Active managed Buildings with
Energy performaNce Contracting

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Guides and recommendations for an effective active building energy performance contracting deployment

The AmBIENCe Consortium

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EXECUTIVE SUMMARY

The purpose of the AmBIENCe project is to reduce the CO_2 emissions of buildings by introducing the flexible use of renewable energy sources in combination with electrification and demand response. By combining energy performance contracting with demand response, we have developed the concept of active-building energy performance contracting (AEPC), which enables new services, new business models and new actors. In recent years, buildings have become more digital and smarter. AEPC extends the concept of energy performance contracting to valorise the demand response flexibility that is available in active buildings. The AEPC concept and tool were validated in two pilot buildings.

Policy measures will play a large role in the success of implementing AEPC. This policy brief will indicate how current regulations and policies, on both the European Union (EU) and national level, must be adapted to foster an uptake of the AEPC concept and business model. Our recommendations are based on the project findings, literature review and stakeholder workshops, and are split into three primary categories: regulatory, financial and administrative. Key needs identified are:

- Continual **regulatory review** as well as the establishment of a **strong enabling framework**
- A **strong energy services market** as well as **tailored financing** programmes.
- **Support measures** such as one-stop-shops and technical assistance programmes to facilitate the complex regulatory and financial needs of the market.

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1. INTRODUCTION

Buildings are responsible for approximately 40% of energy consumption and 36% of CO_2 emissions in the European Union[1]. Energy efficiency measures are essential not only to improve buildings' energy, indoor quality and environmental performance, but also to combat the current energy crisis and high energy prices, and help the EU shift away from its dependence on Russian gas. By taking advantage of available technologies, without compromising the comfort and well-being of building users, energy efficiency measures should be seen as a priority within the EU energy agenda. In addition to lowering energy use, using energy more efficiently, e.g., using local and/or renewable energy sources, is a complementary approach to reduce buildings emissions.

Developing new smart energy services that use flexibility from demand-side resources in different sectors is essential to fully unlock the potential of buildings to achieve energy cost savings and contribute to climate goals by reducing CO_2 emissions. The use of information and communication technology (ICT) solutions and tools can trigger significant CO_2 emissions and cost savings, coupled with renovating the existing building stock.

The AmBIENCce project seek to advance these solutions by extending the concept of energy performance contracting by valorising the flexibility that active buildings offer through active control and demand-response services. We call this concept active-building energy performance contracting, or AEPC.

This paper provides an overview of the project and final outcomes, as well as recommendations on how current regulations and policies must be adapted to foster an uptake of the AEPC concept and business model.

1.1 PROJECT OVERVIEW

The H2020 AmBIENCe (Active Managed Buildings with Energy Performance Contracting) project aims to extend the concept of energy performance contracting to active buildings, which are buildings equipped with active control options that can actively participate in demand response. The AmBIENCe project provides a new concept and business model for performance guarantees from active buildings, combining savings from energy efficiency measures with additional savings and earnings resulting from the active control of assets. Energy performance contracting has been used for energy savings measures for over 30 years in the EU (and 50+ in the US). Incorporating flexibility within an energy performance contract, however, has potential to provide greater incentives for building owners to undertake energy performance contracting solutions.

Energy performance contracts are a contractual agreement between an end-user and energy service provider (typically an energy services company (ESCO) or technology provider). They include an agreed financing term, a repayment agreement and a guarantee of energy savings. Energy performance contracts can cover a wide range of energy-saving measures, including but not limited to boiler and chiller systems, lighting, HVAC, roofing, insulation, windows and building management systems, as well as deep renovation including multiple measures.

[1] https://www.bpie.eu/publication/a-guidebook-to-european-buildings-efficiency-key-regulatory-and-policy-developments

1.2 ENERGY PERFORMANCE CONTRACTING AND ACTIVE BUILDINGS

Energy performance contracting is a way to deliver energy savings projects with third-party financing. Using the definition from the Energy Efficiency Directive, an energy performance contract is a contractual arrangement between the beneficiary and the provider of an energy efficiency improvement measure. Investments (work, supply or service) in that measure are paid for using a contractually agreed level of energy efficiency improvement or other agreed energy performance criterion, such as financial savings. Energy performance is verified and monitored during the whole term of the contract.[2]

In an energy performance contract, payment is closely linked to the success of the interventions carried out by the supplier. In most cases, the (energy service) supplier is also in charge of the equipment and maintenance for the duration of the contract. This is an advantage both for the beneficiary – the end-user, who is relieved from this duty – and for the supplier, because good maintenance ensures greater energy savings and therefore greater and earlier economic returns. Also important is the need to verify the results during and at the end of the contract: an energy performance contract should contain a clear procedure (indicating also the measurement and verification instrumentation to be used) to objectively and indisputably measure and verify the achievement of the contractual targets.

Demand response: "Changes in electric usage by end-use customers from their normal consumption patterns in response to changes in the price of electricity over time, or to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized[1]."

The active building energy performance contracting (AEPC) concept is a combination of demand response and energy performance contracting schemes. Active control-based services can contribute to both demand response in reaction to market/price signals and contractually external regulation of electricity demand based on the (heat and electricity) storage potential of the building. Introducing flexibility and demand response in more buildings, allowing energy to be used when prices are low as more renewable energy sources are available, will decrease the CO_2 emissions and reduce the energy cost of buildings.

[2] Directive 2012/27/EU, Article 1 (27)

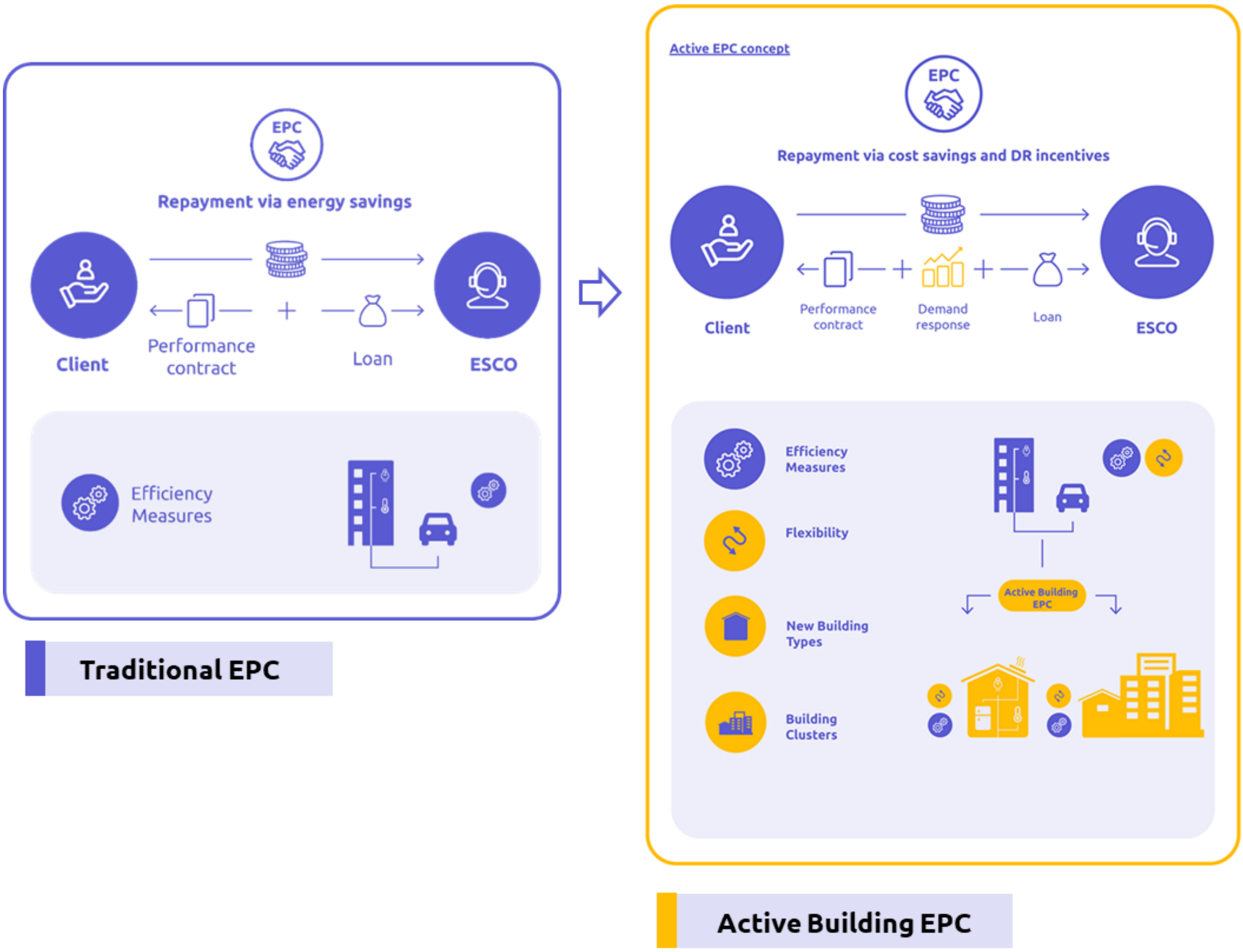

FIGURE 1: TRADITIONAL VS ACTIVE ENERGY PERFORMANCE CONTRACTING

The AEPC concept is an enhancement of the basic energy performance contracting concept, through a strong focus on electrification (also of the local heat supply and including mobility) and the addition of active control measures. This means that AEPC provides the extra features of demand response/flexibility, while preserving all the characteristics of a classic energy performance contracting model.

AEPC has the potential to extend performance guarantees by leveraging the flexibility of the building. In this way, the scope of an energy-saving guarantee is extended to a cost-saving guarantee, as a direct result of demand response activities in the building (e.g., load shedding, load shifting, self-consumption). Increased electrification based on the use of renewable energy sources will also guarantee reduced CO_2 emissions.

In AEPC, different types of demand response (implicit and explicit) should coexist to allow for consumer choice and enable an efficient energy system. Both demand response types are included in the AEPC concept to accommodate different consumer preferences and to exploit the full spectrum of consumer and system benefits from demand response.

Implicit and explicit demand response

Implicit demand response (also known as price-based demand response) is the consumer's reaction to price signals from short-term market pricing. Sensors and digital tools enable consumers to adapt their behaviour based on these price signals to save on energy expenses.

Explicit demand response (also known as incentive-driven demand response) is committed, dispatchable flexibility that can be traded on the electricity market through an aggregator that facilitates and manages the available demand response from the consumers.

The demand response type is one of the parameters that strongly influences the business model, as it defines whether the ESCO acts as an aggregator or alternatively interacts with other aggregators or directly with the requesters of flexibility (i.e. system operators), decided on a project-by-project basis. Other parameters are the building type, occupation model, owner/tenant relation and financing. While there are multiple variations of business models for AEPC.[3]

With explicit demand response, the business model varies significantly, as the role of an aggregator must be introduced. The aggregator is an intermediary that collects and manages flexibility from the consumers and negotiates it on the market or with the system operators.[4]

To help make this possible, the Active Building Energy Performance Modelling (ABEPeM) platform was developed as part of the project.[5] The ABEPeM platform collects all relevant project information including design options and scenarios and provides a template for acquiring the required inputs (e.g., building components, contract duration, total investment, building information, measures information and energy use, and scenario information including price scenarios). ABEPeM was developed to perform the main calculations and quantify the terms of the contract to shape the features of an AEPC.

[3] The details for each of the AEPC business model variations are fully described in the Business Models for the Active Building EPC concept.

[4] The full options and description can be found in the report Business models for the Active Building EPC concept

[5] See report Proof-Of-Concept of an Active Building Energy Performance Modelling framework

2. REGULATORY AND MARKET OVERVIEW

In order for AEPC to be introduced in the EU, a regulatory and market review was conducted to understand the existing frameworks for energy performance contracting, which measures are currently used and what supporting (or inhibiting) policies are in place in the four consortium countries (Italy, Spain, Portugal and Belgium).

The key findings of the regulatory analysis are as follows:[6]

- Belgium and Italy are well positioned to implement AEPC, whereas Spain and Portugal still need to overcome significant barriers.
- The **main enablers and best practices found at Member State level** include the strong legislative background and standards established for energy efficiency in buildings, the well-developed energy performance contracting market, the **establishment of product requirements to guarantee the supply of network services** from demand side and improve integration of flexible demand in the market, and the current revision of **requirements to reduce minimum bid sizes** while enhancing benefits for small customers.
- The **main barriers that need to be removed** are the **insufficient amount of market players as aggregators,** the **lack of economic and contractual incentives, data privacy issues** and the **high cost for the qualification and measurement verification equipment** to create flexibility from demand side.

Diving into more detail, the analysis looked at three key areas within the consortium countries:

1. **Status of energy performance contracting/ESCOs,** through the analysis of main regulations, directives and policies on energy performance contracting, main types of energy performance contracts, and main actors involved in the market.

   Italy is the most advanced country in the consortium. Its ESCO market is among the biggest and most developed in Europe, mainly due to the strong legislative background and standards established for energy efficiency in buildings. Italy is followd by Belgium, where the energy service market is stable and moderately sized. Spain and Portugal trail behind. In Spain, a complex set out governmentail support measures has not yet delivered the expected boom in the energy services market. The ESCO sector in Portugal remains underdeveloped and small. Figure 2 shows the overall analysis of the 4 coutries reviewed.

[6] See report Overview of actors, roles and business models related to Enhanced EPC and Building Demand Response Services

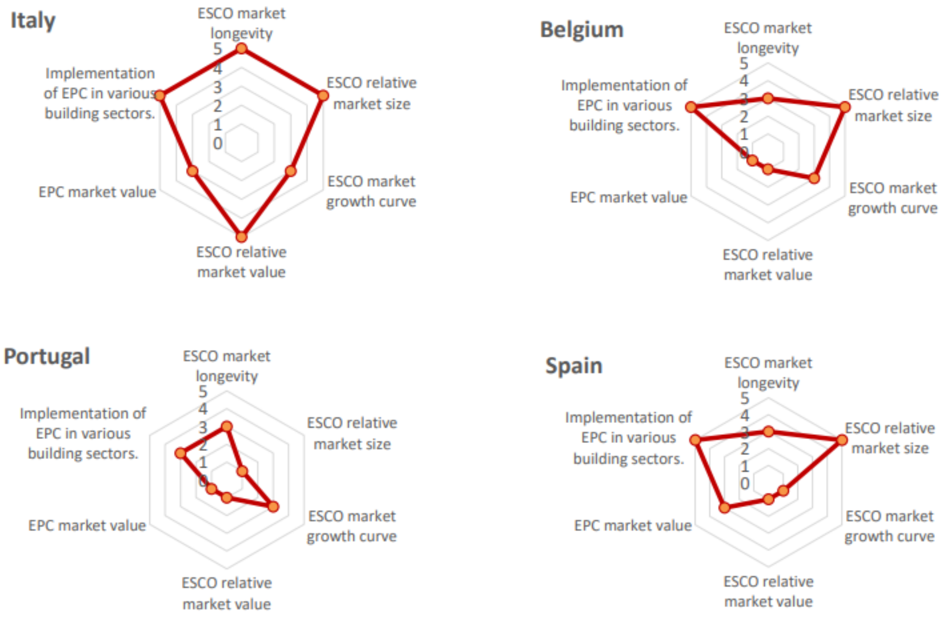

FIGURE 2: ESCO STATUS PER CONSORTIUM COUNTRY

2. **Status of demand response services**, through the analysis of the implicit demand response and main type of schemes implemented, explicit demand response and demand access to the market. This analysis aimed to understand factors such as to what extent demand is allowed as a resource within national electricity markets, independent aggregators, and regulations/policies supporting aggregation of distributed energy resources.

   In terms of demand response services offered by clusters of buildings, Belgium is the most advanced country in the consortium. The Belgian transmission grid operator has created a new framework to enable participation of new energy sources (such as demand flexibility) with new types of market players (such as aggregators). While the implementation of this framework is still ongoing, the end goal is to open up the market to a wider range of particpants (TSO/DSO, and demand response).

   Belgium is followed by Italy, which has made substantial changes to the relevant regulatory framework since 2017. The Italian Regulatory Authority for Electricity, Gas and Water undertook a complete review process of the ancillary service market, with a view towards opening up the market to new participants. By introducing the role of aggregator, this framework aims to increase the supply of network services necessary for the national electricity system while also integrating these new participants into the electricity system.

Ancillary service market (from the EU directive on common rules for the internal market for electricity) covers services necessary for the operation of a transmission or distribution system, including balancing and non-frequency services, but not including congestion management [3]. Demand-side response measures are often left out of this definition, meaning energy savings companies are not able to participate in this market.

Following successful pilot projects, regulations in Italy have been amended to allow demand-response aggregators to particate in energy markets. Additional changes were made to the regulation in 2020 relating to the pilot project, for the participation to the ancillary service market [4]. Following this measure, in December 2020, an extension of the supply term for the balancing resources by means of mixed enabled virtual units was announced [5].

In Spain and Portugal, however, significant regulatory barriers still exist that prevent demand response and asset aggregation. Figure 3 shows the analysis of the 4 countries reviewed.

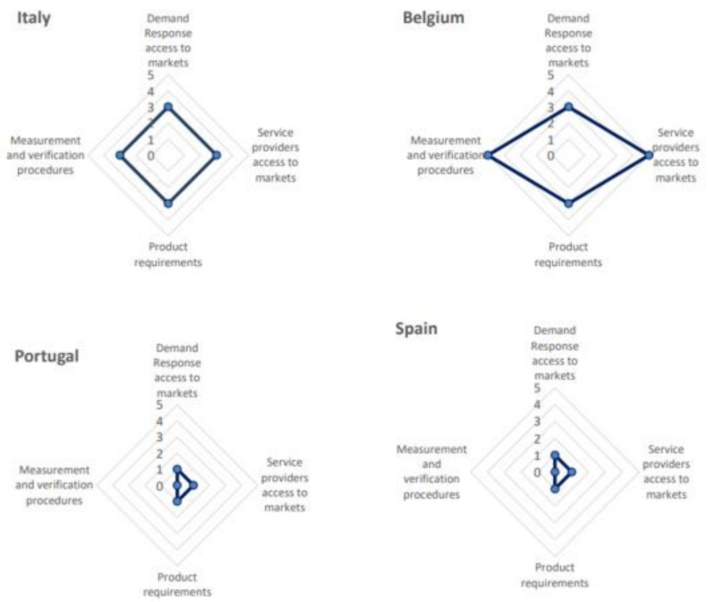

FIGURE 3: STATUS OF DEMAND RESPONSE SERVICES

3. LEARNINGS FROM CONSORTIUM COUNTRIES

Based on the country workshops, pilot projects and research conducted throughout the Ambience project, the main barriers and enablers identified in the four consortium countries are presented below. These findings were used to inform the overall policy recommendations. Additionally, they highlight trends and recurring issues across the countries surveyed (see Table 1).

TABLE 1: LEARNING FROM CONSORTIUM COUNTRIES

Consortium country	Enablers	Barriers
Italy[7]	• Strong legislative background and standards established for energy efficiency in buildings. • High competence of ESCOs – guaranteed results reassuring customers that the ESCO will only be compensated if the proposed interventions are effective and lead to energy savings.	• The frequent changing of economic and fiscal incentive schemes, which hampers long-term planning and the realisation of long-term projects. • Poor technical preparation of the company senior management and public officials – company and government decision-makers may not fully understand the profit opportunities offered by energy-saving interventions. • Contractual complexity of energy performance contracting – many technical and economic clauses regulating the remuneration and activities of the ESCO.
Portugal	• Optimisation of the potential of auto-consumption linked to local injection/supply market condition. • Regulatory changes requiring upgrading buildings with active control equipment and building management systems. • Changes to some tariffs can leverage demand response – the most important change would be the implementation of dynamic tariffs, followed by different consumption tariffs.	• Financing (access to funds) • Lack of appropriate tools to design and manage flexibility services. • Technical issues (e.g., lack of AEPC measurement and verification protocols and tools). • Lack of standard definition and framework for demand-side resources and a lack of financial incentives.
Spain	• Royal Decree 244/2019, which allows for shared self-consumption for local	• Lack of regulations for flexibility to enable innovation and demand participation to the market.

[7] Full list of barriers and solutios from the Italian workshop in ANNEX I

	distributed energy resources (with restrictions) • 01/06/2021 New hourly tariffs • Increase in electricity prices	• Limited access to the various market options for demand and distributed energy resources, with high market entrance costs. • Absence of a clear support scheme for fostering distributed energy resource penetration in the market. • Interoperability of hardware (to allow future aggregation of distributed energy resources) and cybersecurity/reliability issues • Distributed energy resources data access to third parties not possible • Lack of knowledge for changing end-user behaviour in order to provide flexibility services • Opacity of energy market and lack of confidence
Belgium	• Strong legislative background and standards established for energy efficiency in buildings. • Very high competence of ESCOs and energy performance contracting project facilitators. • National ESCO association. • Several public one-stop-shops. • Ongoing revision of the regulatory framework according to the concept of technology neutrality, to guarantee the supply of network services from the demand side and improve integration of flexible demand in the market. • Well-established regulatory framework for accepting independent aggregators and for revisions of minimum performance requirements.	• Contractual complexity of energy performance contracting. • Lack of awareness about the benefits of energy performance contracting. • Subsidy conditions focusing on input-driven methods, using technical specifications rather than functional and performance-based specifications in tenders. • Absence of historical monitoring data.

3.1 COUNTRY PILOTS

The AmBIENCe AEPC concept was developed and tested in two pilot projects – a commercial building in Portugal and a residential building in Belgium.

3.1.1 BELGIUM

The Belgian pilot, called Château Parmentier, is a single-family home (with two residents), built in 1912, located in Seneffe, Belgium depicted in Figure 4. The residential building contains 337 m^2 of heated space, of which 134 m^2 is fully and permanently heated in winter, with the rest being heat on a partial or modular basis. It is a typical example of a "maison de maître" (urban mansion), which places some major constraints on insulation from the outside for aesthetic reasons and because of urban regulations.

FIGURE 4: BELGIAN PILOT BUILDING, OVERVIEW AND GRAPHICAL REPRESENTATION

The measures implemented in the Belgian pilot are:

- Building insulation (including external roof insulation, window replacement, external wall insulation and ground floor insulation)
- An electric heat pump
- An intelligent electric vehicle charging point
- Smart equipment/energy management system and a digital smart meter.
- Solar PV

The purpose is to extend this work to become an initial AEPC, by adding and exploiting electrification of heat supply (i.e., via heat pumps) with solar PV and electric vehicle charging, as well as other appliances, allowing for flexibility.

3.1.2 PORTUGAL

The Portuguese pilot, also affiliated with one of the consortium partners, is one of the two office buildings that make up the EDP headquarters in Oporto, Portugal. Built in 2011, it has 10 floors, of which three are underground and dedicated to parking and technical areas. These include seven electric vehicle chargers installed for use by employees, with eight more planned. The two buildings together are around ~36,000 m² (18,545 m² above ground) and have a combined occupancy of 1,100 people.

There is already partially automated control of the building's consuming devices, including lighting and heating, ventilation and air conditioning (HVAC). However, to make AEPC operational requires the installation of further monitoring and control.

The building did not have any energy performance contracting implemented, but by design, various energy efficiency measures already exist in the building, such as power-driven shading blades installed on the façades and controllable lighting, via dimmers, according to external brightness. The pilot energy performance contract proposes an additional set of energy efficiency measures as well as optimisation of building assets (namely the HVAC system). The flexibility potential of the building will be calculated in relation to the cost savings of performing implicit demand response, making use of different time of use tariffs.

The measures implemented in the Portuguese pilot are:

- Increased PV generation capacity;
- Replacement of lighting with LEDs;
- Installation of variable speed drives in the chillers;
- Standby optimisation of air handling units;
- Active control of the heating and cooling to make use of time of use tariffs (smart heating/cooling).

3.2 COUNTRY FINDINGS/LESSONS LEARNED

Country workshops concluded that the increase in energy prices has increased the margins for energy management. There remains great uncertainty about how the market will evolve, and there is significant concern surrounding financial risks. Measures should be taken to create long-term market signals and provide stability for investment.

The Belgian and Portuguese pilots experienced a set of individual and shared difficulties, all of which should be taken into account for future replication. Regarding the customer acquisition process, neither pilot was willing to officially sign the contract. In the Portuguese case, this was due to a unique particularity with the building owner and ESCO being part of the same overall company. In Belgium there were several factors, related to COVID and other private issues with the building owner.

From the static and dynamic simulations and business case analysis, which is currently ongoing, both pilots identified a need to simplify/standardise the data collection/flex forecasting/modelling process, citing transparency as an important factor for the client and the ESCO to understand assumptions and risks. However, in this process there is a need to find a proper balance between a simplified model, and one that can address "bespoke" building components.

4. RECOMMENDATIONS

These recommendations are based on lessons learned through the analysis conducted throughout the project, as well as the country workshops held in Belgium, Spain, Portugal and Italy. The experience on the pilot projects also serves to inform these recommendations. While each consortium country is at a different stage in terms of the ESCO market and demand response, the recommendations are considered relevant to all countries involved, no matter the stage of development.

While all recommendations are all geared toward European and national policymaking, the following section has been split into three categories: regulatory, administrative and financial.

4.1 REGULATORY

The demand response market is complex and unique within each consortium country. Involving the right stakeholders is essential to make sure all members of the value chain are considered when addressing regulatory guidelines.

- The primary regulatory barrier identified was participation in the balancing market (this is primarily only an issue when dealing with explicit demand-response models, however). Overall, within the energy market generation is favoured over demand-response solutions. Regulatory recommendations/guidelines to address this include:
  - Conducting a national **review of energy markets (balancing, ancillary, etc.)** toward opening participation to new players (i.e., demand response and energy efficiency services). This will help national governments to understand what their unique market barriers are and where they can amend regulation to enable wider participation.
  - Based on a national review, **revising the regulatory framework for the energy market** to make it "technology neutral" and able to accept **independent aggregators.**
  - Following a review and revision, creating an **enabling framework to facilitate participation**.
- **Implementing dynamic tariffs** to increase implicit demand-response participation.
- **Ensuring clear, long-term vision** so that market players can adapt to new policies and legislation. This can be done via national long-term renovation strategies (or national building renovation plans, under the proposed Energy Performance of Buildings Directive recast). National governments should include provisions related to the demand-response market.

4.1 FINANCIAL

Finance remains an overarching issue for energy performance contracting, and therefore brings the same barriers for active energy performance contracting – the "active" part is only a minor addition to the overall investment in energy performance contracting.

- While individuals and companies can, and do, sometimes choose to arrange their own financing, a strong ESCO market is key to facilitating energy performance contracting projects due to its intermediary role. Several key financial recommendations therefore focus on the ESCO sector. A **strong ESCO market** to deliver services and finance includes:

- A strong national legislative background;
- **Transparency** in ESCO transactions;
- More **central tracking** of the size and activity of the market.

- Regardless of whether the project is funded via an ESCO or an individual, a guarantee fund can alleviate the financial risk accured during the project, enabling ESCOs or individuals/companies to engage in a contract more freely.
- A **fund to provide CAPEX/OPEX** for increased sensoring and measurement and continued support for research and development for innovative technology solutions can increase the potential success of interoperability.
- **Introduce specific financial incentives** – such as subsidies, a revolving fund, third-party financing or tax incentives. This can be done via earmarked recovery and resilience funds or national long-term recovery plans.

4.2 ADMINISTRATIVE

Technical assistance and other guidance measures, such as one-stop-shops, are essential to help navigate the regulatory, legal and financial frameworks for AEPC.

- Either **establish one-stop-shops** for energy efficiency renovation programmes or, where these already exist, provide information specific to administering AEPC. Services should be offered for a variety of stakeholders including building owners, public authorities and service providers.
- Interoperability issues are unanimously cited as a barrier across all consortium countries. Administratively, guidance is needed to encourage interoperability in order to facilitate energy management systems. Specific emphasis is needed to **simplify and standardise data collection**. There are two key policy instruments that can help this:
    - The smart readiness indicator aims to enable buildings to use information and digitalisation to suit occupant needs and link building users to the grid, while improving building energy efficiency.
        - For the smart readiness indicator, ensure a flexible EU scheme, which includes provisions for flexibility and demand response, to allow for the varying internal capabilities of Member States.
        - Tailor support plans to different Member States to facilitate relatively even implementation across countries.
    - Proper use and implementation of a **European wide digital building logbook.** A digital building logbook enables better data tracking and decision-making throughout the life cycle of a building, including the management and functioning of building components. Being able to track energy savings data and financial data in one place will in particular help the administration of energy performance contracts (and especially active contracting, since there are more components to keep track of). Specially, a digital building logbook can store data more reliably, lowering the contractual risks associated with energy performance contracting. It can also track real-time data, simplifying the monitoring process, aligning with the use of time-of-use tariffs.
        - Develop a user-friendly interface.
        - Provide a clear scope of the logbook and clear legal framework.
        - Include a process for regular data validation updates.

- Creating a standardised contract and associated documentation (which can be significantly enhanced by the use of a digital building logbook) reduces the administrative burden associated with energy performance contracting for the owner and the ESCO. The contract has associated cost and savings calculations.

5. CONCLUSIONS

Overall, the barriers associated with active energy performance contracting – primarily complex regulation, access to finance and (perceived and/or real) administrative complexity – can be addressed by these regulatory, financial, and administrative guidelines. The key recommendatiosn include:

- Conduct national reviews of the key barriers to entry of the energy markets, and plan clear, long-term policies based on new/updated policy to address barriers.
- Ensure a strong legislative framework for the ESCO market, so ESCOs can carry out AEPC projects, and provide dedicated funds for energy performance contracting projects.
- Utilise one-stop-shops, and a digital building logbook to facilitate the administrative components of the project, and ease the data collection process.

Continued support for research and innovation for new technologies and pilot projects, as well as an analysis to look into these issues, are also integral for the implementation of active energy performance contracting.

ABBREVIATIONS AND ACRONYMS

ABEPeM	Active Building Energy Performance Modelling
AEPC	Active Building EPC
DSO	Distribution system operator
EU	European Union
HVAC	Heating, ventilation, and air-conditioning
LED	Light-emitting diode
ICT	Information and communication technology
PV	Photo-voltaic
TSO	Transmission system operator

ANNEX I. BARRIERS AND SOLUTIONS FROM THE ITALIAN WORKSHOP

TABLE 2: SUMMARY OF IDENTIFIED BARRIERS AND SOLUTIONS FROM THE ITALIAN WORKSHOP

FACTOR	BARRIERS	POTENTIAL SOLUTIONS
CUSTOMER PERSPECTIVE	• Standardisation and interoperability • Lack of awareness • Lack of financial incentives	• Define use-cases with a customer-centric approach • Encourage interoperability to facilitate energy management
MARKET ACCESS	• Lack of standard definition and framework for demand-side resources and providers: o Roles and responsibilities of aggregators and demand flexibility providers o Quantification of flexibility o Data sharing procedure • Conflicts on remuneration among balancing responsible parties, retailers and demand-side flexibility providers, and its differences with generation-side flexibility • Integration of implicit and explicit demand response	• Ensure flexibility delivery by improving energy management systems and smart metering • Design a framework of interactions and roles for stakeholders • Reflect implicit and explicit demand response in the baseline methodology
DESIGN OF FLEXIBILITY AS A PRODUCT	• Lack of definition on flexibility What is the flexibility product with the attributes of change in the consumption pattern or reaction to price? What are the qualifications needed for the demand-side flexibility provider? • Short-term vs. long-term flexibility Lack of clear understanding for contribution of demand-side flexibility to the required capacity Contradictions of providing long-term availability with short-term compensation • Unclear responsibility and roles of building renovation passports	• Provide proper definition through rules and regulation improvement
AVAILABILITY OF TECHNOLOGY	• Lack of availability of measurement/metering equipment on building level • Lack of digitalisation and ICT solutions • Lack of smart appliances	• Provide CAPEX for increased sensoring and measurement • Encourage digitalisation adaptation to customer need by introducing new platforms
MEASUREMENT, VALIDATION, AND SETTLEMENT	• Baseline creation methodology Complex baseline methods Accuracy of baselines Biased baselines • Place of measurement • Information exchange for verification and settlement purposes	• Provide an adequate baseline methodology for specific flexibility resources • Standardise the requirements for metering equipment and measurements process to enable flexibility calculation
PRIVACY AND SECURITY	• Consent of consumer on accessing and analysing smart meter data	• Provide clarification on the process of flexibility calculation and deployment