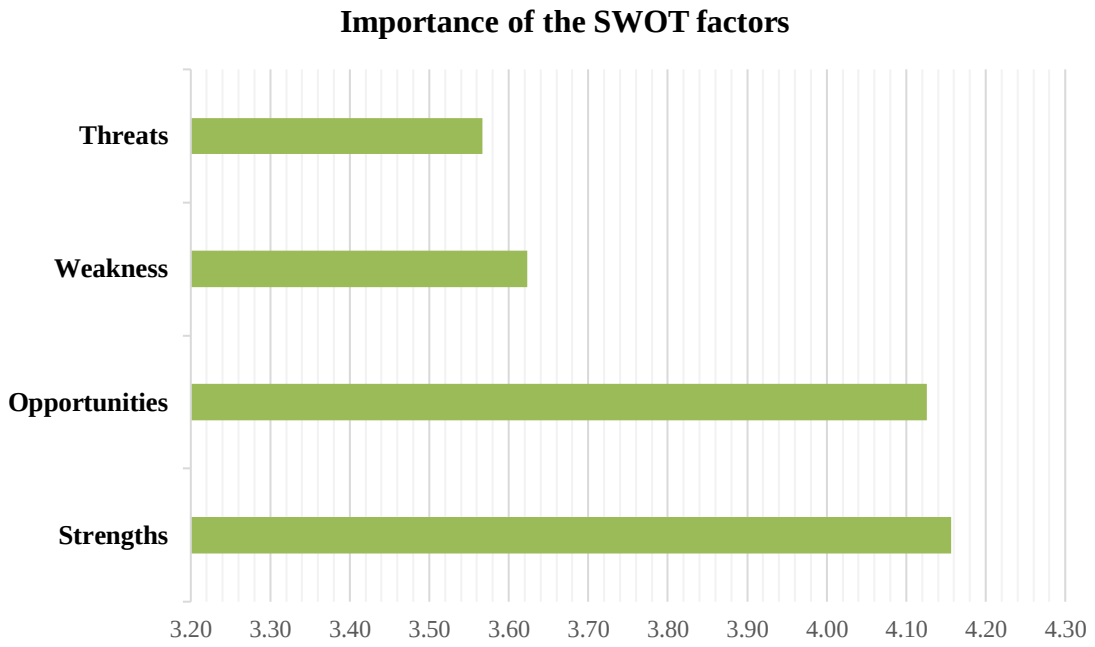

Figure 6. Importance of the SWOT factors based on preliminary findings of the online survey (Phase II: Online survey).

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7. Policy strategies for Pay-for-Performance business models in the European Union

Based on stakeholders' insights/ preferences and outcomes of our SWOT analysis, as presented in **Table 2** and **Figure 6**, we present ten (10) specific policy strategies for implementing P4P schemes in the EU:

7.1. Exploiting economic stimulus packages

Economic stimulus packages can facilitate the implementation of innovative business models that support actual/ metered performance, such as P4P schemes, and enhance the EPC business model through the presence of aggregators to target "hard to reach" sectors (e.g., residential sector, small and medium commercial buildings, etc.).

Energy efficiency actions (e.g., construction, energy renovations, etc.) can support the goals of economic stimulus programmes by supporting existing workforces. They can create new jobs, boost economic activity in key labour-intensive sectors and deliver longer-term benefits such as increased competitiveness, reduced GHG emissions, improved energy affordability and lower bills. These stimulus activities can build on pre-existing approaches and accelerate the achievement of existing policy targets or leverage new, more radical approaches. Article 7 and Article 18 of the EED could include provisions for using stimulus funds towards the development of energy efficiency programmes and in particular programmes that would depend on metered savings and bring innovation in the energy efficiency market.

7.2. Establishment of demanding energy performance requirements

Stricter energy performance requirements for new and existing buildings should be established to all segments of the building stock along with timebound compliance deadlines.

To reach new climate goals, minimum energy performance requirements would need to become stricter and apply beyond major renovations, introducing deadlines for buildings to comply with (Sunderland & Santini, 2021). Enforcing stricter energy-related requirements during the design or retrofit phase of buildings will not only bring substantial energy savings. It will also ensure more employment opportunities, increased energy security and opportunities for deploying innovative business models. Innovative business models that rely on actual savings, such as P4P schemes, could be broadly promoted.

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7.3. Strengthening the role of energy efficiency market players

The role of energy market actors like ESCOs, aggregators, contractors, etc., should be strengthened to ensure their participation in renovation processes and their inclusion in the residential sector.

Article 18 (energy services) of the EED has contributed to the development of the energy service market, but its provisions can be better implemented and enforced. A recent report from the Buildings Performance Institute of Europe (BPIE) highlights that EU countries that went beyond the minimum requirements of Article 18 have a more developed energy service market in place (Roscini & Glicker, 2020). In this effort, energy management solutions and innovative business models using metered savings methodologies are important. They maintain and increase energy performance over time and their promotion could ensure the further development of a successful energy service market.

7.4. Recognising and valuing energy efficiency as a resource

Utilities and DSOs should be required and incentivised to make use of energy efficiency as a viable resource providing services to the energy system. In addition, the metered savings methodology (EED, Annex V) should be incentivised or partially required as a step toward performance-based schemes.

Energy efficiency can deliver sustained reductions in energy use by improving baseline efficiency and targeted peak-demand reductions when considering demand-response and technologies such as air-conditioning units and heat pumps, which are often used during peak demand. With improved measurement, reporting and verification of the reduction of energy use, energy efficiency can become a valuable resource to utilities and grid operators.

7.5. Promoting metered methodologies to increase accuracy and transparency

Although monitoring, reporting and verification rules of energy savings improved during the last revision of Article 7, they should be further strengthened to increase transparency and accountability.

Article 7 of the EED is a key provision of the Directive, due to contribute to more than half of the total energy savings needed to achieve the EU's 2030 energy efficiency targets. Measures taken under Article 7 should have the intended consequence of improving energy efficiency and result in savings that would not have happened otherwise, avoiding 'free riders' and double counting. If encouraged and incentivised, the metered savings methodology could ensure the measurement of actual savings with increased accuracy and transparency.

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7.6. Increasing ambition on public buildings

Additional requirements should be placed on public buildings (e.g., expand renovation obligations beyond central government buildings to all public buildings, etc.). The increased need for renovation should be complemented with increased requirements for actual/ metered savings and the inclusion of energy efficiency service providers.

With the extension of the provisions under Article 5 of the EED to all public buildings, provisions for implementing an Energy Management System and making use of ESCOs and innovative business models will have to be developed. In this regard, there will be a link between Article 5, Article 8 and Article 18. The implementation of Article 5 also builds on the transposition and implementation of the EPBD. In accordance with Article 5, it has to be ensured that the agreed percentage of total floor area of heated and/ or cooled buildings owned and occupied by central government is renovated each year to meet at least the minimum energy performance requirements set by Article 4 of the EPBD. In this context, requiring measurement and verification of savings by using the metered savings methodology would also facilitate the development of DBLs, including comfort and real energy consumption indicators. This is in line with digital developments expected in the upcoming years as announced in the Renovation Wave.

7.7. Increasing ambition on Small and Medium Enterprises

Additional requirements should be placed on SMEs (e.g., mandatory audits and implementation of the recommendations, etc.) complemented with increased requirements for actual/ metered savings.

Article 8 should expand and include audit requirements for all enterprises including SMEs. Annex VI, which contains the minimum criteria for energy audits, should be revised and updated. However, carrying out energy audits does not deliver savings if the resulting recommendations are not implemented. To this end, Article 8 should mandate the implementation of energy efficiency measures resulting from the audit, starting with those that have a shorter payback time (for example, less than five years) as in this case the economic return is almost immediate. Energy management solutions, encompassing concrete energy efficiency actions, should be considered as fulfilling the audit obligation. In this regard, it should be included as part of the revision that Member States shall encourage the application of the metered savings methodology (where technically possible) while guidance should be issued to ensure consistency in the interpretation and application of the requirements.

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7.8. Ensuring stakeholders' involvement

Ensuring stakeholders' involvement in all the individual steps of the design process is necessary for the successful implementation of P4P schemes in the EU.

To increase transparency and stakeholders' involvement, co-creative regulatory processes should ensure that stakeholders are part of establishing the critical aspects of the regulatory design, such as setting performance targets and incentives. Utilities might understandably try to set achievable targets, whereas a regulatory body or other stakeholders may argue for targets that seem unachievable. Engaging in a collaborative process, with the overarching policy objectives guiding the discussion, is more likely to result in a set of targets and incentives that will promote success and achieve meaningful outcomes.

7.9. Establishing standards and promoting capacity building activities

Training and capacity building activities should be promoted to facilitate the adaptation and implementation of P4P schemes along with the establishment of standards, template contracts and procedures.

It is important to make P4P schemes attractive and not an administrative burden for energy service market actors. Limited information and technical capacity to put in place innovative business models and financing schemes poses a problem for deploying P4P schemes. The lack of standard contracts and standards and processes for energy efficiency aggregators could hinder their broad deployment in the EU. So, training and capacity building activities around the scheme should be offered to promote the model and facilitate its implementation. In addition, establishing standards, template contracts and procedures will ensure the successful development and roll-out of P4P schemes in the EU.

7.10. Raising awareness and empowering citizens

The concept of the energy efficiency aggregator should be promoted at national level and final users/ consumers need to be aware of P4P schemes' benefits and their potential.

Energy efficiency aggregation should be promoted, clearly defined and well-regulated at national level in Member States. In this context, contractual agreements, contracts and processes should be established in accordance with the national regulation of each country after consultation with all interested parties. National Energy and Climate Plans should include provisions for training programmes on innovative business models to raise awareness and engage citizens, empowering their role through innovative schemes and business models.

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8. Conclusions

The purpose of this report is to reflect on the possible ways that the existing regulatory framework and upcoming policy developments in energy efficiency in the EU building sector could **(i).** facilitate the roll-out **(ii).** affect the viability and **(iii).** identify opportunities/ risks for the commercial development of P4P schemes. To meet these objectives, we followed a participatory multi-method approach based on literature review, stakeholder engagement and a qualitative decision-making technique.

1. First we conducted extensive desk research on the most recent and relevant policies, regulations and directives that could be relevant for the implementation of P4P schemes and facilitate their integration into the existing EU regulation.

2. Based on insights from our review, we formulated potential policy pathways based on recent and upcoming developments. We then analysed them using a SWOT analysis method. Carrying out a SWOT analysis made it possible to identify the market and regulatory conditions that are best-suited to P4P schemes as well as the threats and barriers that could hinder their successful implementation.

3. We conducted bilateral online interviews with eleven (11) key stakeholders and experts from the fields of research, industry, and policymaking to reflect on, and refine, the insights of our SWOT analysis. We also designed an online survey to collect insights/ considerations from a larger sample of stakeholders across the EU. This added an extra layer of validation to our work, helped evaluate the accuracy of our findings, and made the results more policy-relevant and meaningful to decision-makers and other end-users.

4. Our two-phase consultation process concluded that developing innovative business models related to energy renovation measures, such as P4P schemes, is necessary for the future of the EU energy system. However, both interviewees and survey respondents agreed that market conditions and current national legislative frameworks across the EU are not as supportive or receptive as they could be toward performance-based energy efficiency schemes. In this context, our work allowed survey participants to reflect on policies, regulations and market actors that could be the most conducive to the implementation of P4P schemes in the EU. It also allowed them to prioritise factors that could have a positive impact, followed by factors that could pose a threat or hinder the further development of P4P schemes.

5. Finally, we devised ten (10) specific policy strategies on how the roll-out of P4P business models could be facilitated and adapted to unfavourable developments in the EU. We acknowledged opportunities, while suggesting measures to mitigate potential implementation risks.

Overall, the unique contribution of our study is that we formulated a comprehensive approach, which combines a SWOT analysis and domain knowledge embedded with

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stakeholders to delve into how P4P schemes could be integrated into the existing EU regulations. Our outcomes aim to inspire further research in this area. We also hope it will serve as a reference point for policy developments and adjustments that will facilitate the design of performance-based energy efficiency financing schemes and the energy efficiency aggregator model, plus the exploitation of energy efficiency as a resource to the grid.

By exploiting the opportunities and adaptation strategies identified in this report, our work will be used to further inform SENSEI engagement activities of third-party investors in P4P schemes under WP6. It will also serve as regulatory guidelines to further explore potential synergies with smart building technologies and aspects that may be looked on with suspicion by building owners and consumers under WP8.

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Appendix A

General Questions	
Trigger points	**Questions**
P4P schemes in the USA are often set in the context of energy efficiency obligations and in many cases, policymakers or regulators have specifically asked utilities or entities in charge of delivering energy savings to create innovative schemes to boost innovation, green job creation and market transformation.	**1.a.** Could P4P schemes play an important role in attaining the energy savings target of EU Member States? If yes, how? If no, why? **1.b.** What would be the benefits for EU Member States and the EU energy market?
	2.a. Do you think that the current regulatory framework and market conditions in the EU allow for the development of P4P schemes? If yes, why? If not, why? **2.b.** How could the regulatory framework change to facilitate the roll-out of P4P schemes?
The Renovation Wave suggests that EU Member States utilise market incentives such as pay-per-performance public support schemes to scale up investments.	**3.a.** How do you imagine such schemes being implemented in the EU? **3.b.** Who could be the administrator? **3.c.** How could such schemes be funded? **3.d.** What could the first pilot programmes look like? (e.g., structure of the programme, the incentive rate, the contractual agreements, etc.)
Target Sector	
Trigger points	**Questions**
The EC will examine the need to extend renovation requirements in buildings at all the public administration levels (also including EC's buildings), and to increase the annual renovation rate.	**4.** Do you believe that public buildings could serve as a role model for new business models, including P4P programmes? If yes, why? If not, why?
Audits requirements may be extended to larger and more complex non-residential buildings such as hospitals, schools or offices according to the EC's proposal. For example, P4P schemes have been extensively implemented in the MUSH (Municipal, University, Schools, Hospitals) sector in North America.	**5.** Taking into consideration that the proposed audit requirements may lead to increased needs in the MUSH sector, could this sector initiate the roll-out of P4P schemes in the EU? If yes, why? If not, why?

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There is a high need to decarbonise the residential sector, so stricter mandatory minimum performance standards (in the context of EPBD) will be proposed by the EC by the end of 2021 (Renovation Wave). Also, energy performance contracting (EPC) has been successfully implemented in large buildings but has not been able to serve SMEs and the residential sector broadly so far. As a result, there is a high need for new business models to leverage private investments.	**6.a.** Should P4P pilots focus on the "EPC aggregation model" targeting harder-to-reach buildings, such as SMEs and the residential sector? If yes, why? If not, why? **6.b.** Ultimately, which sector is the most appropriate for P4P pilots to target at the beginning?
Energy Services	
Trigger points	**Questions**
The structure and characteristics of P4P schemes implemented in North America differentiate depending on the area, the administration, final users etc to fit in market conditions.	**7.a.** Could energy market actors (e.g., aggregators, ESCOs, etc.) facilitate the implementation of the first EU P4P pilots, and if so, how? **7.b.** How could P4P schemes promote/ enhance the energy service market in the EU?
	8.a. To what extent could the level of information accessible to end-users/ consumers, and the level of their engagement, play a role in the successful roll-out of P4P schemes in the EU? **8.b.** Why should end-users/ consumers decide to participate in a P4P scheme instead of a traditional energy efficiency programme?
Market Uptakes	
Trigger points	**Questions**
Digital Building Logbooks that will integrate all the building-related data provided by the upcoming Building Renovation Passports, Smart Readiness Indicators, and Energy Performance certificates, to ensure compatibility and integration of data along the renovation process.	9. Could digitalisation and availability of such data facilitate the development of performance-based schemes in EU?
Considering that Member States will proceed with the roll-out of smart meters according to their updated targets, we expect an overall penetration rate of 77% by 2024 and 92% by 2030 at EU level.	**10. Could the roll-out of smart meters (and more generally, of advanced metering infrastructure) influence the adoption of P4P schemes for the implementation of energy efficiency measures? If so, how?**
The OpenEEmeter software developed by RECURVE in USA calculates changes in energy consumption for building energy efficiency projects and portfolios by implementing the CalTRACK methods in a consistent and replicable way. CalTRACK is a set of empirically tested methods to standardise the way normalised meter-based changes in energy consumption are measured and reported and can be	11.a. Could the development of such tools facilitate the development of P4P schemes in the EU? 11.b. Should we foster more innovative tools and methods to facilitate Measurement and Verification (M&V)? 11.c. Is the lack of such tools a reason why energy efficiency is not currently treated as an energy resource?

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Other policy/ Regulatory issues	
Trigger points	**Questions**
Any other aspects that we might have omitted?	
Pay-for-performance is also enabled through the procurement of energy efficiency as a grid resource. Rather than a contract between an energy services company (ESCO) and an end-user/ consumer, pay-for-performance in the form of demand capacity is a relationship between load-serving entities (e.g., utilities, etc.) and various market actors capable of aggregating pools of projects that reduce grid demands and abate carbon.	**12.** How could this approach be supported in the EU, enabling a transition from current programmes that pay in advance based on predicted savings with highly regulated delivery systems, to a market where load-serving entities can procure energy efficiency as a distributed resource, allowing business models to compete?

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Appendix B

1. **Which specialisation/ sector best suits you?**
   - Energy policy expert.
   - Energy efficiency expert.
   - P4P schemes expert.
   - Energy efficiency programmes manager.
   - Energy Service Company (ESCO).
   - Utilities/ Distribution System Operator (DSO).
   - Government (please specify the level EU, national, regional, local).
   - Academic/ Research Institution.
   - Consultancy.
   - Other (please specify).

2. **What is the name of your organisation?**

3. **In which country is your organisation based?**

4. **What is your role in the organisation?**

5. **What is your working experience?**
   a. Less than 2 years;
   b. 3 to 5 years;
   c. 6 to 10 years;
   d. More than 10 years.

6. **Which option describes your gender identity?**
   a. Male;
   b. Female;
   c. Other;
   d. Prefer not to answer.

7. **Have you ever heard of P4P schemes?**
   - Yes, I have utilised or been involved in P4P schemes;
   - Yes, I am familiar with the concept;
   - I have heard of the schemes, but I do not know them very well;
   - No, it is the first time I have heard of them;
   - Other.

8. **Do you believe that developing innovative business models related to energy renovation measures, such as P4P schemes, is necessary for the future of the EU energy system?**
   - Yes;
   - No;
   - I do not know.

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9. **Please rate the degree to which you agree or disagree with the following statement: "*Market conditions and national legislative frameworks in the EU are not as supportive or effective as they could be towards performance-based energy efficiency*".**
   (1) Strongly disagree;
   (2) Disagree;
   (3) Neither agree nor disagree;
   (4) Agree;
   (5) Strongly agree.

The following questions focus on the ways that policy and regulatory developments in the EU may become a risk or an opportunity for Pay-for-Performance (P4P) schemes. The developments under consideration are related to the possible ways that the implementation of the Renovation Wave and of the proposed EU 2030 climate and energy framework can affect the viability of P4P schemes.

Prior to this questionnaire, we conducted a comprehensive analysis of the current regulatory and market framework in the EU and the possible policy developments, and we performed a Strengths-Weaknesses-Opportunities-Threats (SWOT) analysis to categorise the different factors identified. Using this approach, we came up with specific statements representing external (opportunities and threats) and internal (strengths and weaknesses) factors relevant to P4P schemes and EU energy policy developments.

You are kindly asked to rate the degree of consensus on these statements (i.e., the degree to which you agree a statement represents a strength, a weakness, an opportunity or a threat according to your perspective), using a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree), and the degree of overall importance of a particular item for the future of the P4P schemes in EU, similarly measured on a 5-point Likert scale (1 = not important at all, 5 = extremely important). This second measure aims at prioritising the most important factors affecting the roll-out of P4P schemes in the EU, and therefore, providing greater insight into the policy strategies that should be developed.

In this section, we would like **(i)** to know the degree to which the following statements seem to you as potential strengths of P4P schemes, and **(ii)** to identify the most important factors that could affect the roll-out of P4P schemes in the EU.

Strengths

1. Economic stimulus packages could be used for the development and implementation of energy efficiency innovative business models, such as P4P schemes, and stimulate jobs and economic opportunities across economic sectors (e.g., construction, industry, services, information technology, etc.).
2. Renovation of public buildings could serve as a role model increasing the renovation rate and the development of new business models like P4P schemes.
3. Supporting the development of energy market actors like ESCOs, aggregators, contractors, etc., is needed for the establishment of P4P schemes.

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4. Allowing Obligated Parties of Energy Efficiency Obligation Schemes (EEOS) to count towards their obligation certified energy savings achieved by third parties (e.g., aggregators, etc.) could strengthen the implementation of P4P schemes. Establishing a standardised method for evaluating the performance of retrofit projects in terms of the energy savings achieved and the outcomes delivered, based on building-specific measured data, would facilitate the adoption of the P4P concept in energy efficiency schemes.
5. The requirement to link financial measures for energy efficiency to energy performance, by using standard values or by another transparent and proportionate method is an important step towards the implementation of P4P schemes.
6. Expanding audits obligation can raise awareness about the energy efficiency potential and create a market for innovative business models like P4P schemes.
7. Improving the knowledge of the performance of the building stock is useful for targeting buildings under P4P schemes.
8. Requiring obligated utilities in Energy Efficiency Obligation Schemes (EEOS) to deliver some of their targets using innovative approaches would have a positive impact on the adoption of P4P schemes.
9. The establishment of demanding energy performance requirements for new buildings and undergoing major renovations in buildings is important for the development of new services or products related to energy efficiency, such as P4P schemes.
10. Including energy efficiency in capacity mechanisms would make energy efficiency a resource comparable to generation resources and would be an important step towards performance-based energy efficiency, and, therefore, the deployment of P4P schemes.

In this section, we would like **(i)** to know the degree to which the following statements seem to you as weaknesses for P4P schemes, and **(ii)** to identify the most important factors that could affect the roll-out of P4P schemes in the EU.

Weaknesses

1. Energy efficiency obligation on public buildings is limited to buildings owned and occupied by central governments, limiting the development of national best practices and the public sector to serve as a visible example for a wider public.
2. Energy audits are currently mandatory only for large enterprises, limiting their impact on the roll-out of innovative business models, like P4P schemes.
3. The use of "metered savings" methodologies is not favoured in the EU, negatively affecting the roll-out of P4P schemes.
4. The predominant delivery mechanism of energy savings through energy efficiency measures concerns mainly upfront fiscal/ financial incentives, leaving less space for P4P schemes.
5. Only in very mature markets, would it be possible for energy suppliers/ distributors to put in place innovative, profitable performance-based business models for energy efficiency.
6. Smart meters and digital information are vulnerable to cybersecurity issues that can jeopardise the security of energy supply and the privacy of consumers' data.
7. Lack of available information about operational performance and smart readiness of buildings is hindering building owners to benefit from demand-response, while ensuring that the goal of improved energy efficiency comes first (performance-based energy efficiency).
8. Companies are not obliged to follow audit recommendations, thus, their need for innovative financing schemes and business models, such as P4P, is restricted.

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9. Expanding emissions' trading to buildings could be used by Member States as a reason to reduce their dedicated efforts on energy efficiency, and to further neglect the creation of innovative financing schemes to decarbonise the building stock.

In this section, we would like **(i)** to know the degree to which the following statements seem to you as opportunities for P4P schemes **(ii)** to identify the most important factors affecting the adoption of P4P schemes in the EU.

Opportunities

1. P4P schemes can reward multi-measure, behavioural, and/ or operational changes, allowing obligated parties to capture savings from complex projects and exploiting the multiple benefits of energy efficiency.
2. Revenues from emissions' trading in buildings could contribute to fund innovative renovation schemes and business models.
3. P4P schemes and the presence of aggregators can enhance the Energy Performance Contracting (EPC) business model and target "hard-to-reach" sectors (e.g., residential sector, small and medium commercial buildings, etc.).
4. Smart meters are not mandatory for P4P schemes, nevertheless, their wide adoption could facilitate the roll-out of P4P schemes.
5. Encouraging or incentivising the "metered savings" methodology plays an important role in establishing performance-based schemes like P4P.
6. Revising Energy Performance Certificates (EPCs) and the Smart Readiness Indicator (SRI) could provide a more robust and reliable indication of the buildings' operational performance.
7. Digital building logbooks boost the availability of information for a wide range of stakeholders and enhance the development of P4P schemes by providing easy information and minimising bureaucratic obstacles.
8. Introducing additional mandatory minimum energy performance standards for renovation increases the demand for renovation, and, therefore, the need for innovative financing mechanisms.
9. Recognising energy efficiency as a viable resource for energy supply and distribution systems, along with the right regulatory incentives, would put utilities in a strong position to fund energy efficiency.
10. Social housing systems rest within complex political and economic environments, and, although, there is huge potential for energy savings, innovative financing schemes, as P4P, are needed to address the retrofit investments' financial gap.
11. Energy communities are emerging around Europe, thus, P4P schemes could be implemented as community energy business models, placing citizens and communities at the heart of the future energy systems.
12. Just transition funding sources could be exploited to finance innovative business models that support the energy system.

In this section, we would like **(i)** to know the degree to which the following statements seem to you as threats for P4P schemes, and **(ii)** to identify the most important factors that could affect the roll-out of P4P schemes in the EU.

Threats

1. P4P schemes may prove unsuccessful unless they are designed and developed according to the national and local energy market conditions to satisfy the needs of final customers and achieve the targeted energy savings.

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2. Limited information and technical capacity to put in place innovative business models and financing schemes pose a problem for the deployment of P4P schemes.
3. Reluctance to put obligation on energy providers/ distributors has an obstructing role in implementing P4P schemes.
4. The lack of standard contracts and the lack of standards and processes for energy efficiency aggregators is a barrier hindering innovative business models in the EU.
5. Several risks related to digital books, such as high costs, legal concerns, uncertainty on the quality and reliability of data, etc., hinders the availability of data for use under P4P schemes.
6. Regularly, smart meters are not deployed to tackle issues like fuel poverty or to support energy efficiency, except for some countries with high risk of fuel poverty.
7. About one-third of the Member States will roll-out smart meters by 2030 or later, as recent cost-benefit analysis still remains negative.
8. Depending on the Member State, the regulatory framework may prevent the development of public/ private partnerships and threaten the implementation of an energy efficiency aggregation model.
9. The tight deadlines for the implementation of the obligations represent a challenge for the majority of the Member States forcing "first in- first served" solutions.
10. Expanding emissions' trading to the building sector introduces more administrative complexity, causes delays in buildings' renovation, and, therefore, delay energy savings and reduction of GHG emissions.

Other

Would you like to add further aspects to the survey, that we didn't mention?

We would like to inform you about our results once we complete analysing the survey data. If you agree to hearing from us again, please enter your contact email address below.

Your personal data will not be linked to the questionnaire.

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