GUIDELINES FOR THE DESIGN OF A P4P PROGRAMME

promoting energy efficiency as a resource, benefiting both building owners and the power system

Deliverable 5.2

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

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1 Executive summary

This report aims at **formulating guidelines for designing a pay-for-performance (P4P) programme** that steers towards **energy efficiency measures in buildings benefiting both building owners and the power system**.

The guidelines are expected to facilitate the design of a conceptual P4P programme[1] which may ultimately be piloted in one or more EU Member States.

The methodological process to establish guidelines consisted of three steps:

1. Desktop research, consisting of theoretical reflections as well as assessment of examples of utility P4P programmes in the US.
2. Capturing expertise within the SENSEI consortium by means of virtual negotiations (‘negotiation games’).
3. Validating the acquired insights through consultations with external stakeholders.

The research resulted in a recommended **design process** which is described below. The process is visualized in Figure 1.

[1] This conceptual scheme is sometimes referred within the SENSEI project as the ‘SENSEI model’.

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Figure 1 – Design process of a P4P programme (Source: Factor4)

The design process starts by mapping the **scope** of a potential P4P programme in each Member State (or region) by selecting one or more objectives:

- Climate goals: decarbonizing society, and in particular the built environment
- Building performance upgrades: comfort, energy consumption
- Power system efficiency: avoided investments in production and distribution capacity (energy efficiency (EE) as a resource)
- Socioeconomic goals: boosting the (green) economy, creating jobs, mitigating (energy) poverty, etc.

This scoping exercise raises the question of how a potential P4P programme should be positioned in terms of its effect on electrical loads:[2] permanent load reduction, and/or

[2] In the SENSEI project we have focused on one energy vector in the built environment, electricity. This assumption is of course not entirely correct, as much fossil fuel (mainly gas) is still used for space heating in buildings. However, a clear tendency towards electrification of space heating (i.e. heat pumps) is ongoing, and electrified heating technologies are expected to become mainstream (often in combination with district heating based on renewable energy sources).

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load shifting (passive/implicit or active/responsive). Figure 2 visualizes a range of positioning options, depending on whether the balance strikes towards structural energy efficiency in buildings (Option A)[3] or supporting the power system (Option C).

Figure 2 - Various options to position a P4P programme (Source: HEBES)

Although all options are deemed worthwhile investigating, we have focused in this report on Option A, the scope of which is closest to the objectives of the SENSEI project, i.e. concentrating in the first place on energy retrofits in buildings, which may have collateral benefits for the grid, and not the other way around (which would be Option C).

Energy communities (Option B) could be a powerful **bottom-up** player/aggregator in a P4P system as well. However, as the transposition of the corresponding EU directives is still ongoing at the time of conducting our research, we have not explored this option in this report.

Option C implies the procurement of EE as an energy and/or grid resource by the power system operators. To a large extent, this would imply a level playing field between procuring energy which is produced and energy which is saved. The energy

[3] We would like to stress here that, in the SENSEI project, as per the Grant Agreement, we have initially tried to stick to energy efficiency in the strict sense of permanent load reduction (cf. definition in §2.3) and not covered renewable energy generation nor energy storage or demand-side response. Of course, technical upgrades in the built environment do not separate these theoretical categories. These upgrades are likely to consist of a mix of technical measures which result in both load reduction and load shifting, and hence in a modified load which represents 'flexibility as a resource' rather than 'EE as a resource'. Another report produced in the context of the SENSEI project focuses on the interplay between P4P and demand response.

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market is currently not adequately regulated to enable option C. At the same time, the aggregation of EE has not yet reached sufficient maturity to propose this as a trustworthy alternative to power production.

P4P programmes consist by definition of an aggregation of many individual EE projects. This means their existence largely depends on a high-level policy initiative that conceives and sparks off the programme and creates legal conditions for running it. The initial challenge, then, is to **identify an appropriate P4P programme initiator (owner).** Experience from the US shows that P4P programmes have their roots in policymaking entities (RAP, 2020). In the EU, parties that are responsible for setting up the regulatory framework that could allow the creation of P4P programmes, under which system operators carry out their activities, could be national climate and energy ministries, national energy regulators, or even the European Commission's Directorates-General dealing with climate and energy directives and regulations.

Once a P4P programme is initiated, a **P4P programme facilitator (developer)** should be identified[4] and take over the ***market* facilitation and the development of the programme**. The P4P programme facilitator is appointed by the programme initiator to practically develop the programme. The main task of a P4P programme facilitator is to stack a relevant selection of benefits into one coherent package, and as such develop a business model for the ultimate EE aggregator.

The next step is for the P4P programme facilitator to organize a tender to **identify EE aggregators**. The latter will establish and oversee portfolios of buildings where energy service companies (ESCOs) implement measures.

The structure of the resulting P4P programme, as well as the terminology of its stakeholders, is summarized in Figure 3.

[4] In certain cases the role of the initiator/owner and facilitator/developer may coincide.

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Figure 3 - Structure of a P4P programme (Source: Factor4)

When trying to wrap up all information which we have analysed at this stage of the project, we were able to visualize a potential P4P programme in the EU about 'measured and aggregated energy efficiency in buildings' by means of a schematic picture which is presented in Figure 4. Of course, this picture is a basic summary which may be further finetuned in more detailed infographics with click-and-reveal features in other parts of the SENSEI project. Notably, the **business model of the EE aggregator** will be further elaborated in Deliverable D6.5. Regarding **financing** component of P4P programmes, we would like to refer to another report being produced in the SENSEI project (Deliverable D6.3).

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Figure 4 – Schematic picture of the proposed P4P programme focussing on EE in buildings (‘SENSEI model’)

Figure 5 – Sneak peek of derived infographics which may be used for dissemination purposes.

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2 P4P programmes: setting the scene

2.1 Vision of the SENSEI project

The SENSEI project envisions rewarding energy efficiency (EE) in buildings as an energy resource and/or grid service. This could be implemented by **upscaling building energy efficiency from individual EE projects to a programme level**, using the pay-for-performance (P4P) concept as a vehicle for aggregation. **Aggregation** is *expected* to enable and facilitate **collateral advantages** such as:

- generating income from providing benefits to the power system, which will improve the business case of energy retrofits in buildings
- attracting capital from investors and/or public subsidy providers to invest in energy efficiency measures.

The SENSEI project also investigates which **supporting services** are needed to run such programmes, e.g. (dynamic) measurement and verification (M&V), data validation, data sharing, etc. This is crucial when implementing EE programmes based on measured savings rather than deemed savings. Indeed, in the 'second generation' of P4P programmes only energy savings that can be measured against a business-as-usual baseline are rewarded: metered energy data is linked to payments. This performance characteristic provides investors and decision-makers with greater certainty that efficiency measures will actually improve building performance. In other words, the performance risk of those parties investing in EE will be reduced.

2.2 The P4P concept in general

P4P programmes compensate energy efficiency resources based on a comparison of metered energy consumption and modelled counterfactual energy consumption, i.e., the energy that would have been consumed in the absence of the energy efficiency action (RAP, 2020). The difference with a traditional EE programme is presented in Figure 6.

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Figure 6 – Comparison of P4P programmes vs. traditional subsidy schemes (Source: RAP, IEECP, 2020)

P4P programmes are structured around two categories of flows: **financial flows (payment)** and **data flows (performance).** The typical payment flows in a P4P programme are described in Table 1.

Table 1 : Payment flows in a P4P programme

Who pays?	A public authority, a utility or another entity is in charge of channelling the payments to the EE aggregator(s) who is (are) tasked with delivering the performance.
Who receives?	End users (e.g. building owners, or ESCOs acting on behalf of building owners) are the final beneficiaries of the programme. EE aggregators act as intermediaries between end users and the entity delivering the payment.
What is paid for?	The eligibility of projects depends on the objectives of the P4P programme (load reduction, load shifting, etc.).
How much is paid?	Payments depend on the amount of energy saved, as well as on any other value the amended energy use pattern may have.

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The management of the **data flows** consists of two main steps, which are explained in Table 2.

Table 2 : Data flows in a P4P programme

Collection of data	P4P programmes need a reliable set of meter readings. This does not necessarily imply that smart meters are needed, but P4P programmes often use advanced energy metering technologies.
Analysis of data	Setting the baseline is a crucial part of the data analysis. This exercise is based on historical data and uses M&V protocols and data analytics to adjust this data set to parameters such as weather, building use, etc.

An important third factor is the flow – or rather allocation – of risk: e.g. performance risk, financial risk. This is being dealt with elsewhere in the SENSEI project (Deliverable D6.3).

2.3 Defining energy efficiency in the context of the SENSEI project

Before diving deeper into the design of a P4P programme, it is important to have a clear understanding about the concept of EE at large, and EE in the context of the SENSEI project.

2.3.1 Load reduction vs. load shifting

According to the Energy Efficiency Directive[5] 'energy efficiency' is defined as 'the ratio of output of performance, service, goods or energy, to input of energy'. The energy input can be measured before its transformation (primary energy), or after its consumption (final energy). An EE improvement represents an increase in this ratio.

In the SENSEI project we have focused on one energy vector in the built environment, electricity. This assumption is of course not entirely correct, as much fossil fuel (mainly gas) is still used for space heating in buildings. However, a clear tendency towards electrification of space heating (i.e. heat pumps) is ongoing. SENSEI anticipates a

[5] Directive 2012/27/EU of the European Parliament and of the Council of 25, article 2, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32012L0027&from=EN

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situation where electrified heating technologies will become mainstream for space heating (often in combination with district heating based on renewable energy sources).

EE measures generate improvements in *final* EE and tend to **structurally reduce load** by diminishing the amount of energy needed to deliver a given service level, for example through more efficient building fabric, lighting and appliances.

Improvements in *primary* EE can be caused by improvements in final EE *and* through the more efficient transformation of primary energy into final energy. Load shifting, for example through demand-side response and energy storage technologies,[6] can improve primary EE by reducing the need to deploy less efficient and more carbon-intensive generation technologies at times of high demand. Onsite renewable generation, storage and demand-side response are not the primary focus of the SENSEI project (RAP, 2020).

The SENSEI project focuses on EE measures that impact the final EE. These actions are often referred to as **end-use energy efficiency measures, or simply "energy efficiency**" for short (RAP, 2020), and aim to ***permanently*** **reduce power consumption.** This is a major difference compared to demand response, where power consumption is *temporarily* reduced (load shedding) or shifted (load shifting) in response to a signal from the utility (explicit demand response) or to a price signal (implicit demand response).

This said, **where permanent power consumption reductions (EE) are realized at peak consumption times** (e.g. by means of technologies that enable pre-cooling or pre-heating based on thermal buffering or inertia), their value for the power system is likely to increase, as flattening the demand curve can directly contribute to improved system and grid reliability. As such, EE in buildings may become part of a larger set of '**behind-the-meter solutions'** (RECURVE, 2019) (demand-side management) which contribute to **demand flexibility**. This demand flexibility has a financial value which may be exploited through market-based mechanisms. Aggregators are likely to play an important role by bundling individual contributions to reduce and/or shift load, offering a sizeable and reliable proposal to the power system operators.

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[6] For example: electric batteries; thermal heat buffers; HVAC flexibility measures (pre-cooling, ice-storage) to meet peak cooling in large commercial buildings.

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2.3.2 Grid-interactive efficient buildings

At a practical level, technical upgrades in the built environment resulting in grid-interactive efficient buildings ('smart' buildings) do not make a distinction between these theoretical categories. These upgrades are likely to consist of a mix of technical measures which result in both load reduction *and* load shifting, hence in a modifiable load which enables 'demand flexibility as a resource' rather than 'EE as a resource'. This is discussed in another SENSEI project report[7] on the interplay between a P4P programme (to foster EE) and demand response (D4.4).

Interestingly, with respect to **combining both efficiency and flexibility** measures in non-residential buildings, recent research conducted in the US by JOULE (2021) suggests that packaging efficiency and flexibility measures yields the largest reductions in net peak electricity demand. Annual electricity savings are comparable to an efficiency-only case. Such packages may be simpler and more cost effective for utilities to market and can increase the value proposition of building efficiency and flexibility from a consumer perspective. On the other hand, the research finds that packaging efficiency with flexibility limits the potential to shift demand into hours of low net system load, when increased electricity demand from buildings could improve the utilization of renewable energy supply.

[7] Deliverable 5.4.

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Figure 7 - Combining energy efficiency and demand flexibility in buildings (Source: JOULE, 2020)

3 Design options based on value stacking

3.1 Value stacking: the principle

In the US, EE programmes have been implemented for some time, and there is a substantial amount of information available. Initially the programmes were based on *deemed* savings; the more recent programmes are developed around *measured* savings ('true' P4P). These programmes combine various benefits ('stacked benefits'). Given the diverse realm of EE programmes in the US, various tests have been developed to assess them, e.g. PAC, SCT, TRC, RIM.[8] These tests evaluate all benefits against their costs.

The stacked benefits are sometimes visualized as a layer cake (Figure 8), where the benefits of (electric) energy efficiency are identified and categorized around three beneficiaries: the utility system, the programme participants, and society as a whole.

[8] https://www.aceee.org/files/pdf/conferences/mt/2009/E2_Price.pdf

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Figure 8: "Layer cake" visualization of various benefits from electric energy efficiency (Source: RAP)[9]

In Europe, Universal Smart Energy Framework (USEF) focuses on flexibility rather than EE. It plays an important role in promoting a smart energy system benefiting multiple stakeholders, from energy companies to consumers. USEF also refers to the principle of 'value stacking' in a white paper about the flexibility value chain.[10]

[9] https://www.raponline.org/knowledge-center/recognizing-the-full-value-of-energy-efficiency

[10] https://www.usef.energy/app/uploads/2018/10/USEF-White-Paper-Value-Stacking-Version1.0_Oct18.pdf

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Figure 9: Flexibility value stacking (Source: USEF White Paper)

Transposing USEF's way of visualizing the flexibility value chain to the concept of a P4P programme that focuses on EE would result in a graph like the one in Figure 10. The P4P programme facilitator is the spider in the centre of the web, selecting, negotiating and packaging the ancillary values of EE, both for the power system (distribution system operator (DSO), transmission system operator (TSO), etc.) and for society as a whole (decarbonizing the power system, combating energy poverty, etc).

Figure 10 - SENSEI P4P programme in USEF iconography (Source: Factor4, inspired by USEF)

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In the SENSEI project, we assume that (part of) the benefits (avoided costs) for the power system resulting from load reduction (as well as load shifting, flexibility etc.) come *on top of* the EE benefits that have already been identified by an ESCO implementing an EE project (whether or not this involved energy performance contracting). This is sometimes referred to as an '**enhanced energy performance contracting approach'**. While the model SENSEI P4P programme is likely to have a stacked nature, the challenge consists in stacking or combining these values without incurring prohibitive transaction costs (RAP, 2020).

3.2 Theoretical design options for P4P programmes

When establishing a P4P programme from scratch, in principle many design options exist. To date, P4P programmes targeting buildings have mostly been run by **utilities** that are subject to energy efficiency resource standards (commonly known as **energy efficiency obligation schemes** in the EU), but more applications could be imagined. Theoretically, P4P programmes could also be applied to valorize EE as a *grid* resource ('**non-wires alternatives**') or as an *energy* resource (**capacity mechanisms**).

Table 3 lists various options that may be within the scope of a P4P programme, grouped by theme:

1. Options related exclusively to EE in buildings
2. Options related to the **interaction between EE and the power system**
3. Other options, not necessarily related to EE in buildings nor to the power system, e.g. mitigating energy poverty.

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Table 3: Potential elements (options) of a P4P programme that steers towards EE measures in buildings that are beneficial for both the built environment and the power system (Source: Factor4)

	Theoretical design options	Should this be covered in an EU P4P programme?
1	**Energy efficiency specifications**	
a	Based on the principle of (improving the) **cost-effectiveness** of EE investments	Yes, this should be the underlying principle of implementing EE.[11] Rather than subsidizing EE, the bottom line should be to boost the net present value of the business case of making the built environment more sustainable.
b	Meeting energy savings **targets** through **dedicated EE market mechanisms**, such as • **EEO schemes** (cf. article 7 of the EE Directive, e.g. white certificate schemes) • **EE auctions** (e.g. examples in Switzerland, Portugal, Germany)	Possibly, but not necessarily –obligation schemes may risk losing touch with the real (energy) market, and may become costly, rigid, illiquid and fragmented.
c	Targeting EE in **specific sectors**	In principle there is no specific target sector. The scope should be as wide as possible in order to maximize impact: tertiary buildings, residential homes, etc. From a practical perspective, however, at the stage of *developing* a novel P4P programme, it may be relevant to select the least difficult option, e.g. large commercial or public buildings, rather than a bundle of residential homes.
d	Fostering **specific technologies** (EE measures)	No, in principle technology-agnostic EE. Of course, those technologies that will be able to avoid energy consumption at peak times are likely to be favoured, e.g. technical systems that are based on the principle of pre-heating/pre-cooling by means of buffering mechanisms.
e	Excluding specific technologies	No, though within the scope of the SENSEI project, focus is on EE technologies, rather than on renewable energy or storage technologies. In practice, it will be difficult to separate EE from renewable energy and storage; in most

[11] See this article from Vlasios Oikonomou and Jean-Sébastien Brock of IEECP: *Let cost-effectiveness guide recovery funding to national efficiency programmes.* /www.eceee.org/all-news/columns/Let-cost-effectiveness-guide-recovery-funding-to-national-efficiency-programmes

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	Theoretical design options	Should this be covered in an EU P4P programme?
		cases a mix of technologies will be combined into a coherent package.
f	Incentivizing building owners to **target *deep* energy retrofits**, and as such avoid focusing on the easiest-to-obtain and/or short-lived savings	Yes, it is important to target deep(er) energy retrofits, rather than harvesting low-hanging fruit. However, this requirement may be in conflict with the business case of P4P programmes, hence not be attractive for investors. The SENSEI model is therefore likely to have to consider incorporating some kind of governmental enforcement and/or compensation to make the business case attractive/positive for third party investors.
g	Not creating disincentives for the **electrification of space/water heating systems,** which in the first place will increase rather than decrease electricity use	Yes, electrification of space/water systems is ultimately expected to contribute to decarbonizing the power system, so electrification should not be discouraged. Decoupling[12] utilities' sales and revenues may be part of the solution. As could restructuring electricity and natural gas invoices according to their real carbon impact, creating a level playing field between energy vectors.
2	**Power system support specifications**	
a	Using EE as a **demand-side *grid* resource** (network service), e.g. by reducing congestion, hence avoiding technical upgrades in network infrastructure ('**non-wires alternatives**', 'smart solutions')	Yes, as the participation of building owners and/or ESCOs will be compensated to a certain extent, which strengthens their business case for investing in EE measures. This power system benefit is currently more likely to be operationally implemented in the EU, as the expected guarantees required from the grid operator may be less stringent compared to capacity auctions.
b	Using EE as a **demand-side *energy* resource** for the power system, e.g. by letting EE participate in **capacity auctions**	In principle, yes, as the participation of building owners and/or ESCOs will be compensated to a certain extent, which strengthens their business case of investing in EE measures.

[12] https://www.aceee.org/blog-post/2020/08/shift-toward-electrification-decoupling-remains-key-driving-decarbonization

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	Theoretical design options	Should this be covered in an EU P4P programme?
		However, from a demand-side perspective, this may not be attainable in Europe, as the energy market legislation is not yet ready for this. When looking at the supply side, the P4P offer is probably not yet sufficiently robust to contractually guarantee a certain capacity (cf. principle of a virtual power plant). Conclusion: currently 'no'.
c	Using EE as a way to assist in **decarbonizing** the power system	Yes. Participating building owners and/or ESCOs may be compensated for their contribution as (part of the) EE may be considered as a *renewable* energy resource. From an operational perspective, it is feasible to incorporate the value of this benefit into a P4P programme.
d	Enabling building owners to (also) benefit from **demand response** services.	In principle, yes, if the goal of improved EE **comes first** (at least under the assumptions of the SENSEI project), i.e. demand response comes on top of EE. From an operational perspective, things should remain manageable. Combining participation in both EE and demand response programmes may be challenging to implement and contract, and conflicts between the two goals must be avoided. See also 1.e above.
e	Providing **other business models to utilities** to compensate for diminishing sales of energy[13]	Yes. Decoupling utilities' sales and revenues may be part of the solution.
3	**Other considerations[14]**	

[13] E.g. Decoupling utility sales of energy and income: Under traditional regulation, utility revenues are largely based on sales – the more they sell, the more they earn. Energy efficiency decreases sales and thus revenues, so utilities are effectively disincentivized to pursue it. Decoupling makes utilities indifferent to sales by providing them with revenues at the level approved by the regulator, regardless of how much they sell.

https://www.aceee.org/blog-post/2020/08/shift-toward-electrification-decoupling-remains-key-driving-decarbonization

[14] ACEEE in the US has conducted interesting research into this, e.g. https://www.aceee.org/research-report/u1905

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	Theoretical design options	Should this be covered in an EU P4P programme?
a	Developing the **energy services market** (ESCOs, energy performance contracts, etc).	Yes, by incorporating ESCOs/energy performance contractors as implementers of EE measures. As such, P4P programmes will be a kind of add-on to energy performance contracts, similar to the intended approach of H2020 projects such as AmBIENCe, frESCO and Novice.
b	EE as an **investment opportunity** for third parties	Yes, if stackable.
c	Social policies (e.g. addressing energy poverty)	Yes, if stackable.
d	Avoided environmental compliance costs (e.g. EU emissions trading system)	Yes, if stackable.

3.3 Lessons learned from P4P programmes in the US

A report produced by RAP (2020) provides policy and regulatory recommendations for potential replication of a P4P approach in the EU. The P4P concept proposed in the context of the SENSEI project ('SENSEI model') is intended to be such a replication. The main lessons learned from the case studies in the US are:

- P4P is often driven by the desire to **modernize EE policies**.
- P4P programmes are mostly **driven by regulation**, in particular EE obligations and carbon emission caps.
- Policymakers and regulators are driving the piloting of P4P programmes by **utilities** in the US.
- Many of the P4P programmes were developed not only to achieve traditional savings, but also to support the electricity system and understand future demand patterns. Hence, the majority of the cases studied intend to deliver **EE as an energy and/or grid resource**.[15]

[15] https://www.ferc.gov/media/ferc-order-no-2222-fact-sheet

FERC Order No. 2222 will help usher in the electric grid of the future and promote competition in electric markets by removing the barriers preventing distributed energy resources (DERs) from competing on a level playing field in the organized capacity, energy and ancillary services markets run by regional grid operators

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- **Many actors** are commonly involved in a P4P programme, with specific responsibilities and roles. The programme delivery is supported by **programme implementers and aggregators**.
- Programmes often target **multiple measures**.
- An appropriate choice of **M&V methodology** is key for implementing P4P programmes.
- Smart meters (advanced metering infrastructure, AMI) help data access, but are not strictly required.

4 Drivers for P4P programmes in the EU

Policy frameworks are important to foster innovative approaches such as P4P programmes. In this chapter we list the main EU policy initiatives in the context of energy and climate that may provide fertile soil.

4.1 Energy efficiency obligation schemes

Under the Energy Efficiency Directive (2012/27/EU), EU countries are requested to trigger a certain amount of energy savings. In many cases this is implemented by setting up an energy efficiency obligation (EEO) scheme. Such schemes require energy companies to achieve yearly energy savings of 1.5% of their annual sales to final consumers. Several EU Member States have implemented or are considering implementing EEO schemes. These schemes consist of energy saving obligations imposed on energy distributors and/or retail energy sales companies, and may be coupled with a trading system. P4P programmes, which are based on **metered** energy savings, could provide a more effective backbone to operate an EEO scheme. When upgrading the EED, the European Commission may want to refer to P4P programmes when providing guidance for setting up and effectively running EEO schemes.

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4.2 The redesigned EU electricity market

4.2.1 Europe's energy system in transition

Europe's electricity system is in a period of profound change (USEF, 2015).[16] It is evolving towards a system of **distributed energy resources**. The number of players involved is increasing accordingly and existing market roles are changing. The electricity market needs to adapt to this new reality; it needs to fully integrate all market players – including flexible demand, energy service providers and renewables.

The integration of the internal market is not expected to stop on the wholesale level. To realize the full potential of the European internal energy market, the retail part of the electricity market has to offer consumers – households, businesses and industry – the possibility of active and beneficial participation in the European Union's energy transition. The market also needs an effective regulatory and governance framework that reduces the need for interventions such as capacity mechanisms.

4.2.2 New roles and players: aggregators, ESCOs.

In the redesigned EU electricity market, new roles are introduced, such as aggregators and ESCOs. Aggregators accumulate the contributions of numerous individual prosumers, and turn these into products/services to serve the needs of other stakeholders in the power system. One advantage of aggregation is that these products provide reliability to the market by eliminating the risk of non-delivery inherent in depending on an individual prosumer. At the same time, aggregation prevents prosumer exposure to the risks.

ESCOs provide energy-related services to end users. They may or may not directly be involved in the energy and flexibility supply chain. These services can cover a very broad range. Businesses might combine the ESCO and aggregator roles.[17]

This kind of aggregation is precisely what SENSEI envisages: clustering EE measures in individual buildings into performance-based programmes. As this kind of programme does not exist yet in Europe, new players are likely to be created/identified: the **P4P**

[16] This chapter is based on the USEF report *The Framework explained*, November 2015.

[17] In the stakeholder consultation carried out by CIMNE, one of the conclusions was that ESCOs could act as aggregators for P4P pilots in Europe.

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programme initiator (owner), the programme **facilitator (developer)** and the **EE aggregator**. This is visualized in Figure 11:

Figure 11 – Proposed process for setting up a P4P programme (Source: Factor4)

4.3 Options to link energy efficiency in buildings to the power system

An important collateral effect of a P4P programme is that EE upgrades may have an impact on the power grid. Accordingly, we have identified three ways through which EE may be linked to the (local) power grid and its operational goals and challenges. These ways differ in the degree of involvement/endorsement that is required from the power grid's main actors: regulators, power system operators and utilities. The higher the need for involvement/endorsement, the shorter the distance between an EE project and the power grid, which is visualized in Figure 12.

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Figure 12 – Three ways through which energy efficiency may be linked to the local power grid (Source: HEBES)

4.3.1 Option A - Local and regional programmes for EE financing

A first option is to engage public institutions with a budget and mission to promote EE, and to facilitate the design of EE programmes that link compensation with specific performance indicators. These indicators may incorporate a variety of goals in a P4P programme: produce energy savings, promote new technologies, align energy consumption with the needs of the local energy systems (supply and distribution constraints), or increase capacity for new energy consumption trends (such as electric vehicles, or cooling).

Public authorities that have an EE-related mandate and are considering setting up a P4P programme are invited to go through the following reflection process:

(1) Programme planning. Set up the objectives of the EE programme, and translate these goals into specifications for the P4P payment scheme. This stage includes the definition of the retrofit project and the project aggregator eligibility criteria, the P4P rates that will be offered for energy savings, the acceptable time plan for their realization, and the total duration of the P4P agreement.

(2) Payment scheme design. Design the request for proposal that prescribes the conditions and requirements for an energy retrofit project to be (co-)financed. This stage includes the details of the payment scheme, the rules for compensation, the required data for determining the consumption baselines and the method for

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estimating the energy savings, as well as the templates for the agreements between the public authorities and the project aggregators.

(3) Impact evaluation. The P4P model allows impact evaluation to take place while the programme is being implemented rather than after its completion. Tools being developed within the SENSEI project, e.g. 'eensight'[18], are likely to be part of the solution.

4.3.2 Option B - EE as a collective asset in energy communities

The Clean Energy Package[19] contains two definitions of energy community: *citizen energy community* (CEC), which is contained in the provisionally agreed recast Electricity Market Directive, and *renewable energy community* (REC), which is contained in the recast Renewables Directive.

A CEC is a legal entity that:

(a) is based on voluntary and open participation and is effectively controlled by members or shareholders that are individuals, local authorities, including municipalities, or small enterprises;

(b) has for its primary purpose to provide environmental, economic or social community benefits to its members or shareholders or to the local areas where it operates rather than to generate financial profits;

(c) may engage in generation, including from renewable sources, distribution, supply, consumption, aggregation, energy storage, **EE services** or charging services for electric vehicles, or provide other energy services to its members or shareholders.

CECs therefore appear to be candidates for participating in a P4P programme. CECs are not a business model by themselves; they are a way to organize collective cooperation in an energy-related activity around specific ownership, governance and a non-commercial purpose (as opposed to traditional market actors). **Metered EE can also be part of the operations of a CEC.** In this, a P4P programme should enable EE improvements to be financed and valorized in the same way as generation assets in CECs.

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[18] https://senseih2020.eu/the-eensight-tool/

[19] https://ec.europa.eu/info/news/clean-energy-all-europeans-package-completed-good-consumers-good-growth-and-jobs-and-good-planet-2019-may-22_en

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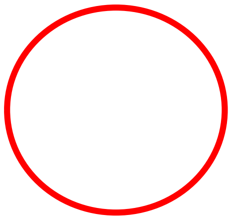
4.3.3 Option C - Direct procurement of demand-side resources

Another option is to make EE part of a well-defined package of demand-side resources and valorize it as a grid resource (non-wires alternative). This approach was tested in a pilot project by Southern California Edison (SCE, 2019). The primary objective was to determine whether locally deployed distributed energy resources can reliably serve the forecasted load growth. Figure 13 presents the composition of the pilot's portfolio of resources.

Figure 13 – Composition of a portfolio of procured demand-side resources



The main insight from the pilot was the need for a diverse mix of resource types to manage peak load growth, since no one resource type has all the performance characteristics to meet local and temporal grid needs.

Although the pilot included a diverse mix of resource types, compensation follows the California Independent System Operator (CAISO) **bifurcation** decision that splits all grid resources into two categories: (a) **load modifying resources**, which reshape or reduce the net load curve, and (b) **supply resources**, which are integrated into CAISO energy markets. This categorization puts EE and dynamic tariff programmes into the first category (i.e. load modifiers).

Load modifiers are resources or programmes that are not seen or optimized by the energy or capacity market, but that modify the fundamental system load shape, preferably in ways that harmonize with the system operator's grid operations. Examples of load-modifiers are **dynamic rates** and **EE programmes**. An effective load modifying

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programme helps create a flatter system load profile, attenuating high energy peaks and valleys and reducing extreme upward and downward ramps (CAISO, 2013).

Since CAISO is able to dispatch only the second category of resources, only this category receives a qualifying capacity value for resource adequacy purposes. Load modifiers are compensated through programmes that identify and support the measures that are most effective in offsetting the need for new generating plants or transmission upgrades.

Within this framework, the P4P approach could be promoted as a way of **procuring the load modifying resources**. In fact, the **Pay for Load Shape (P4LS)** product proposed by the California Public Utilities Commission's Working Group on Load Shift can be a point of reference. P4LS is based on target load shapes that are updated periodically based on evolving grid conditions. It is dispatched outside of the CAISO market, and customers that meet or approach the target load shape would be compensated based on energy market and/or capacity cost savings based on a performance assessment.

The design of this kind of P4P programme should take into account the perspective of the following business actors:

System operators

System operators need to define the potential share of energy efficiency in a demand-side resource portfolio. In other words, they need to define the part of the services from demand-side resources that can be covered by permanent or slowly adapting changes in consumption profiles. The value of an energy retrofit project to the grid depends on the operational characteristics of the grid (e.g. time and seasonality of peaking, load factor), as well as on the time periods when consumption changes from the project occur. Although different power grids face different challenges, in most cases a system operator would prefer **energy retrofit projects that specifically target the hours when the probability of load loss is high** and/or the hours when known and persistent variability in the net load[20] leads to ramping events, i.e. large changes in the magnitude of the net load lasting for a few hours.

[20] Net load is the difference between the total demand for electricity and the electricity production from variable generation resources.

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Another challenge often faced is shaping the demand so as to minimize the curtailment of electricity from renewable sources, and hence **increase the grid's hosting capacity for renewable energy sources**.

P4P programme facilitators (developers)

A critical aspect to address is that system operators will not directly compensate the EE measures and will not directly monitor the respective performance indicators. Anything that is out of the system operators' scope should be the responsibility of other public institutions that initiate and manage P4P programmes for the procurement of the demand-side resources – the P4P programme facilitator (developer). As such a party is likely not to exist yet, it may have to be created.

4.3.4 Assessment of design options

Although all options are deemed promising, we have focused in this report on Option A, the of which scope is closest to the objectives of the SENSEI project, i.e. **concentrating in the first place on energy retrofits in buildings**, which may have collateral benefits for the grid, and not the other way around (which would be Option C).

Energy communities (Option B) could be a powerful **bottom-up** player/aggregator in a P4P system. However, as the transposition of the corresponding EU directives is still ongoing at the time of conducting our research, we have not explored this option in this report.

Option C implies the procurement of EE as an energy and/or grid resource by the power system operators. To a large extent, this would imply a level playing field between procuring energy which is produced and energy which is saved. The energy market is currently not adequately regulated to enable option C (cf. inspiring initiative in the US[21]).

We would like to stress here that, in the SENSEI project, as per the Grant Agreement, we have initially tried to stick to EE in the strict sense of structural/permanent load reduction (cf. definition in §2.3) and not covered renewable energy generation nor energy

[21] https://www.ferc.gov/media/ferc-order-no-2222-fact-sheet

FERC Order No. 2222 will help usher in the electric grid of the future and promote competition in electric markets by removing the barriers preventing distributed energy resources from competing on a level playing field in the organized capacity, energy and ancillary services markets run by regional grid operators

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storage or demand-side response. Of course, technical upgrades in the built environment do not separate these theoretical categories. These upgrades are likely to consist of a mix of technical measures which result in both load reduction and load shifting/shedding, and hence in a modified load which represents 'flexibility as a resource' rather than 'EE as a resource'. Another report produced by the SENSEI project will explore the interplay between performance-based EE and demand response.

5 Guidelines for setting up a P4P programme

5.1 Methodological process to establish guidelines

The methodological process to establish guidelines consisted of three steps:

(a) Desktop research consisting of theoretical reflections as well as assessment of examples in the US (cf. chapters 2, 3 and 4 of this report).

(b) Capturing expertise within the SENSEI consortium by means of virtual negotiations ('negotiation games', cf. paragraph 5.2).

(c) Validating the acquired insights through consultations with external stakeholders (cf. paragraph 5.3).

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Figure 14 Methodology followed to develop P4P (pilot) design guidelines

5.2 Virtual negotiations within the SENSEI consortium ('negotiation games')

5.2.1 Methodology

Before asking feedback from external stakeholders, we decided to capture all expertise within the SENSEI consortium, which encompasses energy experts and researchers from a wide scope of organizations. Rather than conducting a survey, it was decided to organize virtual negotiations ('negotiation games').

These are based on roleplay, in which various research questions are translated into questions or statements over which stakeholders negotiate. For example, in the negotiation game focusing on the perspective of the ESCO, statements were structured along the following lines:

- *"As an ESCO, I would expect that …"*
- *"As an ESCO, I would be reluctant to …"*
- *"As an ESCO, I would address this issue by …"*

As such, during the sessions, the partners of the SENSEI consortium have imagined/described the various stakeholders' perspectives in terms of probable **expectations/drivers**, perceived **threats/risks** and potential accommodating **solution elements**.

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Figure 15 - Conceptual SENSEI programme showing the stakeholders and their interactions

In Figure 15 we have depicted the conceptual SENSEI model. The numbers in green indicate the series of negotiation games that were organized between May and December 2020. The perspectives of the following stakeholders were inventoried:

1. ESCOs
2. Investors and financial institutions[22]
3. Power system operators
4. Building owners
5. Aggregators

In the subsequent paragraphs we summarize the insights that came out of the negotiation games.

We give the financial perspective in a separate report (D6.3), which we recommend is read in conjunction with the current report.

[22] Reported in “How to design P4P schemes in order to attract investors” (D6.3)

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5.2.2 Insights collected from negotiation games

5.2.2.1 Programme initiator (owner)

P4P programmes should not be initiated only by system operators, and nor should producing grid benefits be the only goal for which performance payments are made. There are numerous other benefits related to energy and climate objectives. Government agencies, regulators, national climate authorities, balancing responsible parties and others could decide on remuneration for specific performance measured directly or indirectly at the energy meter. An argument worth considering is that governmental involvement might enhance trust in the programme and provide some level of guarantee towards covering performance and financial risks.

Recommendation:

Consider a wide scope of potential P4P programme initiators (owners).

5.2.2.2 Programme design

Depending on the nature of the programme initiator (owner), the objectives of the programme will have to be carefully defined. Indeed, it is easy to imagine potential conflicts between the individual interests of the different stakeholders involved in a programme. An example would be a programme designed to achieve metered grid capacity benefits for the system operator, whereas the participating ESCOs are rewarded solely on achieving energy performance benefits in an energy performance contracting context. Both benefits might conflict, or at least not be concomitant. Another example are energy vector change measures (e.g. electrification of space heating), resulting in primary energy savings, but increasing grid load. It is not impossible to deal with these conflicting situations, but it requires a very careful definition of the programme's goals, the paid-for performance and the associated metered KPIs.

Recommendation:

Identify conflicting situations based on the developed business process model and develop (categories of) clearly defined programme goals.

5.2.2.3 Professional marketing of P4P programmes

One of the key roles of the programme facilitator (and the EE aggregator) will be to put a programme onto the market. This is an essential step to achieve the necessary scale in number of energy retrofit projects. In order to convince potential building owners (or local energy communities) to participate in the programme, the EE aggregator will have

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to package advantages and benefits smartly while matching the needs, expectations and typical questions of candidate participants. A lot of experience from the EE services sector has been built up in this field over the last decades, e.g. in the US. The added sales and marketing activity in the context of the roll-out of a large P4P programme is a clear advantage compared to the selling of individual energy retrofit projects.

Recommendation:

Launching new concepts such as P4P programmes is likely to require professional promotion campaigns going beyond listing benefits. These promotion efforts should be inspired by sales and marketing plans from aggregators in existing utility P4P programmes and from legacy players in the EE services sector.

5.2.2.4 Programme scale

A decent programme size is important to allow for standardization, accommodate overhead costs and enable performance risk mitigation. A minimum guaranteed volume of EE is also an expected explicit requirement from the system operators as the EE would be relied upon as a non-wire network resource. Scale will bring additional benefits for other stakeholders, such as grouped procurement of equipment, and sales and marketing costs amortized over a much larger project base.

Recommendation:

The programme participant acquisition process should be managed by an aggregator with market access to a large candidate participant base (for example the customer base of a system operator), with strong expertise in both market communication and EE.

5.2.2.5 Programme duration

The time horizon for the programme will be a key element in the design. Longer durations will mean longer stable additional income flows generated by the metered benefits. Too short programme durations might trigger focus on short-term goals like EE quick wins as opposed to deep energy retrofits (which are needed to decarbonize the built environment). For reliability, grid operators and investors will probably require a duration of at least a certain number of years. Examples from P4P programmes in the US show durations of minimum three years.

Recommendation:

Check and validate expectations and requirements on programme duration with external stakeholders.

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5.2.2.6 Limitations due to regulatory frameworks

The roll-out of P4P programmes might be limited or constrained by existing regulatory frameworks. For example, in most EU countries system operators have only a limited and regulated set of activities they can execute and from which they can generate income. In that context a system operator might not be permitted or interested in developing a new market mechanism for P4P transactions. Another example is metering, as only dedicated meter reading companies may be permitted to install meters and access meter data. In addition, nationally governed and regulated energy tariffs might also apply to P4P rates. Privacy and GDPR issues also fall within this category.

Recommendation:

A detailed legal and regulatory feasibility analysis for the roll-out of P4P should be performed for the EU context, and probably for each Member State individually.

5.2.2.7 Robust operational model

A P4P programme includes the interaction between several stakeholders, most of which already operate according to formal processes and contractual frameworks, such as grid operation and balancing, investment evaluation guidelines, energy performance contracting, etc. It is crucial that P4P programme transactions follow a well-defined, lean and streamlined process framework, without adding complexity or administrative burden – or rather lowering it by grouping and standardizing common management and administration tasks or assuring financing for EE investments.

It is also important to avoid overlaps or gaps between the activities of the different stakeholders. For example, the negotiation game that focused on building owners raised a lot of typical questions and concerns from building owners that are already being dealt with by ESCOs today, based on years of experience in executing energy performance contracting projects. It would be inefficient if the EE aggregator tries to deal with the same issues without aligning with participating ESCOs. The same holds for issuing project eligibility criteria by the EE aggregator.

Recommendation:

Develop a robust business process integrating the different roles and tasks of the P4P model, from programme definition and participant acquisition to the packaging of financial benefits towards third-party investors.

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5.3 Consultation with external stakeholders

5.3.1 Methodology

External stakeholder consultations took place between April and August 2021. During this external stakeholder consultation, the internally developed ideas and guidelines were subjected to the opinion of real players in the application areas of a P4P programme: regulators, governmental agencies, system operators, ESCO associations, building owners, etc.

Rather than ask the external stakeholders for feedback on documents describing the SENSEI P4P programme basics in detail, the external stakeholder consultations were conducted as semi-structured interviews.

The interviews were approached as a conversation between industry colleagues, aimed at collecting first-hand feedback, both positive and negative, and useful practice-based inputs on three aspects of the conceptual P4P programme being developed within the SENSEI project (cf. Figure 15): communication, evaluation and potential roll-out.

The motivation for this approach is that most P4P programme experience and literature originates from a US context and that during the internal negotiation games only theoretical exercises were conducted to try to identify the different stakeholders' perspectives. This delivered hypothetical interpretations of the usability of P4P programmes by EU stakeholders in an EU context. It was therefore judged more useful to engage with external stakeholders from an EU perspective on the basics of the P4P programme concept in a spirit of co-creation.

5.3.2 Questions discussed with external stakeholders

In the semi-structured interviews, the questions were grouped according to three main categories:

1. Communication of the P4P programme concept:

   Does the interviewee understand the concept and its implications?

2. Evaluation of the P4P programme concept:

   What is the interviewee's first evaluation in terms of pros and cons?

3. Potential roll-out of a P4P programme:

   Can the interviewee see local potential for piloting a P4P programme?

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Table 4 - Questions of the semi-structured interview

Questions on communication around the P4P programme concept
Have you heard of P4P programmes before?
Are all aspects of the concept clear to you? Can the concept be better defined or described? Are there some (important) missing details in your opinion?

Questions on the evaluation of the P4P programme concept
Do you think such a programme may work in your country/region?
Are you familiar with existing EE services market mechanisms like energy performance contracting? Is that market (very) active in your country/region? Do you think P4P programmes would intervene positively or create conflicting situations/interests?
Are you aware of existing EEO programmes in your country or other EE stimulating programmes? Who are the involved parties?
According to you, could it work? What would be needed to make it work?
Which kind of performance do you think would be paid for by whom in a P4P programme (e.g. grid capacity, decarbonization goals, production capacity, other benefits…), if any?

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Questions on the potential <u>roll-out</u> of a P4P programme
In your country/region, can you think of an existing programme based on deemed results that could be replaced by a P4P programme?
Can you imagine a P4P programme pilot in your country/region? Having what performance goals? Involving which parties (programme initiator, programme owner, aggregator, building owner type, investors)?
Can you identify an organization that could be an aggregator in your country/region? This organization should be capable of setting up a programme promotion campaign to gather enough participants (building owners) as well as managing technical and financial aspects of a P4P programme, including delivering the contractual performance guarantee towards the programme initiator.
Would there be regulatory constraints to rolling out P4P programmes in your country/region?
Would there be other constraints (acceptance of the P4P concept, interference with existing programmes …)?

5.3.3 Consulted external stakeholders organizations

- ARPAE Emilia Romagna, Italy – Regional agency for prevention, environment and energy
- SACYR, Spain – ESCO
- ANESE, Spain – National Association of ESCOs
- ICAEN, Spain – Catalan Institute of Energy
- P.M. Service srl, Italy – ESCO
- Asso ESCo, Italy – ESCO
- COMSA, Spain – ESCO
- Electricity Networks department of the Regulatory Authority for Energy, Greece

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- Centre for Renewable Energy Sources and Saving, Greece - Energy Policy Analysis department

5.3.4 Insights collected during the consultations

5.3.4.1 P4P programmes not commonly known

Only a few stakeholders have explicitly heard or read about P4P programmes. Given the fact that these programmes have mainly been piloted in the US, that fact should not be too surprising. This is, however, an important reality that needs to be taken into consideration. All too often innovative market mechanisms fail or are severely delayed in their initial deployment because of lack of knowledge among the market players. Lack of knowledge leads to lack of trust. As an example, this situation has very clearly been observed for the launch of energy performance contracting markets in EU Member States. New market roles have even been created to overcome this barrier: energy performance contracting *market* facilitators and *project* facilitators. The former are active in the field of marketing energy performance contracting concepts, and the latter assist those tendering for (complex) energy performance projects. Even then it took many years before energy performance contracting evolved past a long pilot projects phase and was adopted on a larger scale by public authorities (the energy performance contracting concept was introduced as early as the 1990s in the EU, cf. the *Berliner Energie Agentur*).

Insight:

The P4P programme concept still needs a lot of marketing and promotion in the EU. Ways to do that, as suggested by the external stakeholders, involve information and communication campaigns specifically directed towards the involved market players and, mainly, starting P4P programme pilot projects in the different Member States.

5.3.4.2 Aggregator concept introduction

In the field of energy networks, the term ‘aggregator’ today mostly refers to a specific coordination and aggregation manager of network demand response or flexibility mechanisms. Most consulted stakeholders first thought this was the role referred to in the SENSEI P4P programme. As presented in paragraph 2.3, the SENSEI project focuses on a different type of aggregator, although ultimately different aggregator roles might come together in one market organization.

Insight:

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In terms of communication, and especially when thinking about launching a pilot within the context of an existing energy services market, it is important to very clearly define the specific P4P aggregator role. In this respect, we recommend adopting the term 'EE aggregator'.

5.3.4.3 Clear P4P programme business model

The overall P4P programme concept as presented during the consultations was clear for all stakeholders. However, since existing literature and P4P examples are US based, some stakeholders missed a more detailed P4P business model in the EU context, i.e. a clear outline of tasks and roles (and the current or new types of organizations that could execute or host these tasks and roles) as well as the flows of information and value between these roles and organizations. The role of aggregator and its place in the business model is, not surprisingly, the most unclear. The business model for the EE aggregator will be detailed in another part of the SENSEI project (D6.5).

Insight:

All aspects of a P4P programme should be documented in an easy to communicate and to explain business model, identifying and describing in enough detail the roles, organizations, and information and value flows.

5.3.4.4 "What's in it for the end consumer"

A key player in the P4P programme as proposed in the SENSEI project is the end customer. The building owner and/or tenant is the person who decides whether to actively participate in any P4P programme. There are many types of end customers, each with their own motivations to join or not join a P4P programme. It should be clear to each of them what the added value will be if they participate in a programme, in financial terms and also preferably in terms of non-financial added benefits. When looking at existing P4P programmes in the US, the aggregator is often an organization combining experience and expertise in both the field of EE and in the field of marketing and communication.

Insight:

The EE aggregator (as well as the P4P market facilitator) needs to be able to set up convincing communication campaigns regarding the benefits, financial and non-financial, for end customers to join a P4P programme.

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5.3.4.5 The (definition of) the aggregator role is crucial

A P4P programme involves at least a programme initiator (energy and climate agency or other governmental organization), end customers (commercial building owners/occupants, public and private multi-site building owners/occupants, residential homeowners/tenants), ESCOs and public and/or private investors, and potentially also system operators. All hold specific positions and views linked to their business interests within the energy (efficiency) market, and are subject to specific regulatory frameworks. For example, financial stakeholders will expect high levels of transparency from the EE aggregator. The acquisition of participating projects is also an important responsibility of the EE aggregator. Its role will be at the centre of each P4P programme and crucial to its success.

Insight:

Many stakeholders believe the EE aggregator will have the most important role in successfully implementing P4P programmes. Defining this role and the associated business model, including regulatory constraints related to the energy and financial market, will be key to gaining trust from the market and thus to the successful introduction of P4P programmes.

5.3.4.6 Complexity of inserting P4P programmes into an existing EE services market

Since the 1980s many EE services market mechanisms have been developed and deployed with the aim of boosting energy renovation volumes. Energy performance contracting is a recent example. Each mechanism has brought its own set of contractual complexity. Some external stakeholders mention that the introduction of P4P will add a new layer and high level of complexity, making contractual arrangements more cumbersome and difficult to implement and follow up. They often perceive P4P as a ‘programme performance contract’ encompassing many energy performance contracts at the individual project level. However, there doesn’t seem to be a conflict between the goals at project and at programme level. They are even perceived as complementary.

Insight:

P4P will add a layer of contractual complexity to the existing energy services market framework. The distribution of risks and benefits/losses will have to be carefully thought through and assigned.

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5.3.4.7 P4P should not replace EEOs

Current EEO schemes are based on *deemed* savings. Upgrading EEO schemes to *measured* savings by incorporating the P4P principle might have the paradoxical result that fewer EE projects are implemented. This is mainly because the absence of initial/upfront subsidy could negatively impact the enthusiasm of some end customers to implement EE measures. Also, P4P programmes could encourage a focus only on quick-win, short-term payback measures.

Insight:

To avoid P4P programmes leading to fewer EE projects, P4P programmes should not necessarily *replace* existing subsidy schemes. A better option might be to explore ways to integrate them within selected subsidy schemes.

5.3.4.8 Advanced M&V (tools) are a crucial element of (mass) market functioning

M&V has been an important concept in EE markets for decades. However, so far this has consisted in measuring energy consumption volumes over longer baseline periods like months or years. As P4P programmes are likely to include load shape modification interventions that also need to be measured, a real-time load curve-based M&V concept (‘dynamic M&V’, ‘M&V 2.0’) and underlying tools will have to become a common element of the functioning of the energy (efficiency services) market. Happily, electricity metering infrastructure is heading in this direction in order to enable the evolution towards smart grids.

Insight:

Massive availability of dynamic M&V infrastructure and tools will be instrumental in successfully rolling out P4P programmes.

5.3.4.9 Will P4P programmes bring enough added (financial) value to investors and to the end consumer?

Maybe even more important will be the possibility to assess and predict the financial benefits and returns in a P4P programme. Some financial stakeholders speak of ‘measurement, verification *and valuation* (MV&V)’ to stress this point. It is not totally clear at this stage how convincing the financial benefits that could be captured in a P4P programme will be for the different actors. Most importantly, financial stakeholders and end customers will have to be presented with clear and convincing figures on improvements in returns, payback times and monetary benefits compared to other EE market mechanisms.

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Insight:

The added financial value of P4P programmes compared to other EE mechanisms should be analysed and demonstrated in a clear and detailed business case.

5.3.4.10 EU system operators might (currently) not be interested in EE as a resource

System operators (mainly distribution system operators) may not be interested in paying for freed capacity on their networks if they are not obliged to. System operators' income is linked to the volume of energy that is transported over their networks. In many network sectors, network capacity only comes under pressure at times of congestion. These system operators might be interested in paying for load shift but not permanent load reduction through a P4P programme, which could limit progress towards climate goals.

Insight:

System operators will not necessarily be ready to pay for load reducing EE programmes. A hybrid model where EEOs are combined with the P4P idea of measured savings might be better suited for the EU situation. P4P programmes in the EU could perhaps focus on arranging payments (bonuses) for all projects where performance helps reach the decarbonization targets.

5.3.4.11 Both investors and ESCOs aim at implementing larger volumes of EE

The investment sector is very actively pursuing sustainable investment opportunities, preferably with large ticket sizes. The timing is right to attract financial stakeholders towards innovative EE market mechanisms (see D6.3 for a more detailed analysis). ESCOs are also positive about bundling a large number of projects in standardized programmes, obviously bringing opportunities for economies of scale. The stakeholder consultations also indicated that many investors will simply not consider being involved unless they are dealing with large investments/aggregated portfolios.

Insight:

One of the aspects of P4P programmes that is valued as highly positive is the volume of investment and business created by implementing programmes instead of individual projects.

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5.3.4.12 Identify the programme initiator (owner)

Especially in pilot phases, the right choice for a P4P programme initiator/owner is very important. It will depend on the objectives of the programme, as discussed earlier in this document. If the goal of the P4P programme is mainly creating non-wired network capacity, the right programme initiator might be a system operator. If the objective is boosting EE investments, it might be a financial institution. The initiator might be a climate or energy agency, when the goal is helping achieve climate goals. And of course a combination of these will probably be a possibility too.

Insight:

When trying to launch a P4P pilot, it will be very important to identify the right (combination of) programme initiators/owners. The choice will depend on the objectives that need to be achieved or supported by the P4P programme.

5.3.4.13 Identify/create a trustworthy programme facilitator (developer)

Deciding on the organization that will develop and facilitate the programme is important. This role could be played by several existing organizations, such as system operators, energy and climate agencies and energy market regulatory agencies, or (partially) outsourced to new players on the market (as in the case of Franklin Energy[23] in the US). This must be very clearly defined starting from the existing context of each Member State. The role of the programme facilitator is crucial, and stakeholders have numerous expectations, including trustworthiness, independence, transparency, financial strength, and good knowledge of the financial, technical, and marketing and communication aspects of the EE (services) market.

Insight:

The programme facilitator (developer) role can be hosted in different types of existing organizations or be a new market player. Depending on the objectives of the P4P programme, the programme initiator will have to carefully think through the different eligible organization types that can be involved as programme facilitators (developers).

[23] www.franklinenergy.com/efficiency-programmes-for-utilities
Franklin Energy is a private company delivering energy management resources to utilities, municipalities, businesses, and customers across the US. "*We're passionate about empowering communities to make sound energy-saving decisions. With **utilities** looking to deepen **their programs,** our priority is to provide the tools necessary to meet their goals, maximizing savings in a timely and cost-effective manner*."

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5.3.4.14 Existing public energy performance contracting programmes could be boosted by a P4P programme

When thinking of launching P4P programme pilots, it is wise to look at existing EE campaigns, like ongoing energy performance contracting subsidy/promotion programmes and EEO schemes. P4P programmes could boost existing schemes by increasing the number of projects, because of the way they bundle projects together over a well-defined and limited period.

Insight:

Existing EE schemes need to be analysed to assess whether P4P programmes could be a complementary mechanism to boost them.

5.3.4.15 Start in a private sector context

Stakeholders suggested it may be easier to start with private organizations like large multi-site organizations as end consumers, rather than residential consumers.

From a financial point of view, smaller private investment organizations with a higher risk appetite are more likely to get involved in an innovative P4P programme. Larger, risk-avoiding financial institutions, like banks and pension funds, will only adopt a new market scheme at a later (going-concern) phase.

On the other hand, involvement of a (semi-)public organization like a climate agency or a system operator would dramatically improve trust in the stability of the P4P programme.

Insight:

Private organizations are more likely to get involved in (pilots for) P4P programmes given their innovative nature. On the other hand, involvement of at least one public organization will create trust and stability, especially in the pilot phase.

5.3.4.16 P4P programme pilot

Respondents were asked to provide their level of interest in participating in a P4P programme pilot if one was launched in their region. Apart from their interest in participating, all interviewees agreed on the fact that EU pilots are essential to make the P4P programme concept known and trusted. Examples from the US alone are not convincing enough.

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Table 5 – Interviewees interested in participating in a P4P programme pilot

Type of organization	Region	Interest level
ESCO association	Spain	Interested
ESCO association	Italy	Not interested
Solar energy company	Italy	Interested
Energy institute	Catalonia	Interested
ESCO	Spain	Interested
ESCO	Spain	Interested
Energy and environment agency	Italy	Not interested
Energy regulatory authority (electric networks)	Greece	-
Energy policy study centre	Greece	-

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6 Summary: proposed approach to design a P4P programme pilot in the EU

By summarizing insights gained from our desk research, internal stakeholder perspective workshops and external stakeholder consultations, we are able to generate a set of guidelines for designing P4P programme pilots in EU Member States.

Before elaborating on the guidelines, we think it is useful to **refresh/harmonize the nomenclature of the stakeholders** referred to in the guidelines, as well as to visualize **their relationship**. This is presented in Figure 16.

Figure 16 - Structure of a potential P4P programme (Source: Factor4)

From Figure 16 it is apparent that the EE aggregator role should be understood in the sense of aggregating 'units' of EE;[24] in other words, bundling EE measures being taken in many buildings, either implemented by ESCOs or by the building owners/users

[24] See paragraph 2.3 for a discussion on the scope of EE, and whether this is interpreted in the strict sense of permanent load reduction, or the broader sense of load flexibility. The interplay between 'classical' EE and demand response is explored in D5.4 of the SENSEI project.

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themselves. In this sense the EE aggregator is equivalent to the demand response aggregator, but trading/brokering another commodity: EE instead of flexibility.

The aggregation process enables opportunities such as:

- **Offering ‘packaged EE’ to those parties willing to pay for it.** In the US there appears to be interest in paying for performance-based EE, as part of ‘behind-the-meter solutions’ (demand-side management), e.g. utility P4P programmes. In the EU, however, stakeholders who are willing to pay have not yet been identified. From our research as well as from interviews with stakeholders, we understand that the EU power system as well as the EU energy market is different from the US, which probably explains this finding.

  From a strategic perspective, this brings us to one of the core questions: should EE P4P programmes be imposed in a *top-down* way, by modifying legislation around the energy system and the built environment at a high level (EU, national), or should they be designed in such a way that they are attractive to parties willing to pay (*bottom up*)? A combination of both approaches would be the best of both worlds, but the more we have investigated the topic, the more we feel inclined to conclude that a top-down initiative would be required to pave the way.

- **Attracting capital from private investors** who are typically interested in large volumes of investment, in order to avoid transaction costs as well as to spread their risk.

Below, we describe the insights gained in the form of guidelines. We have tried to structure these in a (chrono)logical order. As such, they describe the **process of designing a P4P programme**. The process is also visualized in Figure 17.

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Figure 17 - Process of designing a P4P programme (Source: Factor4)

1. Map the **scope for P4P programme pilots**[25] in each Member State in terms of the specified programme objectives:
    - o Climate goals: decarbonizing society, and in particular the built environment
    - o Building performance upgrades: comfort, energy consumption (cf. Renovation Wave)
    - o Power system efficiency: avoided investments in production and distribution capacity (EE as a resource).
    - o Socioeconomic goals: boosting the (green) economy, creating jobs, mitigating (energy) poverty, etc.
2. Identify the corresponding **potential programme initiators (owners)**, i.e. organizations that could trigger the programmes.

[25] A feasibility study for setting up a pilot in Catalonia (Spain) is being conducted within the SENSEI project (D6.2).

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3. Appoint a programme **facilitator** that will develop the EE aggregator business model as well as promote the market for EE aggregation.
    - Map the landscape of EE market mechanisms already in place and their potential interference with a P4P programme.
    - Map the existing organizations that could be part of a P4P programme in each Member State.
    - Define the **business model for the EE aggregator** at various levels of detail, since this will largely coincide with the full P4P programme business model and will serve as key material in its explanation and promotion. While conducting this exercise, clearly distinguish between 'low-hanging fruit' and structural measures (deep renovations).
    - **Launch communication campaigns** to explain the P4P programme concept by means of:
        - Real P4P programme examples (e.g. tenders)
        - Quantitative material on savings, return on investment, number and types of buildings, duration of programmes
        - Testimonials from different types of stakeholders.
4. Tender for **EE aggregators** who will operate the programme.
5. Assess and select buildings that are good candidates for participation in a P4P programme, and solicit **ESCOs and/or building owners** to participate.

When incorporating these insights into the picture which was used at the start of the SENSEI project (Figure 15), we are able to present an upgraded version (Figure 18).

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Figure 18 – Schematic picture of the proposed P4P programme focussing on EE in buildings ('SENSEI model')

It is important to note that the presented model specifications, including the actors involved, their role in the scheme, and the concrete financial and data flows described, are **only one of several options available** when designing a P4P programme. The one provided here is a general overview of a how the SENSEI model is structured, but the concrete specifications of each P4P scheme built under this framework will have to be decided based on the stakeholders involved, the regulatory environment, and the analysis of the market in which the programme will be carried out.

The potential options are likely to depend on e.g.

- the **business model of the EE aggregator**. This is elaborated in Deliverable D6.5.
- the way the **financing** of the P4P programmes is structured. This part of the research is reported in Deliverable D6.3 which is entirely dedicated to this topic.

Figure 18 will be further detailed in other tasks of the SENSEI project, e.g. by means of click-and-reveal windows on the dissemination platform (T3.5) (infographics).

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Figure 19 – Sneak peek of derived infographics which may be used for dissemination purposes.

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7 Abbreviations and acronyms

Acronym	Description
P4P	Pay for performance (output-based rewarding)
P4P programme (scheme)	Programme using the P4P concept on an aggregated/bundled basis
CEC	Citizen energy community
REC	Renewable energy community
DSO	Distribution system operator
TSO	Transmission system operator
EE	Energy efficiency
EEO	Energy efficiency obligation
M&V	Measurement and verification
M&V '2.0'	M&V that enables energy consumption to be measured during a short span of time (e.g. 15 minutes), which enables capturing of load modification; sometimes also referred to as 'dynamic M&V'.
ESCO	Energy service company
WP	Work package
Dx.y	Deliverable number in the SENSEI project

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