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DELIVERABLE: D2.4

Catalogue of non-energy services

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Building Up Next-Generation Smart Energy Services Offer and Market Up-take Valorising Energy Efficiency and Flexibility at Demand-Side.

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Executive Summary

Document D2.4 summarizes the activities carried out under Task T.2.5, which focuses on the development of a Catalogue of Non-Energy Services for integration into smart energy efficiency (EE) services. The aim of this analysis was to identify technical solutions used within Energy Savings Performance Contracts (ESPC) to assess non-energy benefits (NEBs) that are not sufficiently described at the national or European level.

Document D2.4 summarizes the activities carried out under Task T.2.5, which focuses on the development of a Catalogue of Non-Energy Services for integration into smart energy efficiency (EE) services. The aim of this analysis was to identify technical solutions used within Energy Savings Performance Contracts (ESPC) to assess non-energy benefits (NEBs) that are not sufficiently described at the national or European level.

The main goal of the catalogue is to support providers of smart energy services in optimizing their business and financial models. By incorporating these NEB and non-energy services into their offerings, providers can diversify and enhance the value proposition of their services, which should lead to more innovative and attractive options for customers.

The catalogue provides a comprehensive overview that details and evaluates NEBs that can be transformed into services, along with other related NEBs. The primary objective of the catalogue is to support smart energy service providers in enhancing their business and financial models. By incorporating these NEBs and non-energy services into their commercial offerings, providers can diversify and improve the value proposition of their services, which is expected to lead to more innovative and attractive offers for customers. The catalogue includes not only a list of possible measures and services that meet the demand for benefits but also a basic breakdown of the services, their ratings, and benefits. This catalogue serves as the foundation for the service offerings of the energy efficiency model currently under development.

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1. Introduction

Deliverable D2.4 reflects the activities undertaken under Task T.2.5, which focuses on the development of a Catalogue of Non-Energy Benefits (NEB) and other non-energy services for integration into smart energy service packages. The deliverable results build on the work carried out in previous steps, the document is linked to previous deliverables, primarily Deliverable D2.3 Status Quo Analysis of NEBs. There, the aim was to identify technical solutions used by ESPCs (Energy Savings Performance Contracts) to assess non-energy benefits (NEBs) that are not well described at national or European level.

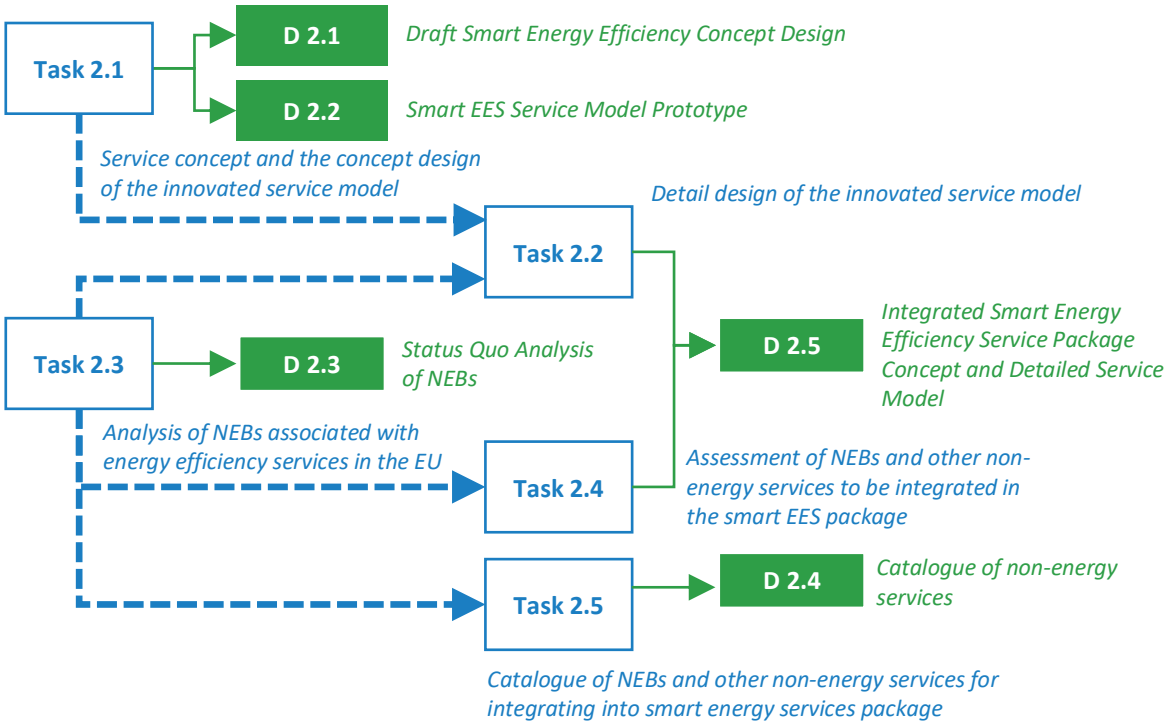

Figure 1: Diagram of the interconnection of deliverables and project tasks in WP2

This catalogue serves as a comprehensive overview that describes and evaluates in detail the NEBs that can be transformed into services, together with other related NEBs. The primary objective of this catalogue is to support smart energy service providers in enhancing their business and financial models. By incorporating these NEBs-turned-into-services and non-energy services into their commercial proposals, providers can diversify and improve the value proposition of their services. This approach is expected to result in more innovative and attractive offers for their customers.

In addition, the catalogue can play a role in engaging and educating consumers. The presentation of non-energy benefits and the related services offered will highlight the benefits and reasons for using energy services and other non-energy services in smart energy service packages. This will help to justify the added value of these services and promote better understanding and appreciation among consumers.

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2. Methods

2.1. Metrics of Comprehensive Measures and Impacts

This chapter presents an approach to developing metrics that will be used to assess the impacts of complex measures, that includes non-energy benefits (NEBs). Complex measures include a wide range of activities that aim to optimise energy services and add value to both providers and consumers. These include, for example, introducing new technologies, improving operational efficiency or increasing customer satisfaction. Evaluating these measures using appropriate metrics will provide a better understanding of their impact and effectiveness.

2.1.1. Identification of Key Indicators

The process of developing metrics will involve identifying key indicators, collecting the necessary data and establishing specific evaluation criteria. The first step in developing metrics is to identify key indicators that will serve as measures of success for each measure. These indicators should be relevant, measurable, and directly related to the project objectives. The key types of indicators used include:

Figure 2 – Key indicators for evaluation of services

Economic indicators:	Costs and savings associated with the implementation of measures, return on investment (ROI), increased revenue or reduced operating costs.
Environmental indicators:	Achieving Sustainability targets. Reduction of greenhouse gas emissions, improvement of air quality, reduction of waste production or water consumption.
Social indicators:	Improved quality of life, increased customer satisfaction, enhanced social cohesion or improved health and safety. Job Creation, Public Health
Technological indicators:	Reliability and performance of technologies, number of innovations successfully implemented, reduction in failure rates and increase in automation.
Energy indicators:	Measuring energy savings, improving energy efficiency or reducing energy consumption. The main objective is to map non-energy benefits and is providing non-energy services, but energy savings/efficiency can be a side benefit.

2.1.2. Determination of Evaluation Criteria

Once the data is collected, it is necessary to establish evaluation criteria that will allow an objective and systematic assessment of the impacts of each measure. These criteria may be quantitative or qualitative and may include:

- **Pragmatic criteria:** simplicity of implementation of the metric, repeatability of measurement, availability of the necessary data.
- **Comparative criteria:** Benchmarking against other projects or industry standards, comparison with project objectives.
- **Success criteria:** Defining thresholds for success, such as achieving a certain level of energy savings or reducing emissions by a set percentage.
- **Temporal criteria:** Evaluating impacts in the short, medium and long term, tracking changes over time.

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- **Sustainability criteria:** Consideration of long-term environmental, economic and social impacts, including their sustainability and scalability.

2.1.3. Metrics and Impact Assessments

The following list shows some of the metrics that have been used in the evaluation of non-energy benefits and non-energy services, both from a customer and provider perspective. Based on the evaluation of each service, they were added to the list and recommended as appropriate for the service model being developed.

Reduction in CO_2 emissions (tCO2e)
Evaluation of the reduction of $C0_2$ and other greenhouse gas emissions due to the implemented measures.
Return on Investment (€)
A financial indicator that measures the amount of funds have been returned/saved relative to the investment.
Customer satisfaction improvement (%)
Percentage increase in satisfaction among customers, for example through surveys or feedback.
Air Quality Improvement (ppm or µg/m^3)
Measurement of changes in air quality before and after the implementation of each measure.
Reduction of disease symptoms, increase in work productivity, etc. (number of cases)
Measure changes using statistical data to show changes in employee behaviour, performance, etc.
Energy savings (kWh or GJ)
Measuring the total reduction in energy consumption after the implementation of each measure.

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3. Catalogue of Non-Energy Services

The purpose of the catalogue is to provide a list of non-energy service packages and other services that reflect the non-energy benefits realised under the smart energy efficiency service model.

The catalogue contains not only a list of possible measures and services to meet the demand for benefits, but also a basic breakdown of the services, their ratings and benefits. The catalogue is the basis for the service offerings of the EES model under development. The services are designed to meet the customer needs identified in Deliverable D2.3 Analysis of the current state of the NEB in Chapter 5 Identification of Consumer Needs.

This chapter presents selected non-energy benefits that are consistent with and build upon the previous Deliverable D2.3 Status Quo Analysis of NEBs. Selected benefits match the focus of the proposed EE service model. The second part of the chapter describes the services offered, categorised by area of influence. Finally, the chapter concludes with a sub-description of the services in the form of a catalogue, where each service has its own sheet on which it is described in detail.

3.1. Selected Non-Energy benefits

The following list summarises selected non-energy benefits that can potentially offer benefits to the service model described in D2.5 Integrated Smart Energy Efficiency Service Package Concept and Detailed Service Model.

Benefits in Quality of the indoor environment

- **Adequate ventilation** - The correct setting up of temperatures and the reduced concentration of CO_2 and other pollutants in workspaces has a direct impact on productivity and health of the occupants.
- **Improved Indoor air quality** - Energy efficient buildings usually have better ventilation systems, reducing pollutants and allergens, which help to improve the health of its occupants. Primarily focused on improving air quality, use of existing technologies in the building, modernization, light modification)
- **Intelligent lighting control** - automation of lighting based on natural light and occupancy. Automatic dimming reduces power consumption, automatic switch-off options. Increase automation and customization to user needs.
- **Adequate lighting** - Increases the work productivity and the satisfaction of the workforce. Additionally, it improves the work environment which results in higher levels of productivity and comfort to its users.
- **Enhanced acoustic performance** - High-efficient buildings have highly insulated windows and doors not only for temperature insulation but also for to reduce the noise received from the exterior.
- **Increased comfort level** - High-efficient buildings have better insulation and high-efficient HVAC systems that can provide its inhabitants higher comfort levels. Noise level reduction by Acoustic resilient products.

Benefits in Maintenance and operation

- **Maintenance services** - Offer the possibility to repair the appliances of customers in the residential sector.

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- **Lower maintenance requirements** - The installation of high-efficiency equipment usually results in lower maintenance requirements (reduced hours/personnel used per year).
- **Reduction of equipment down-time** - The installation of high-efficiency equipment combined with an adequate maintenance plan drives to a significant reduction of equipment down-time, which results in an increase in productivity.
- **Performance monitoring and diagnostics** - Real-time monitoring of device performance for early detection of faults and equipment mal-function.

Benefits in Safety and durability

- **Enhanced security** - Smart buildings using sensors and software for automated building management including security systems, improve the inhabitant's sense of security without human intervention.
- **Reduced risk of electrical Fire** – The use of high efficiency appliances and LED lighting which tend to operate at lower temperatures and usually have enhanced safety fixtures reduces the risk of electrical fires.
- **Enhanced emergency response and resilience** – In case of natural disasters, smart buildings equipped with energy efficient equipment and advanced integrated alarm and communication systems can improve evacuation processes and emergency responses, providing real-time alerts and guidance during crises. Additionally, buildings with onsite generation and storage systems provides energy in case of power outage.
- **Installation of smoke and CO_2 detectors** - Providing early warning of danger in case of fire or poor indoor air quality.
- **Safe and resilient environment** – Enabling automatization of HVAC systems prevents the health and safety threats in case of pandemic situation and helps to keep indoor environment safe and provides health protection at work.

Benefits in Sustainability and environmental certification

- **Reduced greenhouse gas emissions** - By using less energy, energy-efficient technologies help to reduce GHG emissions, which improves air quality and reduces the impact on climate change.
- **Reduced water Use** - The use of high efficiency appliances (washing machines, dishwashers, etc.) reduces the water consumption, helping to save a valuable natural resource.
- **Increased use of renewable energy sources** - installation of solar panels or wind turbines. Increasing the self-sufficiency of renewable energy production. Reducing the cost of purchasing energy.
- **Green building certifications and corporate attractiveness** - Smart buildings often achieve certifications like LEED, BREEAM or WELL, enhancing the building's reputation and confirming built-in benefits gained during the whole life cycle of the building enhancing health, wellbeing and positive environmental aspects. The company's public image regarding sustainability and responsible practices is emphasized and it contributes for the companies to achieve their ESG goals. Moreover, smart high-efficient buildings with strong sustainability credentials attract environmentally conscious tenants, investors, and employees.

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Benefits in Services Providing Economic Advantages

- **Increased Property Value** - Energy efficient buildings are more desirable for investors and tend to have higher market value
    - Change in property price due to reconstruction
- **Access to Regulatory and Financial Benefits** - Smart energy-efficient buildings can apply, if available, for government incentives, grants, and tax benefits aimed at promoting sustainable development and reduction of the building carbon footprints.
- **Lower Insurance Premium** - Due to the enhanced security, safety, and resilience features, smart buildings may qualify for reduced insurance premiums.
    - *Savings on insurance/mortgage*
        - *In the Czech Republic, banks and financial institutions offer interest rate reductions on mortgages for buildings in energy class A or B. The amount of the rebate and other requirements for the rebate vary from institution to institution.*
        - *Along with the mortgage discount, a discount on property insurance is often offered to cover damage to photovoltaics, heat pumps or other modern technical equipment in buildings.*
        - *Current offer: ČSOB - 0.2% interest rate reduction on a property in energy class A or B, discount on the energy label of the building (30%), 30% discount on property insurance when using a mortgage.* [1]
- **Knowledge and awareness** - evaluation of the economic efficiency of energy measures. Provide customers with clear and structured information on the costs and benefits of different energy measures, making investment decisions easier.
- **Financial consulting for energy projects** - assistance in obtaining grants and financing.

Benefits in Stability and reliability

- **Enhanced Grid Stability** - The use of building energy efficient equipment, onsite generation and storage systems reduces the energy demand from the grid, which contributes for higher grid stability, especially in peak demand periods
- **Promoting decentralised energy systems** - using local energy sources to increase stability
- **Promote energy storage** - as a measure of energy independence, resilience in case of natural disasters and stability for electricity networks

Benefits in social responsibility

- **Helping to vulnerable consumers** - Education and awareness programmes - training for vulnerable groups on energy saving
- **Payment protection** - Payment insurance service is offered to allow customers to pay invoices in case of financial problems, long-term unemployment, temporary incapacity for work, unemployment

[1] https://www.csob.cz/lide/bydleni/serial/proc-energeticky-usporne-bydleni#:~:text=Na%20poji%C5%A1t%C4%9Bn%C3%AD%20m%C3%A1te%20pak%20slevu%2030%20%25%2C%20pokud,zp%C5%AFsobem%20m%C5%AF%C5%BEete%20dostat%20na%20slevu%20a%C5%BE%2018%20%25.

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3.2. Non-energy services in relation to selected non-energy benefits

The content of this chapter is a list of non-energy services that are relevant to Energy Efficiency services focusing on energy efficiency and energy flexibility. The list will become the basis for the prototype energy service model being developed, which is described in Deliverable D2.5 Integrated Smart Energy Efficiency Service Package Concept and Detailed Service Model. From there, specific services will be selected based on national requirements and in combination with the energy services offered.

Non-energy services, such as improving air quality, increasing housing comfort or supporting the local economy, play a key role in sustainable development and the overall well-being of society.

Note: Highlighted services in the following bullets indicate selected services that are described in more detail and included in the catalogue sheets.

The following inventory does not include services related to building energy efficiency, heating/cooling or water heating in buildings. Non-energy services are primarily aimed at achieving non-energy benefits, but reducing energy demand can also be a contribution. The services are categorised according to their main area of benefit.

Services in the field of Ventilation and Air condition

Effective ventilation and air conditioning systems are essential for maintaining a healthy indoor environment. Services such as ductwork design and installation, air quality monitoring, filter installation, and energy recovery ventilators ensure that air circulation is optimized, and pollutants are minimized. These services not only improve air quality, reducing allergens and harmful particles, but also enhance energy efficiency by recovering and reusing energy within the system. The benefits include increased comfort for occupants, improved health outcomes, and reduced energy costs, making buildings more sustainable and liveable.

- **Ductwork Design and Installation**
- **Improvement Air quality through Monitoring**
- **Installation of filters to improve air quality**
- **Installation of Energy Recovery Ventilators**

Services in the field of Intelligent Lighting and Control

Intelligent lighting and control systems are vital for enhancing energy efficiency and user experience in both residential and commercial spaces. Services like the installation of smart lighting systems, daylight harvesting sensors, and user customization features allow for tailored lighting solutions that adapt to the needs of the occupants. These systems not only reduce energy consumption by adjusting lighting based on natural light availability but also create a more pleasant and productive environment. The benefits include lower energy bills, increased occupant satisfaction, and a reduced carbon footprint.

- **Installation of smart lighting systems**
- **Install sensors – daylight harvesting systems**
- **Installation of smart thermostat**

Services in the field of Maintenance and Technical Services

Regular maintenance and technical services are crucial for ensuring the longevity and efficiency of building systems. Services such as maintenance and cleaning of ventilation systems, regular equipment upkeep, predictive maintenance analytics, and emergency repair services help prevent

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system failures and extend the lifespan of equipment. By proactively addressing potential issues, these services minimize downtime and repair costs, ensuring that systems operate at peak performance. The benefits include enhanced reliability, improved safety, and cost savings over time.

- **Regular equipment maintenance**
- **Predictive maintenance analytics**
- **Emergency repair services**

Services in the field of Safety and Security

Safety and security services are essential for protecting occupants and property from potential hazards. The installation of smoke and CO_2 detectors, regular testing and maintenance, user training programs, and equipment inspections ensure that safety systems are functional and effective. These services help prevent accidents and respond quickly to emergencies, creating a safer environment for everyone. The benefits include peace of mind for occupants, compliance with safety regulations, and reduced liability for property owners.

- **Installation of smoke and CO_2 detectors**
- **Regular equipment inspections and testing**

Services in the field of Renewable Energy & Sustainable Solutions

Renewable energy solutions are key to transitioning to a sustainable energy future. Services such as solar panel installation, wind turbine installation, and integration with smart grids enable buildings to harness clean energy sources. These solutions not only reduce reliance on fossil fuels but also lower energy costs and carbon emissions. The benefits include increased energy independence, potential revenue generation through energy sales, and a positive impact on the environment, contributing to global sustainability goals.

- **Renewable source installation**
- **Installation of high efficiency appliances/technologies**
- **Installation of water use reduction**

Services in the field of Decentralized Energy Systems and Storage

Decentralized energy systems and storage solutions are innovative approaches to energy management that enhance resilience and energy efficiency. Services like battery storage solutions, microgrid design and implementation, and community energy projects allow for localized energy production and consumption. These systems provide greater control over energy resources, reduce transmission losses, and support the integration of renewable energy. The benefits include increased energy security, reduced energy costs, and the ability to support community initiatives focused on sustainability.

- **Battery storage solutions**
- **Microgrid design and implementation**
- **Community energy projects**

Services in the field of Support for Electromobility

Support for electromobility is essential for promoting sustainable transportation solutions. The installation of EV charging stations facilitates the adoption of electric vehicles, making them more accessible to consumers. This service not only supports the transition to cleaner transportation but also helps reduce greenhouse gas emissions and air pollution. The benefits include improved public

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health, enhanced infrastructure for electric vehicles, and alignment with global efforts to combat climate change.

- **Installation of EV charging stations**

Services in the field of Payment Protection and Support for Vulnerable Groups

Payment protection and support services are crucial for assisting vulnerable populations in managing their energy costs. These initiatives help prevent energy poverty and promote social equity. The benefits include improved quality of life for vulnerable groups, reduced financial stress, and a more inclusive approach to energy access.

- **Monitoring and reporting**
- **Implementation of payment assistance programs**

Services in the field of Sustainability Consulting and Certifications

Sustainability consulting and certification services are vital for organizations seeking to improve their environmental performance. Services such as sustainability assessments, preparation for certification applications, and workshops on sustainable practices provide valuable insights and guidance. These services help organizations identify areas for improvement, achieve recognized certifications, and implement best practices. The benefits include enhanced reputation, increased operational efficiency, and compliance with regulatory requirements, all contributing to a more sustainable future.

- **Sustainability assessments**
- **Preparation for certified applications**

Services in the field of Financial Consulting for Energy Projects

Financial consulting for energy projects is essential for ensuring the viability and success of sustainability initiatives. Services such as cost-benefit analysis, grant application assistance, and financial modelling for energy investments provide organizations with the tools they need to make informed financial decisions. These services help identify funding opportunities, assess project feasibility, and optimize investment strategies. The benefits include improved financial performance, access to funding, and the ability to implement impactful energy efficiency projects.

- **Cost-benefit analysis for energy projects**
- **Grant application assistance**
- **Financial modelling for energy investments**

Services in the field of Education and Awareness Programs

Education and awareness programs are crucial for fostering a culture of sustainability and energy efficiency. These programs raise awareness of the importance of energy conservation and sustainable practices. The benefits include increased community involvement, enhanced knowledge, and a collective effort towards achieving energy efficiency goals.

- **Workshops on energy efficiency**
- **Development of educational materials**

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3.3. Catalogue sheets

The following sheets expand on the list of services in the previous subsection and go into more detail about each individual service.

Non-energy services are described in detail and analysed from several perspectives. The services correspond to the set criteria, which are specified in more detail in the previous deliverables D2.2 and D2.1. Households are primarily considered as the end user of the service. Service providers should be EES providers or aggregators. Services are categorized as: economic, environmental, social and community, business and operations, educational or other. This classification is important because it allows for a better understanding of what type of benefits the service provides and how it can be integrated into broader sustainable development strategies.

In addition, the following points are elaborated for each service: the timeframe for implementation and the costs or investments required will also be important aspects to provide an overview of the financial and time requirements for each service. This information will help stakeholders to make better decisions and plan their resources. Other important elements will be the identification of potential sources of income and methods for measuring and verifying the effectiveness of services, including the output indicators to be monitored.

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Non-energy service table No. 1 - Ductwork design and installation

No.:	Non-energy service name:
01	**Ductwork Design and Installation**

Category:

☒	☒	☒	☐	☐	☐
Economic	*Environmental*	*Social and community*	*Business and Operational*	*Educational*	*Other*

Service detail description:	Service aims at optimising ventilation systems in work areas to ensure a healthy and productive environment for employees. This service includes analysis of the current state of ventilation, design and implementation of effective solutions to improve air quality and reduce the concentration of CO_2 and other pollutants.
Implementation strategies:	**Assessment of the current situation**: An analysis of the existing condition will be performed, which will include an examination of the existing technology, a review of the current ventilation system, and a determination of whether it meets air quality requirements. **Air Quality Measurements**: Meters will be installed to measure the levels of CO_2, particulate matter and other pollutants in the work areas. The installed meters will be used to measure the air quality in the monitored areas. **Suggested improvements**: Based on the measurements, modifications such as increasing airflow or installing new ventilation units will be proposed. **Maintenance and cleaning**: A regular maintenance plan for the ventilation system, including filters and ducts, will be proposed to ensure their efficiency.
Related benefits:	Adequate ventilation - Adequate ventilation is a key factor in maintaining a healthy working environment. Properly set temperatures and optimal ventilation levels contribute to better concentration, reduced fatigue and improved overall employee well-being. The correct setting up of temperatures and the reduced concentration of CO_2 and other pollutants in workspaces has a direct impact on productivity and health of the occupants

Timeframe for implementation:

Installation time:

The installation time depends on the scope of the object for which it is carried out. For a classic Family house, a time scale of 1 week (Analysis, installation and testing) can be calculated

Expected results:

Short-term results: Improvements in air quality may be noticed within days to weeks after installation, especially if significant modifications have been made to the ventilation system.

Long-term results: Permanent improvements in productivity and health of building occupants can be observed within 1-3 months.

Costs/investments needed:

Personnel costs: analysis and planning, air quality measurement, solution design, ventilation system installation

Material costs: Mechanical ventilation, ventilation system components, construction work

Revenue streams:

Revenue from the sale of the analysis of the existing situation and the sale of the proposal
Revenue from the sale and installation of air/recuperation units and other ventilation equipment.
Revenue from regular maintenance and servicing of installed systems.
Revenue from consultancy services in the field of air quality optimisation and energy efficiency.

Measurement and verification +	Monitoring the concentration level of harmful substances (CO_2)

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Monitored output indicator	
Policy Implications and Recommendations: *Links to policy, legislation, incentives or support mechanism.* *Czech Republic: ČSN EN 16798, Standard for Energy performance of buildings – Building ventilation*	
Resources and References	*General sources of information on this benefit* *- Research papers* *- Industry reports* *- Websites and organizations*
Case studies and best practice:	*Case studies, where this benefit was used or was quantified* *- Overview of successful projects with NEB* *- Detailed descriptions of each case* *- Quantified benefits achieved* *- Lessons learned*

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Non-energy service table No. 2 - Installation of smart air quality meters

No.: 02	**Non-energy service name:** **Installation of smart air quality meters**
Category: ☐ *Economic* ☒ *Environmental* ☐ *Social and community* ☒ *Business and Operational* ☐ *Educational* ☐ *Other*	
Service detail description:	This service involves the installation of devices that monitor air quality in real time and provide pollution data. Connection to the HVAC system - increase indoor air quality, reduce heat loss through unnecessary ventilation, ensure sufficient air quality for a healthy indoor environment.
Implementation strategies:	The first step is to analyse the existing air quality in the building and identify areas that need improvement. Goals such as monitoring pollutant levels (e.g. CO_2, dust, VOCs) and ensuring a healthy indoor environment are set. Mounting of meters at designated locations, connection to the electrical system and setting up communication protocols for data transmission, if necessary, shall be performed. Once installation is complete, testing and commissioning is carried out.
Related benefits:	**Real-time monitoring**: allows you to monitor air quality in real time, helping quickly identify and respond to problems. **Improving health and wellbeing**: Accurate measurement of pollutants contributes to better health for residents and workers, which can reduce sickness and absenteeism. **Data for decision-making**: It provides valuable data for analysis and decision-making on improving indoor environment and energy efficiency. **Automation and integration**: Meters can be integrated into smart building management systems, increasing efficiency and reducing energy costs.
Timeframe for implementation: Installation time: 1-2 days (depending on the number of meters and the complexity of the installation). Expected time for results: 1-2 weeks (after installation, the meters will start providing data immediately, but for trend analysis and air quality assessment it is recommended to monitor the data for at least 1-2 weeks).	
Costs/investments needed: Staff costs: Installation technicians (1-2 technicians for 1-2 days), Data analysis expert Cost of materials: Smart air quality meters, Accessories (cables, mounting material)	
Revenue streams: *Sales and installation: revenue from the sale and installation of smart air quality meters for homes and commercial buildings.* *Maintenance and service: regular maintenance and servicing of meters, including battery replacement and calibration.* *Data analysis: Offer air quality data analysis and reporting services, which may include monthly or quarterly reports to customers.*	
Measurement and verification + Monitored output indicator	Air quality (CO_2 levels, dust particles, VOCs, etc.) Comparison of measured values with recommended air quality standards (e.g. WHO).

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Non-energy service table No. 3 - Installation of filters to improve air quality

No.: 03	**Non-energy service name:** **Installation of filters to improve air quality**
Category: ☒ *Economic* ☒ *Environmental* ☐ *Social and community* ☐ *Business and Operational* ☐ *Educational* ☐ *Other*	
Service detail description:	The service will provide installation of air filters and other technologies to improve air quality and cleanliness.
Implementation strategies:	First, an analysis of existing air quality and identification of pollutants is performed, followed by an implementation plan that specifies the type of filters, timeline and budget. The necessary resources, including finance and technology, are then secured and the installation of filters in existing ventilation systems proceeds. After installation, testing and monitoring of filter efficiency and air quality will be carried out, taking into account feedback from stakeholders for possible adjustments and optimisation of the system.
Related benefits:	**Improved air quality**: filters effectively remove dust, allergens and other pollutants, contributing to a healthier indoor environment. **Reducing health risks**: improving air quality can reduce the risk of respiratory illnesses and allergies, leading to better overall well-being for residents. **Energy efficiency**: High-quality filters can improve the efficiency of ventilation systems, leading to lower energy costs. **Long equipment life**: Regular maintenance and filter changes extend the life of ventilation and air conditioning systems.
Timeframe for implementation: Installation time: 1-3 days (depending on the number of filters and the complexity of the ventilation system). Expected time for results: 1-4 weeks (results of air quality improvements can be seen almost immediately, but monitoring for 1-4 weeks is recommended to fully evaluate the effectiveness of the filters and their impact on occupant health).	
Costs/investments needed: **Staff costs**: Installation technicians to install filters in ventilation systems, Experts to assess the system if existing systems need to be analysed **Material costs**: Filters of various types (e.g. HEPA, carbon) to improve air quality, Accessories such as mounting materials and gaskets	
Revenue streams: *Sales and installation: revenue from the sale and installation of various types of filters to improve indoor air quality.* *Maintenance and replacement of filters: Regular maintenance and replacement of filters, which may include maintenance contracts at regular intervals.* *Consultation and advice: Providing advice on the most appropriate filters and systems for specific customer needs.*	
Measurement and verification + Monitored output indicator	Filter efficiency (reduction of pollutant levels) - Measurement of pollutant concentrations before and after installation of filters. Comparison of results with air quality standards.

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Non-energy service table No. 4 - Installation of energy recovery ventilators

No.:	Non-energy service name:
04	**Installation of Energy Recovery Ventilators**

Category:

☒	☒	☐	☐	☐	☐
Economic	*Environmental*	*Social and community*	*Business and Operational*	*Educational*	*Other*

Service detail description:	Installing energy recovery ventilators involves installing equipment that efficiently uses the heat from the exhaust air to heat or cool fresh air, thereby reducing heating/cooling costs and improving the energy efficiency of buildings. This technology is key to ensuring a healthy indoor environment as it allows fresh air to be supplied without significant energy loss. Heat recovery units are particularly useful in passive and low-energy houses where it is important to minimise energy loss.
Implementation strategies:	The first step is to analyse the existing ventilation and heating system in the building. Goals such as reducing energy costs, improving air quality and increasing occupant comfort are established. Once the installation is complete, testing and commissioning is carried out. Key indicators such as heat recovery efficiency; air quality and energy consumption are monitored. Based on this data, any adjustments and optimisations to the system are made**.**
Related benefits:	**Improving air quality**: Ensuring fresh air and removing pollutants from indoors. **Environmental benefits**: Reduction of CO_2 and other greenhouse gas emissions through lower energy consumption. **Increased comfort**: Maintaining a stable temperature and humidity indoors, contributing to occupant comfort. **Energy savings**: Reduce heating and cooling costs through efficient use of heat.

Timeframe for implementation:

Installation time: 3-7 days (depending on the size of the building and the complexity of the system).

1-3 months (after installation, energy savings and air quality improvements may be noticeable, but to fully evaluate the system's effectiveness and its impact on energy costs, it is recommended to monitor results for 1-3 months).

Costs/investments needed:

Staff costs: Installation technicians to carry out the installation of the heat recovery ventilators, System design experts, if there is a need to design the optimal solution.

Material costs: Energy recovery ventilators that provide efficient air exchange, Accessories such as ducts, mounting material and insulation.

Revenue streams:

Sales and installation: income from the sale and installation of heat recovery ventilators and related systems.
Maintenance and servicing: Regular maintenance and servicing of heat recovery systems, including inspections and repairs.
Energy consultancy: Provision of advice on energy efficiency and optimisation of systems to reduce energy costs.
Financial modelling and analysis: Offering financial modelling and ROI analysis services for heat recovery systems.

Measurement and verification + Monitored output indicator	Stability of indoor air temperature - reduction of cold fresh air flow. Energy benefits - reduced heating and cooling costs

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Non-energy service table No. 5 - Installation of smart lighting systems

No.:	Non-energy service name:
05	**Installation of Smart Lighting Systems**

Category:

☐	☒	☒	☒	☐	☐
Economic	*Environmental*	*Social and community*	*Business and Operational*	*Educational*	*Other*

Service detail description:	Installing smart lighting involves the process of introducing advanced lighting that can be controlled by mobile apps, voice assistants or automated systems. These systems allow users to customize lighting to their needs and preferences, increasing comfort and energy efficiency.
Implementation strategies:	1. Consultation and needs analysis 2. System design - Based on the analysis, create an individual smart lighting design that includes: component selection, System architecture 3. Installation of equipment - Technicians carry out the installation of selected components 4. Configuration and integration 5. Testing and training 6. Maintenance and support
Related benefits:	**Increased comfort**: Lighting control via mobile apps or voice assistants provides easy and convenient access to lighting throughout the home. Users can easily change the intensity and colour of light to suit their needs. Personalisation and ambience. The ability to change the colour and intensity of the light helps to create a pleasant atmosphere in the home or office. **Safety and security**: Smart lighting systems can be integrated with security features such as motion sensors and automatic lighting when motion is detected. This increases home security and deters potential thieves. **Energy saving**s: smart lighting enables efficient management of energy consumption. Users can set schedules, automate turning lights off and on, and use motion sensors, resulting in lower energy costs.

Timeframe for implementation:

The installation time for smart lighting is usually between 2 and 6 hours, depending on the size of the space, the complexity of the system and any preparatory work such as additional electrical modifications. Once installation is complete, the system is usually operational immediately, allowing users to start using the basic functions. To take full advantage of advanced features and automation, it is recommended to spend 1 to 2 hours setting up applications and integrating with smart assistants, as well as spending several days testing different scenarios to optimize the system.

Costs/investments needed:

Staff costs: Personnel costs include salaries and bonuses for technicians and specialists who carry out the installation and configuration of the smart lighting.

Material costs include all components needed to install smart lighting. Smart bulbs and LED lighting: cost varies by brand, type and features (e.g. dimming, colour changing). Controls: cost of smart switches, dimmers and motion sensors. Installation materials: cables, connectors, mounting elements and other necessary accessories. Software and apps: If required, purchase of licences for specialist lighting control software.

Revenue streams:

The main source of income for the service provider is the fees for the installation of smart lighting. These fees can be charged on an hourly basis or as a fixed price per project, depending on the scope and complexity of the installation.

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The service provider may also generate revenue by selling components needed for installation, such as smart bulbs, controls, and other installation materials. In this way, they can offer complete packages to customers, increasing the overall value of the service. *Once installed, providers can offer maintenance and technical support services that include regular checks, software updates and troubleshooting assistance. These services may be charged on a monthly or annual subscription basis.*	
Measurement and verification **+** **Monitored output indicator**	Lighting level: Measurement of lighting intensity in lux to ensure it meets user requirements. Frequency of use: Monitoring the time and frequency of use of individual light sources. Energy savings: measure the reduction in energy consumption in kilowatt hours (kWh) after installation. Before and after comparison: Comparison of energy consumption and lighting level data before and after installation. Sensor metering: Use of sensors to monitor energy consumption and lighting levels in real time. User data analysis: Collecting and analysing lighting usage data through applications and control systems.

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Non-energy service table No. 6 - Install sensors – Daylight harvesting systems

No.: 06	Non-energy service name: **Installation of sensors – Daylight Harvesting Systems**

Category:

☒ Economic	☒ Environmental	☐ Social and community	☒ Business and Operational	☐ Educational	☐ Other

Service detail description:	**Definition**: Daylight harvesting systems optimize the use of natural daylight in indoor spaces by adjusting artificial lighting levels automatically. **General Description:** These systems use sensors to measure light levels in real time and control lighting fixtures accordingly. Components often include daylight sensors, dimming ballasts, and control systems integrated with building automation. **Examples:** Office buildings with sensor-based lighting adjustments near windows. Schools using daylight harvesting to create productive learning environments. Warehouses reducing overhead lighting when adequate daylight is present
Implementation strategies:	**Steps to Integrate:** Conduct a site assessment to determine daylighting potential. Design a system layout, including sensor placement and controls. Procure necessary materials and equipment. Install and test the system to ensure optimal functionality**.** **Stakeholder Engagement:** Engage building owners, tenants, and facility managers early in the planning phase. Provide training sessions for end-users on system operation and benefits. Collaborate with local authorities and energy consultants to align with regulations**.** **Reporting and Communication:** Develop a project implementation timeline and milestones. Share regular progress updates with stakeholders. Document and report energy savings and system performance post-installation.
Related benefits:	Energy Efficiency: Reduction in energy consumption and utility costs. Health Improvements: Enhanced circadian rhythm regulation, reducing eye strain and improving mood. Sustainability: Lower carbon footprint and alignment with green building standards. Productivity Gains: Improved lighting quality fosters better performance and focus in work or learning environments.

Timeframe for implementation:

Installation Time
Typically takes 1-4 weeks for small to medium-sized facilities.
Larger buildings may require up to 2-3 months.
Expected Time for Results
Energy savings can often be observed within the first billing cycle post-installation.
Full ROI (Return on Investment) is typically achieved in 2-5 years, depending on the scale and usage.

Costs/investments needed:
Personnel Costs: Installation team (electricians, technicians): depending on project size.
Ongoing maintenance costs.
Material Costs
Sensors
Dimming ballasts
Control systems

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Revenue streams: *For the Service Provider* *Sale of daylight harvesting equipment and systems.* *Maintenance contracts and ongoing support.* *lighting as a service* *For Beneficiaries* *Energy savings realized by building owners or tenants.* *Potential tax incentives or rebates for implementing energy-efficient technologies.*	
Measurement and verification + Monitored output indicator	Monitored Output Indicator: Energy savings (kWh reduction) compared to baseline consumption. Improved lighting quality metrics (e.g., lux levels). Methods or Approaches to Quantify Results: Pre- and post-installation energy audits. Use of energy management software to track savings. Available Tools and Software: Building management systems (BMS). Best Practices for Measurement and Verification Requirements: Establish baseline lighting energy consumption before installation. Regularly calibrate sensors to ensure accuracy. Conduct periodic energy performance reviews
Policy Implications and Recommendations: *Promote subsidies or tax rebates for adopting daylight harvesting systems.* *Mandate inclusion of daylight harvesting in building codes for new constructions.* *Encourage public-private partnerships to advance implementation in schools, offices, and public spaces.* *Support educational initiatives on the benefits of daylight harvesting for stakeholders.*	
Resources and References	1. International Energy Agency (IEA): International Energy Agency (IEA): Daylighting Best Practices. https://www.iea-ebc.org/Data/publications/EBC_Annex_29_PSR.pdf 2. Xiujie Li, Yeyan Wei, Junbin Zhang, Peng Jin, Design and analysis of an active daylight harvesting system for building, Renewable Energy, Volume 139, 2019, Pages 670-678, ISSN 0960-1481, https://doi.org/10.1016/j.renene.2019.02.097. 3. L.T. Doulos, A. Kontadakis, E.N. Madias, M. Sinou, A. Tsangrassoulis, Minimizing energy consumption for artificial lighting in a typical classroom of a Hellenic public school aiming for near Zero Energy Building using LED DC luminaires and daylight harvesting systems, Energy and Buildings, Volume 194, 2019, Pages 201-217, ISSN 0378-7788, https://doi.org/10.1016/j.enbuild.2019.04.033.
Case studies and best practice:	1. Integrating daylighting and lighting in practice, IEA SHC Task 61 / EBC Annex 77: Integrated Solutions for Daylighting and Electric Lighting Lessons learned from international case studies, IEA SHC Task 61 / EBC Annex 77: Integrated Solutions for Daylighting and Electric Lighting (https://task61.iea-shc.org/Data/Sites/1/publications/IEA-SHC-Task61--Technical-Report-D3-D4-Integrated-Solutions-for-Daylighting-and-Electric-Lighting.pdf)

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Non-energy service table No. 7 - Installation of smart thermostat

No.:	Non-energy service name:
07	**Installation of Smart Thermostat**

Category:

☒	☒	☒	☐	☐	☐
Economic	*Environmental*	*Social and community*	*Business and Operational*	*Educational*	*Other*

Service detail description:	Definition: Smart thermostats can measure and adjust indoor temperature automatically, leading to improved comfort for residents by maintaining an optimal environment. General description / brief explanation: The device learns user preferences and schedules, optimizing temperature control for comfort. It can reduce the frequency of manual adjustments, which enhances living conditions. Examples: A smart thermostat can automatically lower the temperature during sleep or when the house is empty, creating a comfortable environment upon the resident's return.
Implementation strategies:	Steps to integrate NEBs into project planning: It will be a part of all Voltalis installations for demand response as the smart thermostat is used to measure and control indoor temperature. Reporting and communication of NEBs: Temperature can be monitored using connected platform as well as MyVoltalis application where Iit can be viewed by the client. This can act as a key feature in marketing materials and project reports.
Related benefits:	Smart thermostats automatically maintain the optimum temperature, ensuring a pleasant and comfortable environment for residents. The device learns users' preferences and schedules, allowing the temperature to be tailored to individual needs and habits. Automatically lowering the temperature when the house is unoccupied or during sleep can lead to significant energy savings and reduced heating and cooling costs. Maintaining a stable and comfortable temperature contributes to the health and well-being of occupants, which can have a positive impact on their productivity and overall quality of life. Minimizing the need for manual temperature adjustments simplifies use and increases occupant comfort.
Timeframe for implementation: Date from which the benefit will be counted: Temperature values can be viewed as soon as the device is installed and connected.	
Costs/investments needed: The costs are associated with the installation of the equipment, the cost of materials and the cost of wages for the installers.	
Revenue streams: *Direct payment for installation and sale of equipment.* *or* *Regular payment for equipment rental (installation and possible dismantling included in the regular fee)*	
Measurement and verification **+** **Monitored output indicator**	This benefit is hard to monetize directly. Quantification and Valuation of NEBs: - Tools and software available: Voltalis Control Platform, MyVoltalis Application. - Best practices for measurement and verification: Ensure regular maintenance and updates to the thermostat software to maintain accuracy in humidity control. As per the comfort temperature specified by the user
Policy Implications and Recommendations:	
Resources and References	Based on Temperature and Humidity for Smart Energy Systems. Sensors 2012, 12, 13458-13470. https://doi.org/10.3390/s121013458

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Case studies and best practice:	ADEME (French Agency for Ecological Transition) explores residential electricity load shedding. This is achieved by temporarily reducing electricity consumption across many homes. Smart thermostat is installed in homes measures and controls energy usage in real-time. It can be remotely operated by an external operator to manage and reduce consumption during peak demand periods, helping to stabilize the grid. The case study is based the data collection and analysis from 2800 users of the technology. It highlights the potential of smart thermostat-like devices in contributing to energy efficiency and grid stability. Link: Enjeux (ademe.fr)

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Non-energy service table No. 8 - Regular equipment maintenance

No.:	Non-energy service name:
08	**Regular Equipment maintenance**

Category:

☐	☒	☒	☐	☐	☐
Economic	*Environmental*	*Social and community*	*Business and Operational*	*Educational*	*Other*

Service detail description:	Inspecting existing equipment, creating a schedule, performing regular inspection and maintenance as required. Customers have the ability to order when their equipment needs to be repaired either for a breakdown or an annual maintenance revision is managed to check that it is working properly.
Implementation strategies:	Appliance maintenance will be carried out for customers who have an agreed maintenance service. A maintenance schedule will be scheduled and implemented on an ongoing basis. Definition: Maintenance services prevent and repair breakdowns of electrical appliances or particular equipment to maintain their optimum performance. - Examples: A customer pays a monthly fee upon which has the right to repair or revise an appliance or equipment. This provides a security on the performance of the equipment and ensures required reparation a short period of time.
Related benefits:	Increase equipment life: Regular maintenance helps extend the life of equipment by preventing wear and tear and breakdowns, reducing the need for frequent replacements. Improved performance: Maintained equipment typically operates more efficiently, which can lead to better performance and increased productivity. Reduced repair costs: Regular maintenance can detect potential problems before they become serious, reducing repair costs and unplanned downtime. Increased safety: Maintained equipment is less prone to breakdowns, increasing user´s safety and reducing the risk of accidents.

Timeframe for implementation:

The maintenance services can be used as soon as the customer is registered as an energy customer with Plenitude

Costs/investments needed:

Costs are primarily associated with human resources. Material costs can be divided into two systems, where the customer has repairs to damaged equipment included, or a cheaper service where only inspection is provided and if repairs are needed, the cost of the repair is charged. Cost of measuring and diagnostic instruments.

Revenue streams:

The customer will pay a monthly fee for the service provided

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Non-energy service table No. 9 - Predictive maintenance analytics

No.: 09	**Non-energy service name:** **Predictive Maintenance Analytics**
Category: ☒ *Economic* ☒ *Environmental* ☐ *Social and community* ☒ *Business and Operational* ☐ *Educational* ☐ *Other*	
Service detail description:	**Definition:** Predictive maintenance in buildings involves using data analytics and IoT technology to monitor the performance of building systems and predict potential issues before they occur. **General Description:** This approach integrates sensors, building management systems (BMS), and machine learning to gather and analyze real-time data. Predictive models identify anomalies and provide actionable insights, enabling proactive maintenance of HVAC systems, elevators, lighting, and other critical components. **Examples:** 1.Monitoring HVAC system performance to prevent energy inefficiency or breakdowns. 2.Using vibration analysis for elevator motor maintenance. 3.Predicting wear and tear in heatting/heat pump systems based on usage patterns.
Implementation strategies:	**Steps to Integrate:** Conduct an assessment of critical building systems and maintenance needs. Deploy IoT sensors on HVAC, elevators, and other key equipment. Set up data collection and analytics systems within the BMS. Train facility staff to use analytics tools effectively. **Stakeholder Engagement:** Collaborate with building owners, operators, and tenants to identify priorities. Engage technology providers for seamless system integration. Communicate the long-term benefits of predictive maintenance to all stakeholders. **Reporting and Communication:** Create dashboards for real-time tracking of system performance. Share periodic updates on cost savings and system reliability. Document and disseminate success stories to promote adoption.
Related benefits:	Cost Savings: Reduction in emergency repair costs and energy bills. Enhanced Safety: Prevents equipment failures that could endanger users. Improved Comfort: Maintains consistent indoor climate and living conditions. Sustainability: Aligns with energy-saving goals and reduces the building's carbon footprint.
Timeframe for implementation: Installation Time Small buildings: 2-4 weeks for sensor installation and system setup. Large commercial buildings: 2-3 months, depending on system complexity. Expected Time for Results Initial insights available within weeks of implementation. ROI typically achieved in 1-2 years depending on project and scope of the equipment.	
Costs/investments needed: Personnel Costs Facility management staff trained in predictive maintenance tools. IT professionals for system integration and data analysis. Material Costs Sensors for HVAC, elevators, and heat pump Analytics software cost IoT devices and network infrastructure.	

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Revenue streams: *For the Service Provider:* *Subscription fees for predictive maintenance platforms or maintenance-as-a-service.* *For building owner:* *Reduced energy bills and maintenance costs.*	
Measurement and verification **+** **Monitored output indicator**	Monitored Output Indicator 1. Reduction in emergency repairs and associated downtime. 2. Improved energy efficiency metrics (e.g., lower kWh consumption). Methods or Approaches to Quantify Results 1. Comparing pre- and post-implementation maintenance and energy costs. 2. Real-time monitoring of system performance metrics. Available Tools and Software 1. Honeywell Forge for Buildings, Siemens Desigo, and Johnson Controls Metasys. 2. Open-source platforms like Grafana for custom analytics dashboards. Best Practices for Measurement and Verification 1. Calibrate sensors regularly to ensure accurate data collection. 2. Use predictive analytics models that are tailored to specific building systems. 3. Perform periodic audits to verify performance improvements.
Policy Implications and Recommendations: *Promote inclusion of predictive analytics in smart building certifications.* *Support training programs for facility managers and building operators on advanced maintenance techniques.*	
Resources and References	1. Predictive Maintenance Assessment Guidelines, https://www.epri.com/research/products/TR-109241 2.https://www.rehva.eu/rehva-journal/chapter/thermography-predictive-maintenance-technology-for-hvac-system-reliability-and-safety-improvements
Case studies and best practice:	1. Niima Es-sakali, Moha Cherkaoui, Mohamed Oualid Mghazli, Zakaria Naimi, Review of predictive maintenance algorithms applied to HVAC systems, Energy Reports, Volume 8, Supplement 9, 2022, Pages 1003-1012, ISSN 2352-4847, https://doi.org/10.1016/j.egyr.2022.07.130. 2. https://sera.tech/blog/hvac-predictive-maintenance 3. C. Nzukam, D. Sauter, A. Voisin and E. Levrat, ""Performances evaluation in view of Predictive Maintenance – A case study,"" 2019 4th Conference on Control and Fault Tolerant Systems (SysTol), Casablanca, Morocco, 2019, pp. 226-231, doi: 10.1109/SYSTOL.2019.8864798 Add to Citavi project by DOI. keywords: {HVAC;Degradation;Buildings;Predictive maintenance;Monitoring;Market research},

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Non-energy service table No. 10 - Emergency repair services

No.:	Non-energy service name:
10	**Emergency Repair Services**

Category:

☒	☒	☒	☐	☐	☒
Economic	*Environmental*	*Social and community*	*Business and Operational*	*Educational*	*Safety*

Service detail description:	**Definition** Emergency repair services involve rapid response solutions to fix critical failures in systems, infrastructure, or equipment to prevent further damage and ensure continuity. **General Description** These services encompass various sectors, including electrical, plumbing, HVAC, and structural repairs. They typically operate 24/7 and require specialized personnel, tools, and logistics for immediate response. **Examples** HVAC or Heat pump repair during extreme weather conditions. Emergency plumbing services for burst pipes. Electrical repairs following power outages.
Implementation strategies:	**Steps to Integrate:** Conduct risk assessments to identify critical repair needs. Establish partnerships with emergency repair service providers. Deploy digital tracking systems for response coordination. **Stakeholder Engagement:** Involve facility managers, technicians, and policymakers. Collaborate with insurance firms for coverage integration. Communicate best practices to end-users for preventive maintenance. **Reporting and Communication:** Develop emergency response dashboards. Publish performance metrics and response time reports. Maintain transparent communication with service users and regulatory bodies.
Related benefits:	Cost Efficiency: Prevents high-cost breakdowns by addressing issues early. Safety Enhancement: Reduces risks associated with faulty equipment. Business Continuity: Ensures minimal disruption to operations. Sustainability: Supports energy-efficient and durable repair solutions.

Timeframe for implementation:

Installation Time
Immediate to a few hours, depending on repair complexity.
Expected Time for Results
Immediate benefits in restoring function.
Long-term impact through improved maintenance practices.

Costs/investments needed:
Personnel Costs
Skilled labour for emergency repair teams.
On-call technicians for 24/7 availability.
Material Costs
Replacement parts and repair tools.
Diagnostic and monitoring equipment.

Revenue streams:
For the Service Provider
Service fees for emergency repairs.
Subscription-based maintenance contracts.
Partnerships with insurance companies.

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For Dwellers *Reduced operational losses due to swift repair solutions.* *Lower costs on long-term equipment replacement.*	
Measurement and verification **+** **Monitored output indicator**	Response Time: Measures the time from the receipt of a repair request to the arrival of a technician on site. Repair Time: Measurement of the time required to complete the repair from the start of the job to its completion. Repair success rate: The percentage of repairs that were successfully completed on the first attempt without the need for follow-up intervention.
Policy Implications and Recommendations: *Encourage regulatory frameworks for emergency repair service standards.* *Implement mandatory service level agreements (SLAs) for essential repair services.*	
Resources and References	1. Hall, F., & Greeno, R. (2023). Building Services Handbook (10th ed.). Routledge. https://doi.org/10.1201/9781003434894 Add to Citavi project by DOI
Case studies and best practice:	1. Service/ Type of Work: Emergency Response, System Replacement, and Sustainable Heating Solution, https://dmgdelta.co.uk/kingston-riverside/

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Non-energy service table No. 11 - Installation of smoke and CO_2 detectors

No.:	Non-energy service name:
11	**Installation of Smoke and CO_2 Detectors**

Category:

☐	☒	☒	☐	☐	☐
Economic	*Environmental*	*Social and community*	*Business and Operational*	*Educational*	*Safety*

Service detail description:	**Definition** Smoke and CO_2 detectors are safety devices that monitor air quality to detect smoke (indicating fire) and dangerous levels of carbon monoxide (CO_2), triggering alerts to prevent harm. **General Description** These detectors use sensors to detect particles or gas levels in the air. Upon detection, they activate alarms, notify building management systems, or alert emergency services through smart connectivity features. **Examples** Battery-operated smoke detectors in residential homes. Hardwired CO_2 detectors in commercial buildings. Smart detectors integrated with building management systems (BMS).
Implementation strategies:	**Steps to Integrate:** Conduct a safety assessment of the building. Determine the optimal placement for detectors. Install and configure smart monitoring features. Train occupants on alarm response procedures. **Stakeholder Engagement:** Involve building owners, facility managers, and fire safety professionals. Collaborate with local fire departments for community awareness. Communicate regulatory compliance requirements. **Reporting and Communication:** Develop real-time monitoring dashboards. Share periodic safety reports with stakeholders. Maintain a record of alarm events and false positives for continuous improvement.
Related benefits:	Life Safety: Early warnings reduce the risk of fatalities. Property Protection: Limits fire damage and associated costs. Regulatory Compliance: Meets safety codes and standards. Peace of Mind: Ensures occupant safety in homes and workplaces. Smart Integrations: Connects with security and automation systems for remote monitoring.
Timeframe for implementation:	Installation Time Residential: 1-2 hours per unit. Commercial: 1-2 days, depending on system complexity. Expected Time for Results Immediate protection upon installation. Long-term benefits in reduced fire-related incidents.
Costs/investments needed:	Personnel Costs Installation by certified professionals. Ongoing maintenance and periodic inspections. Material Costs Standalone detectors Smart detectors with connectivity Large-scale integrated systems

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Revenue streams: *For the Service Provider* *Sales and installation services.* *Subscription-based remote monitoring solutions.* *Maintenance and inspection contracts.* *For Dwellers* *Cost savings from avoided damages and insurance benefits.* *Enhanced property value due to improved safety features.*	
Measurement and verification + Monitored output indicator	Monitored Output Indicator: Reduction in fire incidents and CO_2 exposure cases. Compliance with safety inspections and regulatory checks. Methods or Approaches to Quantify Results: Incident reports and emergency response records. Insurance claim reductions. Available Tools and Software: Smart home apps (Google Nest Protect, First Alert Onelink). Building Management Systems (Siemens Desigo, Honeywell fire detection system). Best Practices for Measurement and Verification Regular detector testing and maintenance. Data analytics on false alarms and actual incidents.
Policy Implications and Recommendations: *Mandate installation in residential and commercial buildings.* *Provide subsidies for low-income households to improve safety.* *Standardize smart detector integration in new building codes.*	
Resources and References	1. Practical Guide to Installing CO_2 Sensors Indoor air quality measurement. Fight against COVID19 and the well-being of users of your premises, https://iotfactory.eu/wp-content/uploads/2021/08/Practical_Guide_Installation_CO2_Sensor-by_IOT%20Factory.pdf 2. Comparing CO2 Standards Across Green Building Certification Systems, https://atmotube.com/blog/comparing-co2-standards-across-various-green-building-certification-systems 3. Fire Detection Systems Pocket Design & Installation Guide (Honeywell) https://buildings.honeywell.com/content/dam/hbtbt/en/documents/downloads/MIAS_Pocket_Design_Guide.pdf
Case studies and best practice:	1. https://developer.kpn.com/blog/case-study-the-nest-protect-smart-smoke-detector 2.Yanfu Zeng, Yizhou Li, Peilun Du, Xinyan Huang, Smart fire detection analysis in complex building floorplans powered by GAN, Journal of Building Engineering, Volume 79, 2023, 107858, ISSN 2352-7102, https://doi.org/10.1016/j.jobe.2023.107858. 3.Min-Yuan Cheng, Kuan-Chang Chiu, Yo-Ming Hsieh, I-Tung Yang, Jui-Sheng Chou, Yu-Wei Wu, BIM integrated smart monitoring technique for building fire prevention and disaster relief, Automation in Construction, Volume 84, 2017, Pages 14-30, ISSN 0926-5805, https://doi.org/10.1016/j.autcon.2017.08.027.

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Non-energy service table No. 12 - Regular equipment inspections and testing

No.:	Non-energy service name:
12	**Regular Equipment Inspections and testing**

Category:

☒	☐	☐	☒	☐	☐
Economic	*Environmental*	*Social and community*	*Business and Operational*	*Educational*	*Other*

Service detail description:	Establish a schedule for regular inspections (e.g. quarterly, semi-annually). Performing physical inspections and testing of equipment such as boilers, cooling systems, lighting and other energy-intensive systems. Conducting tests to verify that equipment is operating in accordance with manufacturing specifications.
Implementation strategies:	Determine which equipment and technologies will be included in inspections and testing. Establish a schedule for inspections, testing and implementation of recommendations. Conduct periodic inspections and testing according to the established schedule. Analysing measured data and identifying areas for improvement. Make necessary adjustments and optimizations based on monitoring results.
Related benefits:	Early detection of problems can prevent costly repairs and downtime. Regular inspections ensure that equipment performs optimally, increasing its reliability and longevity. A proactive approach to maintenance reduces the likelihood of unplanned downtime. Improved energy efficiency contributes to lower greenhouse gas emissions.

Timeframe for implementation:

The overall timeframe for implementing a periodic inspection and equipment testing service may vary depending on the specific needs and conditions of each company. It is important to keep in mind that while some results may be visible early on, the full benefits and savings will usually only become apparent after an extended period of monitoring and optimization.

Costs/investments needed:

The cost of salaries or fees of specialists who carry out inspections and testing. Investments in modern measuring and testing equipment such as energy analysers, thermal cameras, and other technologies needed for inspections.

Revenue streams:

The main source of income will be regular fees.

Measurement and verification + Monitored output indicator	Indicators may include, for example: improvements in equipment efficiency (e.g. power factor) Reduction of CO_2 emissions (tonnes), Equipment failure rate under control. Use of calibrated and certified measuring instruments to ensure accuracy and reliability of data. Careful recording of all measurements and results, including methodology and instruments used, for transparency and auditability.

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Non-energy service table No. 13 - Renewable source installation

No.: 13	**Non-energy service name:** **Renewable source installation**
Category: ☒ *Economic* ☒ *Environmental* ☐ *Social and community* ☒ *Business and Operational* ☐ *Educational* ☐ *Other*	
Service detail description:	Definition: Encouraging generation and self-consumption by educating and training customers. Encouraging the installation of autonomous systems providing energy independence to customers and promoting renewable energy. Examples: Installation of photovoltaic panels for residential customers. Offer installation of photovoltaic panels with batteries to accumulate the produced electricity.
Implementation strategies:	Assessment of the client´s energy use to offer the best solution for their needs based on potential RES generation.
Related benefits:	Reduction of energy costs: Saving on electricity bills and possible generation of energy that can be sold to the grid or stored in a battery. Clean energy: Reduction of carbon footprint and use of inexhaustible natural resources. Increased property value Energy independence: Less dependence on energy companies by generating your own energy and being more resilient to price variations.
Timeframe for implementation: The moment of implementation will be when the installation is completed, and the self-consumption is being produced. Once this is produced, it will start to generate energy for the customer and in turn will be able to sell the surplus or store it in a battery if it is available.	
Costs/investments needed: Personnel costs are those necessary to carry out the offer, technical visit, and installation of the equipment on the client's property, e.g. photovoltaic panels and inverter. Material costs are the equipment to be installed, such as the photovoltaic panels, the inverter, the structure and the small material.	
Revenue streams: *Energy study for the client to offer the best solution for their needs based on photovoltaic energy.*	
Measurement and verification + Monitored output indicator	Number of installed renewables. Customer satisfaction questionnaire. Size of installed capacity of renewable energy sources.

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Non-energy service table No. 14 - Installation of high efficiency appliances/technologies

No.: 14	**Non-energy service name:** **Installation of high efficiency appliances/technologies**
Category: ☒ *Economic* ☒ *Environmental* ☒ *Social and community* ☐ *Business and Operational* ☐ *Educational* ☐ *Other*	
Service detail description:	Installation of high efficiency appliances and technologies. Providing design, installation, inspection and commissioning.
Implementation strategies:	Assessment of the current state, including a review of existing technology. Proposed modification of the existing technology focusing on reduced CO_2 emission levels, energy savings and cost savings. Improvement of energy efficiency: Efficient heating and cooling systems: encouraging installations of heat pumps. Efficient household appliances: replacement of existing appliances with those with a higher energy efficiency (energy label A+++). Use of renewable energy: Installations of RES to reduce CO_2 emissions. Reduction of energy consumption: Replacement of traditional luminaires with LED lighting. Sustainable mobility: Promote electric vehicles using renewable energy to reduce GHG emissions.
Related benefits:	Efficient equipment provides reduction of greenhouse gas emissions and cost savings. It is beneficial for the customer by contributing to the reduction of the climate footprint and optimisation of equipment performance by reducing energy consumption.
Timeframe for implementation: Depending on the emission reduction measures to be implemented, it can be verified in one period or another.	
Costs/investments needed: Personnel costs: Analysis and planning, measurement of CO_2 emissions, determination of solutions, installation of energy efficiency improvement systems. Material costs: Equipment necessary for the reduction of CO_2 emissions.	
Revenue streams: *Savings generated by the replacement of equipment and reduction of CO_2 emissions*	
Measurement and verification + Monitored output indicator	Improved performance, economic benefits and CO_2 reductions.

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Non-energy service table No. 15 - Installation of water use reduction

No.: 15	Non-energy service name: **Installation of water use reduction**

Category:

☒	☒	☐	☐	☐	☐
Economic	*Environmental*	*Social and community*	*Business and Operational*	*Educational*	*Other*

Service detail description:	Water-saving education will be promoted. As well as the level of equipment to find more efficient equipment reducing water consumption.
Implementation strategies:	**Replacement of household appliances with more efficient triple A-rated appliances. Replacement of taps and showers with low-flow equipment to reduce water consumption.**
Related benefits:	Reduction of costs Clean energy: reduction of carbon footprint, use of inexhaustible natural resources. Increased property value A part of the direct economic benefit to the costumer on cost savings related to the water reduction, it is a great environmental benefit due to climate change and the need to save water in Europe, especially in the southern parts of Europe.

Timeframe for implementation:

In the case of equipment replacement, from the moment equipment is replaced by more energy efficient equipment.

Costs/investments needed:

Personnel costs to determine what can be optimised, working hours for the replacement of equipment.

Material costs of the equipment to be replaced, e.g. dishwashers, washing machines, taps, showers.

Revenue streams:

Savings generated by the replacement of equipment and reduction of wastewater

Measurement and verification + Monitored output indicator	Reduced water consumption, reduced waste water, reduce costs for the water usage

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Non-energy service table No. 16 - Battery storage solutions

No.:	Non-energy service name:
16	**Battery Storage Solutions**

Category:

☒	☒	☐	☐	☐	☐
Economic	*Environmental*	*Social and community*	*Business and Operational*	*Educational*	*Other*

Service detail description:	Providing design and installation services for battery systems that are tailored to specific customer needs. The ability to integrate battery systems with solar panels, wind turbines and other renewable energy sources to maximize the use of the energy produced.
Implementation strategies:	Selection of the appropriate type of battery system (e.g. lithium-ion, lead acid, etc.) based on project needs and specifications. Performing the installation of the selected battery system in accordance with technical standards and safety regulations. Performing tests to verify the functionality and performance of the battery system.
Related benefits:	The ability to use stored energy at times when energy prices are at their highest, resulting in additional savings. Storing energy in batteries allows users to be less dependent on traditional energy suppliers and increases their energy independence. Battery systems allow efficient storage of energy generated from renewable sources such as solar panels and wind turbines, increasing their usability. Helping to smooth out fluctuations in the supply of renewable energy, contributing to the stability of the electricity grid.

Timeframe for implementation:

Preparing the plan and then installing it is a matter of a few days or a week. It depends on the number of devices to be designed and the other systems with which the battery storage will be connected.

It is expected that the results will come immediately after installation. To evaluate the impact, a longer horizon must be followed to eliminate short-term variations.

Costs/investments needed:

The cost of salaries or fees for technicians and engineers who install, integrate and maintain battery systems. The cost of the battery systems themselves, which may vary depending on the type (e.g. lithium-ion, lead-acid) and capacity. Cost of installation materials such as cables, connectors, mounting components and other necessary equipment. Investment in software and hardware systems to monitor and manage battery performance.

Revenue streams:

The main source of income for the service provider, which includes fees for the installation of battery systems and their regular maintenance. Income from the provision of expert advice and recommendations to optimise the use of battery systems and integration with renewable energy sources.

Measurement and verification + Monitored output indicator	Amount of energy stored and used from the battery system (kWh). Financial savings achieved through the use of stored energy during peak tariffs. The speed with which the battery system responds to energy demands.

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Non-energy service table No. 17 - Microgrid sesign and implementation

No.:	Non-energy service name:
17	**Microgrid Design and Implementation**

Category:

☐	☒	☒	☐	☐	☐
Economic	*Environmental*	*Social and community*	*Business and Operational*	*Educational*	*Other*

Service detail description:	Creation of a detailed microgrid design, including technology selection (e.g. solar panels, wind turbines, battery storage, generators). Carrying out the installation of all components of the microgrid, including renewables, battery systems and control technologies.
Implementation strategies:	Assessment and selection of the appropriate design based on project needs and specifications. Performing the installation of the selected system in accordance with technical standards and safety regulations. Performing tests to verify the functionality and performance of all components.
Related benefits:	Increased reliability and stable energy supply. Microgrids facilitate the integration of renewable energy sources such as solar panels and wind turbines, contributing to sustainability and reducing greenhouse gas emissions.

Timeframe for implementation:

These are usually large-scale projects, analysis and planning can be expected to take several months, as well as the implementation and subsequent testing will take several months.

Costs/investments needed:

The cost of building the necessary infrastructure such as electrical substations, cabling and other related civil works. The cost of purchasing and installing equipment such as solar panels, wind turbines, battery systems, inverters and other microgrid components. The cost of staff to work on the project, including engineers, technicians, project managers and other specialists.

Revenue streams:

Selling energy management services that help users optimize their energy consumption and reduce costs. Selling generated electricity, selling grid stability - energy flexibility.

Measurement and verification	Amount of energy produced by the microgrid; Reduction of greenhouse gas emissions due to the transition to renewable energy sources.
+ **Monitored output indicator**	The use of metering devices to directly monitor energy production, consumption and other parameters. Creating models to simulate microgrid performance and estimate energy savings and emissions.

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Non-energy service table No. 18 - Community Energy Projects

No.:	Non-energy service name:
18	**Community Energy Projects**

Category:

☐	☒	☒	☐	☒	☐
Economic	*Environmental*	*Social and community*	*Business and Operational*	*Educational*	*Other*

Service detail description:	Design and installation of technologies within the energy community. Facility management and control, facility performance monitoring, energy storage and distribution management.
Implementation strategies:	Analysing and planning, implementation and subsequent testing.
Related benefits:	Reducing energy costs Energy independence Increased awareness of sustainability Improving energy security Flexibility and adaptability

Timeframe for implementation:

These are usually large-scale projects, analysis and planning can be expected to take several months, as well as the implementation and subsequent testing will take several months.

Costs/investments needed:

The cost of building the necessary infrastructure such as electrical substations, cabling and other related civil works. The cost of purchasing and installing equipment such as solar panels, wind turbines, battery systems, inverters and other microgrid components. The cost of staff to work on the project, including engineers, technicians, project managers and other specialists.

Revenue streams:

Selling energy management services that help users optimize their energy consumption and reduce costs. Selling generated electricity, selling grid stability - energy flexibility.

Measurement and verification + Monitored output indicator	Amount of energy saved through project implementation. Amount of energy produced by the project (e.g. in kWh). Reduction of greenhouse gas emissions due to the switch to renewable energy sources. Use of metering equipment to directly monitor energy production, consumption and other parameters. Use of targeted surveys to monitor community engagement and social impacts.

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Non-energy service table No. 19 - Installation of EV Charging Stations

No.: 19	**Non-energy service name:** **Installation of EV Charging Stations**
Category: ☐ *Economic* ☒ *Environmental* ☐ *Social and community* ☒ *Business and Operational* ☐ *Educational* ☐ *Other*	
Service detail description:	The installation of Electric Vehicle (EV) Charging Stations refers to the process of setting up infrastructure that allows electric vehicles to recharge their batteries. This service encompasses site assessment, equipment procurement, installation, and maintenance of charging stations.
Implementation strategies:	Conduct a feasibility study to identify optimal locations for charging stations. Collaborate with local authorities for necessary permits and regulations. Select appropriate charging technology based on user needs and site conditions. Implementation of the project
Related benefits:	Economic: Increased foot traffic, potential job creation in installation and maintenance. Environmental: Reduction in greenhouse gas emissions by promoting electric vehicle use. Social and Community: Enhanced accessibility to charging infrastructure, fostering a community of EV users. Business and Operational: Improved brand image for businesses that support sustainable practices. Educational: Opportunities for community education on electric vehicles and sustainability.
Timeframe for implementation: Installation Time: Typically ranges from a few days to several weeks, depending on the number of stations and site complexity. Expected Time for Results: Initial usage data can be collected within 3-6 months post-installation	
Costs/investments needed: Personnel Costs: Salaries for project managers, engineers, and installation technicians. Material Costs: Expenses for charging equipment, electrical infrastructure, and site preparation.	
Revenue streams: *Charging fees from users, potential partnerships with businesses for advertising, and government incentives for renewable energy initiatives.*	
Measurement and verification + Monitored output indicator	Track the number of charging sessions and energy dispensed. Survey users for satisfaction and usage patterns. Analyse the impact on local traffic and its business revenue.

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Non-energy service table No. 20 - Monitoring and Reporting

No.: 20	**Non-energy service name:** Monitoring and Reporting
Category: ☐ *Economic* ☐ *Environmental* ☐ *Social and community* ☒ *Business and Operational* ☒ *Educational* ☐ *Other*	
Service detail description:	For customers, their consumption is monitored and customers are alerted if their costs exceed an agreed limit. Customers are informed of their consumption and associated costs in real time.
Implementation strategies:	Inspection of the existing condition, checking of the equipment, installation of measuring equipment, regular monitoring and reporting.
Related benefits:	For customers, their consumption is monitored and customers are alerted if their costs exceed an agreed limit. Customers are informed of their consumption and associated costs in real time. Instant information on consumption allows customers to react quickly to changes and adapt their behaviour. Customers learn more about their habits and consumption, which can lead to more informed decisions in the future.
Timeframe for implementation: Customers can start to see results immediately after installation, especially when it comes to real-time consumption monitoring. However, for more comprehensive analysis and evaluation of service effectiveness (e.g., cost reduction or change in consumer behavior), it may take 3-6 months to collect sufficient data.	
Costs/investments needed: They include salaries for technicians who install and maintain the systems, project managers who oversee the implementation, and customer support to help users with any questions or problems. Material costs: includes hardware costs (e.g. meters, data processing servers) and software costs (e.g. licenses for data monitoring and analysis applications).	
Revenue streams: *Monthly or annual fees from customers for using the monitoring system.*	
Measurement and verification + Monitored output indicator	Gathering feedback from customers on their experiences and savings. Consumption and cost tracking applications that provide a user-friendly interface for customers.

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Non-energy service table No. 21 - Sustainability Assessments

No.:	Non-energy service name:
21	**Sustainability Assessments**

Category:

☐	☒	☐	☐	☒	☐
Economic	*Environmental*	*Social and community*	*Business and Operational*	*Educational*	*Other*

Service detail description:	Analysis of the overall environmental impact, including consumption of natural resources, waste production and greenhouse gas emissions. Analysis of how natural resources (water, energy, raw materials) are used and proposals for their more efficient and sustainable use. Assessment of compliance with local, national and international regulations and standards. Develop specific recommendations and strategies.
Implementation strategies:	Analysis of the current situation, proposal to increase sustainability. Supervision of the implemented measures. Follow-up monitoring and analysis of results.
Related benefits:	Protection of natural resources Reducing greenhouse gas emissions Improving health and well-being

Timeframe for implementation:

Highly dependent on the assessment of the existing situation and on the proposed measures.

Costs/investments needed:

The total cost of the project depends on its scope, objectives and the specific measures to be implemented.

Revenue streams:

Income from the provision of professional consultancy services in the field of sustainability, energy efficiency and environmental management.

Measurement and verification + Monitored output indicator	The monitored predictors may include: Reduction of CO_2 emissions (t) Amount of waste recycled (kg) Water consumption (m^3) Improved air quality (e.g. pollutant concentrations)

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Non-energy service table No. 22 - Preparation for certification applications

No.: 22	**Non-energy service name:** **Preparation for Certification Applications**
Category: ☐ *Economic* ☒ *Environmental* ☒ *Social and community* ☐ *Business and Operational* ☐ *Educational* ☐ *Other*	
Service detail description:	Certificate of energy efficiency, is an official document that collects information on the energetic characteristics of the house. It is based on the energy consumption of each dwelling for a year. The calculation includes production of DHW, heating, lighting, cooling and ventilation. It must be carried out by a certified technician.
Implementation strategies:	Include the evaluation and certification of energy in a package of services FlexiSmart Home. - There is a need for a network of specialized technicians at national level in each country capable of evaluating housing. - Creation of a web communication network between certifiers and companies offering energy certification services. - Annual reports on the energy situation of housing
Related benefits:	Knowledge of energy efficiency in housing. Increase in the value of property Better comfort and quality of life Reduction of energy pollution Eligibility for support scheme
Timeframe for implementation: It is relatively short time - in 24-72 hours energy certification per a house	
Costs/investments needed: Cost includes subcontracting a company specialized in the realization of energy certificates. This cost can range between 75-250 € depending on the size and type of housing and location of the house. No materials would be needed.	
Revenue streams: *The benefit for the client is obtaining the energy certification and knowledge of potential improvement reduction of energy consumption*	
Measurement and verification + Monitored output indicator	Official tools for the production of energy certificates: Leader-Calener; Cerma; HULC; Cypetherm HE Plus; SG Save; Tekton 3D; CE3X;
Policy Implications and Recommendations: *The energy certificate is mandatory in homes if they want to sell or rent. In 2050, it must be fulfilled that the houses have zero emissions, and this will be regulated through the energy certification. The energy certificate is required to qualify for energy rehabilitation aid.*	

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Non-energy service table No. 23 - Cost-Benefit Analysis for Energy Projects

No.:	**Non-energy service name:**
23	**Cost-Benefit Analysis for Energy Projects**

Category:

☒	☐	☐	☒	☐	☐
Economic	*Environmental*	*Social and community*	*Business and Operational*	*Educational*	*Other*

Service detail description:	Provides a framework for decision-making by quantifying the financial implications of energy projects. It assesses both direct and indirect costs and benefits, including energy savings, maintenance costs, environmental impacts, and social benefits.
Implementation strategies:	Identify the energy project to be analysed. Gather data on costs (installation, maintenance, etc.) and expected benefits (energy savings, incentives). Conduct the CBA using established methodologies. Present findings to stakeholders for decision-making.
Related benefits:	Improved energy efficiency leading to reduced utility bills. Enhanced property value due to energy upgrades. Contribution to environmental sustainability through reduced carbon emissions. Increased comfort and health for residents due to better energy management.

Timeframe for implementation:

Varies by project scope; typically ranges from a few weeks to several months depending on the complexity of the energy upgrades.

Costs/investments needed:

Costs associated with hiring energy analysts, project managers, and technical experts to conduct the CBA and oversee project implementation.

Revenue streams:

Fees for conducting the CBA, project management, and consulting services.

Measurement and verification + Monitored output indicator	Surveys to assess user satisfaction and comfort levels. Financial analysis to track cost savings over time.

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Non-energy service table No. 24 - Grant Application Assistance

No.: 24	Non-energy service name: **Grant Application Assistance**

Category:

☒ Economic	☐ Environmental	☐ Social and community	☐ Business and Operational	☒ Educational	☐ Other

Service detail description:	Grant application assistance is a service that helps client to obtain funding through grants for energy efficiency projects and initiatives. The service includes advice on identifying suitable grant opportunities, preparing application documents and navigating the application process.
Implementation strategies:	Conduct an initial assessment to understand the client's needs, project goals, and eligibility for various grant programs. Research and identify relevant grant opportunities that align with the client's objectives. Assist in drafting and reviewing application materials, including project descriptions, budgets, and supporting documentation.
Related benefits:	Increased access to funding for energy efficiency projects, leading to enhanced sustainability efforts. Improved project viability through professional guidance in the application process. Greater awareness of available financial resources and support for energy initiatives.

Timeframe for implementation:

The duration of the grant application process can vary, typically ranging from a few weeks to several months, depending on the complexity of the project.

Costs/investments needed:

Expenses related to hiring grant writing specialists, project managers, and administrative staff who will assist in researching, drafting, and submitting grant applications.

Revenue streams:

Fees charged for grant application assistance services, which may be structured as a flat fee, hourly rate, or a percentage of the grant amount secured.

Measurement and verification + Monitored output indicator	Tracking the number of grant applications submitted and the success rate of those applications (i.e., the percentage of applications that receive funding). Monitoring the total amount of funding secured for clients as a result of the assistance provided. Monitoring energy/CO_2 saved per project. Collecting feedback from clients on the effectiveness of the service and the impact of secured funding on their projects.

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Non-energy service table No. 25 - Workshops on Energy Efficiency

No.:	Non-energy service name:
25	**Workshops on Energy Efficiency**

Category:

☐	☐	☒	☐	☒	☐
Economic	*Environmental*	*Social and community*	*Business and Operational*	*Educational*	*Other*

Service detail description:	Workshops on Energy Efficiency are educational sessions designed to inform participants about the principles of energy efficiency, practical strategies for reducing energy consumption, and the impact of individual behaviour on energy use. The workshops provide a platform for participants to learn about energy-saving techniques, the benefits of energy efficiency, and how small changes in daily habits can lead to significant reductions in energy consumption. Through interactive discussions, demonstrations, and hands-on activities, attendees gain practical insights that can be applied in their homes to enhance energy efficiency and reduce utility bills.
Implementation strategies:	Planning the activity and assessing the topic, relevant stakeholders, time frame, place and the type of the workshop. Ensuring the appropriate promotion of the workshop and arranging all logistics. Conducting the workshop and collecting and analysing post-workshop experience.
Related benefits:	Increased awareness of energy efficiency among households. Empowerment of residents to take actionable steps toward reducing energy consumption. Potential cost savings on energy bills for participants. Contribution to community-wide energy reduction goals and environmental sustainability.

Timeframe for implementation:

Workshops can be organized within a few weeks, depending on the availability of venues and instructors.

Participants may begin to see changes in their energy consumption habits immediately after the workshops, with measurable savings potentially observed within a few months.

Costs/investments needed:

Expenses related to hiring facilitators, energy experts, and administrative staff to organize and run the workshops. Costs for educational materials, workshop supplies (e.g., handouts, demonstration equipment), and venue rental.

Revenue streams:

Fees for conducting workshops, potential sponsorship from local businesses or energy companies, and grants for educational programs.

Measurement and verification + Monitored output indicator	Pre- and post-workshop surveys to assess changes in participants' knowledge and attitudes toward energy efficiency. Collecting testimonials and case studies from participants who implement energy-saving measures.

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Non-energy service table No. 26 - Development of Educational Materials

No.:	Non-energy service name:
26	**Development of Educational Materials**

Category:

☐	☒	☒	☐	☒	☐
Economic	*Environmental*	*Social and community*	*Business and Operational*	*Educational*	*Other*

Service detail description:	The Development of Educational Materials for Energy Efficiency involves creating informative and engaging resources aimed at educating households about energy-saving practices, technologies, and behaviours. These materials can include brochures, guides, online content, videos, and interactive tools designed to enhance understanding and promote energy-efficient habits.
Implementation strategies:	Conduct a needs assessment to identify the specific topics and formats that will be most beneficial for the target audience. Collaborate with energy experts, educators, and graphic designers to develop high-quality content. Pilot the materials with a small group of users to gather feedback and make necessary adjustments before wider distribution.
Related benefits:	Increased awareness and understanding of energy efficiency among households. Empowerment of individuals to take actionable steps toward reducing energy consumption. Enhanced community engagement in sustainability initiatives. Potential cost savings for households through improved energy management.

Timeframe for implementation:

Development of educational materials can take several weeks to a few months, depending on the complexity and number of resources being created.

Costs/investments needed:

Expenses related to hiring content creators, graphic designers, and subject matter experts to develop the materials. Costs for printing physical materials, hosting online content, and any software or tools needed for content creation.

Revenue streams:

Sales of training materials, local, national and European grants, support from local governments.

Measurement and verification **+** **Monitored output indicator**	Pre- and post-distribution surveys to assess changes in knowledge and attitudes toward energy efficiency among users. Tracking engagement metrics (e.g., downloads, website visits, attendance at webinars) to evaluate the reach and impact of the materials. Collecting feedback from users on the usefulness and clarity of the materials.

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4. Integrated Smart Energy Services Packages

In the context of modern energy efficiency management and sustainability, the integration of smart energy services is becoming increasingly significant. The aim of this approach is to connect various types of services, including non-energy services, into cohesive packages that better meet user needs and maximize the benefits of these services. This chapter focuses on the principles of designing and creating these integrated packages of smart energy services.

The selected and studied non-energy services form a key foundation for the development of services included in these packages. Deliverable D2.5 elaborates on the design of individual services, emphasizing their interconnections and synergies.

The following two subsections illustrate the relationships between individual services and the identified and selected non-energy benefits. In this comparison, energy services and energy benefits are not taken into account, even though they are interconnected with other services, mutually influencing each other, and non-energy services can also have energy benefits.

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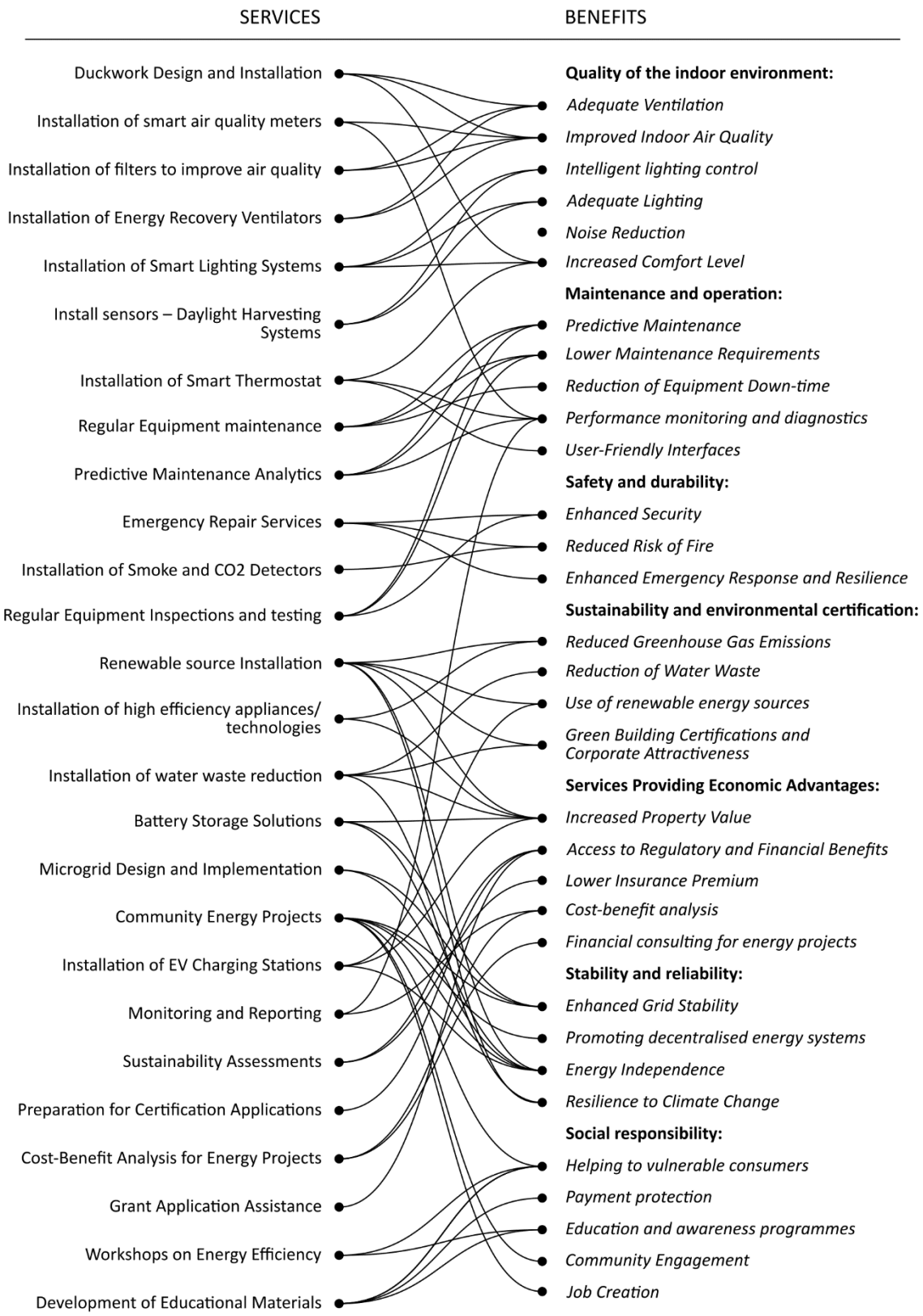

Figure 3 - Bundling of services into packages according to benefits

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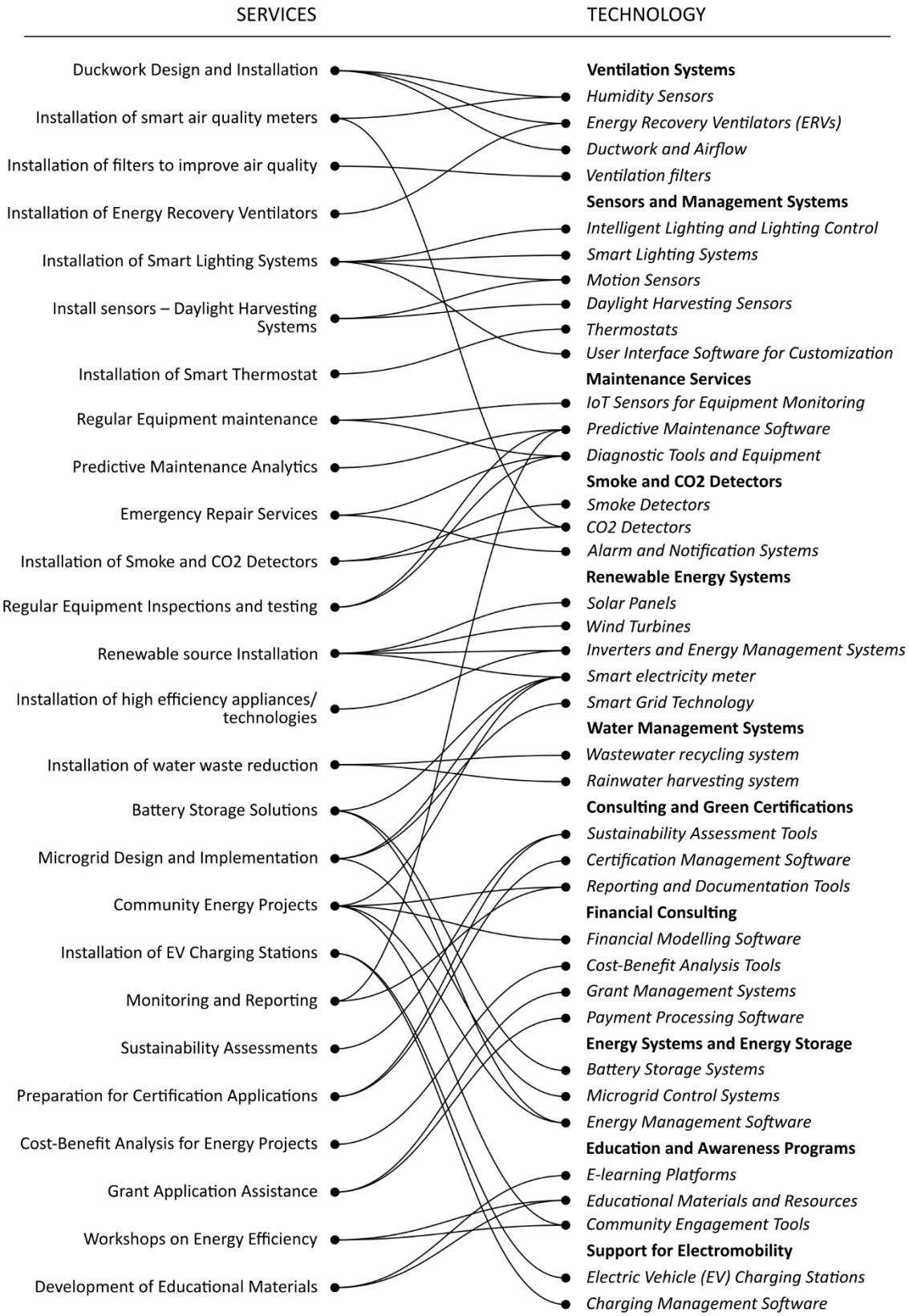

Figure 4 - Bundling of services into packages according to technologies

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5. National specifics for the offered Services Packages

When designing and delivering international energy efficiency service packages, it is essential to consider the specificities of each country. These differences can significantly affect the implementation, operation and adoption of the solutions offered. The chapter will focus on the key aspects that need to be considered when adapting services to different national contexts. Each country has a unique legal and regulatory framework that affects not only energy efficiency services but can also affect non-energy services, this chapter aims to identify and describe the most important differences between the selected countries. The findings will be used to guide the adaptation of the EE service model in each country.

National specifics for Slovakia

Since 1991 and based on the adoption of the Resolution of the Government of the Slovak Republic No. 493 of 10 September 1991, Slovakia has been improving energy efficiency of buildings, starting with thermal insulation of multi-family buildings. Since then, most apartment buildings, often made of prefabricated panel segments, and many family houses, more than 460 thousand family houses and multi-family buildings accounting for 671 thousand apartments in total, have been insulated at least on 25% of their envelope (definition of complex renovation at that time) to achieve savings on energy costs, and their old windows were replaced with new ones. These construction measures were mostly used to ensure energy savings. They were also based on the climatic conditions of Slovakia. Its territory is divided into three climatic zones – warm, moderately warm and cool. Up to 78% of the territory of Slovakia consists of hills and highlands.

After this initial, approximately 20-years long period, the next stage of increasing the energy efficiency of buildings and other sectors takes place through the introduction of innovative modern technologies for energy saving – especially solar heat collectors, photovoltaics and heat pumps. Currently, a less used technology in Slovakia are wind turbines. In the field of thermal energy, a survey of geothermal energy potential was also carried out, which has a certain potential for Slovakia and initial projects for its use are being implemented in the eastern part of the country. With the development of these technological solutions, prosumers are emerging in regions of Slovakia.

The amendment to Act No. 251/2012 Coll. on Energy, which became valid on 1 October 2022, introduced new terms into Slovak legislative, namely "energy community" and "community producing energy from renewable sources". These entities can have a diverse legal form within the Slovak Commercial Code, or they can be non-profit organizations or civil associations.

The energy services in Slovakia are provided by ESCO companies that offer energy consulting and products and services in the form of solutions in energy storage, energy management, photovoltaics, cogeneration, local distribution system, lighting in buildings, planning and preparation of distribution equipment and transformer stations, management of technological equipment, air conditioning and cooling systems and equipment for thermal energy. Services for clients include design, financing, operation and service of these projects. At the same time, combined solutions for the development of EPC and the creation of energy communities are provided on the market. However, these schemes are not yet widely popular and widely adopted by residential and commercial sector. Energy suppliers offer benefits in the same areas and, in addition, in the areas of demand response and electromobility.

Public financial aid programmes

Green for Households and Green Solidarity

Through the national projects “Green for Households” and “Green Solidarity”, the installation of renewable energy devices in households across all regions of Slovakia has been supported from 2023

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to 2029. This support contributes to the adoption of technologies such as photovoltaic panels, solar collectors, biomass boilers, and heat pumps in both family homes and apartment buildings. Additionally, for family houses, the program also offers support for the installation of wind turbines. The "Green for Households" program covers 50% of eligible expenses for the purchase and installation of these technologies. Furthermore, the project provides an additional 15% financial benefit for households in single-family homes installing emission-free devices, or for those that discontinue the use of solid fuels.

"Green Solidarity" programme is designed for low-income households and aims to address energy poverty among vulnerable communities. Eligible households can apply for support for the installation of photovoltaic panels, solar collectors, and biomass boilers. Those who meet the program's criteria will receive an 80% increase in the funding rate. The support can cover up to 90% of eligible expenses for the purchase and installation of the equipment.

The "Green for Households" and "Green Solidarity" projects build upon the success of the first three national "Green for Households initiatives," which were financed through the Operational Programme Quality of the Environment from 2015 to 2023. Thanks to European and state support, nearly 60,000 renewable energy devices have been installed in Slovak households to date. These include 20,716 heat pump installations, 16,998 photovoltaic systems, 14,516 solar collectors, and 7,045 biomass boilers. Households used support totalling €124.5 million to purchase the equipment. The total installed capacity of the supported systems has exceeded 460 MW. Over 1,700 eligible contractors participated in the projects. Between 2009 and 2011, the initial state subsidies were awarded for installation of 5,410 solar systems in family houses and just 39 in apartment buildings. Additionally, 1,427 households received subsidies for biomass boilers.

These figures do not include renewable energy technologies installed by individuals and businesses that did not receive state support for their acquisition. As a result, the numbers presented here represent only a portion of the devices installed in Slovakia during these years. Many early adopters were motivated more by a desire to use renewable energy sources than by financial savings, as investment costs typically exceeded the regular costs of energy consumption at state-regulated prices, and the return on investment over the lifetime of the technology was often very low. Currently, the financial benefits of renewable energy systems are more in protecting households against sharp increases in energy prices due to market volatility and further deregulation of the energy prices for households, which could lead to significant financial impacts on households.

Intelligent metering systems

The installation of intelligent metering systems in Slovakia is carried out in accordance with the obligations of the distribution system operators, as specified in Act No. 251/2012 Coll. on Energy and Decree No. 358/2013 Coll., which establishes the procedures and conditions for the implementation and operation of intelligent metering systems in the electricity sector. According to the applicable legislation, the distribution system operator will install an intelligent metering system at the supply points of final electricity consumers connected to the distribution system at a low-voltage level, with an annual electricity consumption of at least 4 MWh. The replacement of the electricity meter and the installation of the smart metering system is free of charge.

Heat pumps

In 2022, 12,100 air-to-water heat pumps were sold in Slovakia. However, in 2023, sales fell by 16%, reaching 10,171 units. Overall, the sales trend has been growing for a long time. The lowest interest in this technology is primarily seen among middle- and low-income groups, who are accustomed to using gas infrastructure and find gas heating more cost-effective.

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Prosumers and energy communities

Since autumn 2023, electricity in Slovakia has been managed through the newly created Energy Data Centre (EDC) data hub, operated by the state's short-term electricity market operator, OKTE. OKTE began its activities in the Slovak Republic on January 1, 2011. It is a subsidiary of the transmission system operator, Slovenská elektrizačná prenosová sústava (a.s.), and is a regulated entity under the authority of the Regulatory Office for Network Industries (URSO). In its services, OKTE addresses all electricity market participants. The scope of the company's activities is defined by both European and national legislative documents. OKTE organizes and evaluates the organized short-term cross-border electricity market and ensures the settlement of imbalances within Slovakia. It also administers the collection of measured data, central invoicing of fees related to electricity system operations, and the reporting of transactions concluded on the wholesale electricity and gas market (REMIT). Furthermore, OKTE organizes and settles support for electricity generation from renewable energy sources and high-efficiency cogeneration. Additionally, OKTE handles activities related to the issuance, transfer, recognition, application, and cancellation of guarantees of origin for electricity from renewable energy sources and for electricity produced by high-efficiency cogeneration, as well as organizing the market for issued guarantees of origin.

The EDC project was launched at the end of January 2023 and has been operational since October 1, 2023, following an update to the energy market rules. One of the features offered is electricity sharing. Currently, energy sharing on the market and smart energy services are at a relatively early stage in Slovakia. Electricity can be shared at individual supply and delivery points, regardless of the electricity supplier. Additionally, there are no fees for sharing electricity through the OKTE EDC, though energy distribution companies charge fees for using the distribution grid. To use electricity sharing via OKTE, a supply point must be equipped with continuous metering. The value of the energy consumed is recorded and evaluated at regular intervals, with each interval lasting 15 minutes.

Conditions for connecting to the system:

- registration with the EDC;
- performing continuous metering;
- the collection point is not allowed to be included in the mandatory purchase or in another shared group;
- the existence of an 'active customer' or 'energy community' as a separate entity within the sharing group. The electricity producer is obliged to provide the Office, pursuant the Act No. 251/2012 Coll. on Energy, by 30 May each year with data for the previous year, expected data for the current year and planned data for the following year on electricity production in its own electricity production facilities, own consumption of electricity produced during electricity production, other self-consumption of electricity and supply of own electricity.

Slovak National energy and climate plan

From 2014 to 2021, the savings achieved through the renovation of private buildings (40%) and the reduction of energy demand in industry (35%) made the most significant contributions to meeting the target set under Article 7 of the Energy Efficiency Directive. The contributions from the transport sector and the public sector (including buildings and lighting) each accounted for 8%.

The buildings sector will continue to be a key area for energy savings potential in the future. New legislation, adopted in line with the transposition of Directive 2018/844, will introduce new requirements for building renovation. These include an emphasis on increasing the number of buildings undergoing deep renovations, additional requirements for technical building systems (such

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as the installation of self-regulating devices, inspection of heating and cooling systems, and more), and the implementation of building automation and control systems.

The aim of these measures is to improve the energy performance of buildings and reduce overall energy demand, which should be covered as much as possible by energy supplied from renewable sources. Meeting the minimum requirements for zero-emission buildings (ZEBs) after 2027/2030 (public/private buildings) for existing buildings will require deep renovation, which involves higher financial costs. This means that the strategy will result in lower energy savings during subsequent renovations (after the lifespan of building elements has ended) for buildings that have already been renovated compared to those undergoing their first renovation.

The Climate Change observed over the last ten years in Slovakia and across the EU will lead to increased requirements for cooling and ventilation in buildings.

National specifics for the Czech Republic

Current situation of energy efficiency and non-energy services
Subsidised energy saving measures for households include, in particular, insulation of the building envelope, replacement of windows, installation of photovoltaic and photothermal systems and other modern heating sources, such as heat pumps. For households, the New Green Savings and Panel programmes and their sub- or derivative subsidy programmes are primarily relevant. The primary objective of these subsidy programmes is to promote energy efficiency and the implementation of energy saving measures. Non-energy benefits are only a kind of by-product.[2]

The promotion of non-energy services is not the primary objective of the subsidy policy in the Czech Republic, some areas may overlap, for example, improving the quality of the indoor environment, installation of smart appliances, meters may be part of subsidised projects, but it is always an energy efficiency project and the technologies in question are its instrument. So far, there are only a few subsidy programmes focusing primarily on non-energy benefits.

Installation of smart meters
From 1 July 2024, a three-year period starts for the installation of new smart meters for all customers with an annual electricity consumption of more than 6 MWh. All customers at the low voltage level with an annual consumption of more than 6 MWh are eligible. It is estimated that this will be up to 850,000 customers. These are mainly customers with higher consumption who also use electricity for heating and water heating. Customers will not have to ask for anything; distribution companies will install the new smart meters according to their own schedule. The distribution companies will be responsible for ensuring the installation of these meters.[3]

Grant Call Energy Infrastructure - Smart Grids
The aim of the call is the development/establishment of smart grids supporting the integration of renewable energy sources into the distribution systems in the Czech Republic. The target group is large enterprises operating in the energy sector. In connection with residential buildings, it is relevant from the end-user perspective, where the call is used by electricity distributors to install smart meters for selected customers.[4]

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2 https://mpo.gov.cz/cz/energetika/dotace-na-uspory-energie/prehled-dotacnich-programu-na-podporu-energeticke-ucinnosti--271831/

3 https://mpo.gov.cz/cz/rozcestnik/pro-media/tiskove-zpravy/zacina-lhuta-pro-instalaci-chytrych-elektromeru--distribucni-spolecnosti-na-to-maji-tri-roky--281901/

4 https://www.optak.cz/energeticka-infrastruktura-smart-grids-amm-vyzva-i/a-162/

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Hydrogen Strategy of the Czech Republic

n 2024, the Czech Republic updated its hydrogen development strategy. The strategy includes consideration of the potential use of hydrogen for energy flexibility, i.e. primarily focusing on the storage of surplus energy and the provision of power balance services. The document does not provide any specific data at this time, but primarily focuses on industry, which is not the goal of the energy service design model for this project. An important section mentions the use of hydrogen for the storage of energy produced within the community energy sector, here is the possibility of including residential buildings. Hydrogen technology is not very applicable to residential buildings in its current form and therefore not included in the selected services provided, but further developments in technology and legislation should be monitored to keep an eye on the market for energy flexibility and potential competition.

Certification of energy service companies in the Czech Republic

The regulations for energy services are regulated by Act 406/2000 Coll., on Energy Management and its subsequent amendments. On the basis of the Act, a list of energy service providers is maintained by the Ministry of Industry and Trade, the data from the list is published, containing basic information about the company (mainly formal information: business name, identification number, address and contact details). Companies in the Czech Republic do not undergo any verification, are not certified and no guarantees for the quality of services provided by the State are provided. Providers interested in being included in the list of energy service providers shall report the relevant data to the list administrator.[5],[6]

The list is managed by the Ministry of Industry and Trade and is publicly accessible. Service providers are divided into two categories, namely Service Providers with Guaranteed Results and Other Service Providers. In 2023, according to the published list, there were 21 service providers with guaranteed results and 35 providers of other services.

National specifics for Germany:

The Building Energy Act[7] (Das Gebäudeenergiegesetz, GEG):

The aim of this law is to make a significant contribution to achieving the national climate protection targets. This is to be achieved through economic, socially acceptable and efficiency-enhancing measures to save energy. emissions and the increasing use of renewable energies or unavoidable waste heat for the energy supply of buildings. Taking into account the principle of economic efficiency, the Act is intended to contribute to achieving the Federal Government's energy and climate policy goals in the interests of climate protection, the steady reduction of fossil resources and the reduction of dependency on energy imports, as well as a further increase in the energy efficiency of the energy system. Share of renewable energies in final energy consumption for heating and cooling and to enable the sustainable development of energy supply. The construction and operation of a plant and the associated ancillary facilities for the generation and transportation of heating, cooling and electricity from renewable energies as well as efficiency measures in buildings are in the overriding public interest and serve public safety. Until building operations in the federal territory achieve greenhouse gas neutrality, renewable energy sources and efficiency measures should be prioritized in

5 Ministry of Industry and Trade of the Czech Republic, Department of Energy Efficiency and Savings 41300, Energy Services, https://mpo.gov.cz/cz/energetika/uspory-energie/uspory-v-praxi/energeticke-sluzby/energeticke-sluzby--277422/

6 Czech Republic, Act No. 406/2000 Coll., on energy management

7 https://www.gesetze-im-internet.de/geg/

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the assessment of protected interests in each case. The GEG act also focus on non-energy building along with other non-energy benefits such as indoor temperature, air quality, servicing and maintenance etc.

Law on Energy Services and Other Energy Efficiency Measures (Gesetz über Energiedienstleistungen und andere Energieeffizienzmaßnahmen, EDL-G[8]), amended by Article 2 of the Law of 13 November 2023:

The Law on Energy Services and other Energy Efficiency Measures (EDL-G) aims to promote energy efficiency and the use of energy services in various sectors. It establishes a framework for the implementation of energy-saving measures, encourages the uptake of energy services, and sets guidelines for monitoring and reporting energy efficiency improvements. Moreover, it also supports different no-energy services measures. For example, by encouraging energy efficiency, the law supports integrated solutions that may include non-energy services, such as water conservation, waste reduction, and sustainable practices. In addition, Energy service providers may bundle energy efficiency improvements with non-energy services to offer comprehensive solutions to clients. It also raises public awareness about sustainability, potentially leading to increased demand for non-energy services. The NECP encourages holistic building strategies that incorporate non-energy services such as water conservation, waste management, and indoor air quality improvements alongside energy efficiency measures. The plan may provide financial support or incentives for projects that integrate energy efficiency with non-energy services, encouraging developers and homeowners to adopt comprehensive solutions.

National Energy and Climate Plan (NECP)

Germany's National Energy and Climate Plan (NECP)[9] outlines its strategy to meet the European Union's 2030 climate and energy targets. The plan integrates measures to enhance energy efficiency, expand renewable energy, reduce greenhouse gas emissions, and ensure energy security. Key objectives include reducing emissions by at least 55% compared to 1990 levels, achieving a 30% share of renewables in gross final energy consumption, and improving energy efficiency by 32.5%. The NECP supports Germany's broader Energiewende (energy transition) policy, focusing on sustainable growth, innovation, and compliance with EU climate goals.

Federal Funding for Efficient Buildings (BEG)

The Federal Funding for Efficient Buildings (BEG)[10] is a funding program by the German federal government aimed at increasing energy efficiency in the building sector. It provides financial support for the renovation and new construction of residential and non-residential buildings that meet high energy standards. Through grants and low-interest loans, property owners and builders are encouraged to implement energy-efficient technologies and measures. The BEG not only promotes the reduction of energy consumption but also the use of renewable energies to support the government's climate goals. Also, it provides generous subsidies for installing heat pumps, promoting renewable energy use and efficient heating solutions.

8 https://www.gesetze-im-internet.de/edl-g/BJNR148310010.html

9 https://www.bmwk.de/Redaktion/DE/Textsammlungen/Energie/necp.html

10 https://www.bafa.de/DE/Energie/Effiziente_Gebaeude/Foerderprogramm_im_Ueberblick/foerderprogramm_im_ueberblick_node.html;jsessionid=07A1E7887140C3EA2917F0B792EFEF05.intranet251

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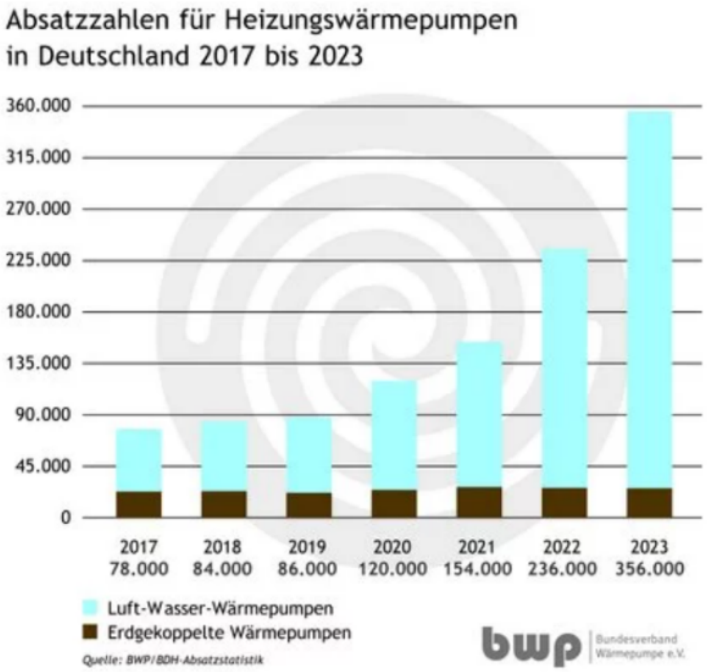

Figure 5 - Sales figures for heating pumps

Since January 1, 2024, funding includes a base subsidy of 30% of eligible costs, with additional bonuses for highly efficient systems, early replacement of fossil fuel heating, and lower-income households. Combined subsidies can cover up to 70% of costs, with a maximum of €21,000 per residential unit. Applications can be submitted online via the KfW, with retroactive eligibility for measures started by August 31, 2024. This initiative supports Germany's energy transition and climate goals. As a result of funding support for heat pump the installation of heat pump have increased significantly (see figure 2).

The Energy Transition Digitisation Act (GDEW) and the Metering Act (MsbG)

The Energy Transition Digitisation Act (GDEW)[11] and the Metering Act (MsbG)[12] are German legislative frameworks designed to enhance the digital infrastructure and processes essential for the energy transition. These acts support the development of smart grids and advanced metering systems that facilitate real-time data exchange, improving demand response and energy efficiency. Additionally, they empower consumers by providing better access to energy data and digital tools, enabling informed decisions about energy usage. The rollout of smart meters has led to the emergence of various new services and business model innovations in the German energy market. Specifically, the MsbG addresses requirements related to data protection and security, as well as the installation, operation, and maintenance of intelligent measurement systems. It also establishes a legally binding schedule for the rollout of these systems, specifying which customers must have them installed and by when.

11 https://www.bmwk.de/Redaktion/EN/Pressemitteilungen/2023/01/20230111-the-cabinet-adopts-relaunch-of-the-digitisation-of-the-energy-transition-and-paves-the-way-for-accelerated-smart-meter-rollout.html

12 https://www.bundesnetzagentur.de/DE/Vportal/Energie/Metering/start.html#:~:text=Das%20Messstellenbetriebsgesetz%20(MsbG)%20unterscheidet%20zwischen,Mai%202023%20in%20Kraft%20getreten.

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Certification of energy service companies in Germany:
In Germany, the certification of energy service companies (ESCOs) is essential for ensuring the quality and reliability of energy services offered. Key frameworks governing this certification include the international standard DIN EN ISO 50001[13], which focuses on effective energy management systems. Additionally, the Energiedienstleistungsgesetz (EDL-G) regulates energy service provision, potentially requiring registration or certification for ESCOs. Funding programs from KfW Bank also play a role in supporting energy efficiency projects, often necessitating specific certifications. Organizations like the German Institute for Standardization (DIN) and the German Energy Agency (dena) provide guidance and resources for ESCO certification in the country.

National specifics for Spain

Current status of energy efficiency and non-energy services
The energy saving measures supported for households include, in particular, the aid scheme found in $PRTR_8$, The aim of this scheme is to finance measures or works to improve the energy efficiency of dwellings that are usually the home of their owners. This programme will finance actions that achieve a reduction of at least 7% in the energy demand for heating and cooling, reduce the consumption of non-renewable primary energy by 30% or replace building elements such as the façade, or the change of windows. The installation of recharging points is subsidized through the MOVES III plan to promote electrification in the mobility sector. Spanish households may also receive a grant of up to €3,000 when installing an aerothermal pump. The grant covers 40% of the cost, according to the Ministry of Transport, Mobility and Urban Agenda (MITMA). The plan runs until 2026.

Figure 6 - Ilustration: Subsidies in heat pump for renovation in Europe

The main objective of these subsidy programmes is to promote energy efficiency and the implementation of energy saving measures. The non-energy benefits are not detailed but it is an extra benefit for the subsidy of energy equipment.

The promotion of non-energy services is not an objective of the subsidy policy in Spain, there are some improvements that can be superimposed through energy efficiency but do not have a priority value

13 https://www.umweltbundesamt.de/energiemanagementsysteme-iso-50001#iso-50001-aufbau-und-anwendung

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since the technology in question is its instrument. There is currently no subsidy programmes focused on non-energy benefits.

Installation of smart meters

In Spain, there is a very advanced situation as regards smart meters, it can be stated that 99.2%[9] of domestic consumers (with less than 15 kW contracted power) have a smart meter installed since the end of 2019, They are therefore charged for electricity on an hourly basis. These meters give a great possibility to control the energy, thus promoting the culture of saving and give a great information when improving energy efficiency.

[9] https://www.cnmc.es/prensa/cnmc-contadores-integrados-20201021

Hydrogen strategy in Spain

In 2024, the green hydrogen development strategy has been updated in Spain. Renewable hydrogen is destined to be a valuable energy vector for end uses where it is the most efficient solution with the process of its decarbonization. This process will be promoted in areas where electrification is not the most efficient or technically feasible. It will also be enhanced in isolated energy systems that are largely dependent on transport to achieve climate neutrality.

The green hydrogen strategy is marked in the PNIEC setting targets for 2021-2030, in which there is a long-term strategy to make Spain climate neutral by 2050. The document[10] presents 34 measures that are included in the hydrogen roadmap, among which administrative simplification and the removal of regulatory barriers to hydrogen production can be highlighted, the creation of a system of guarantees of origin (GO), promote the competitiveness of renewable hydrogen.

[10] https://www.miteco.gob.es/content/dam/miteco/es/ministerio/planes-estrategias/hidrogeno/hojarutahidrogenorenovable_tcm30-525000.PDF

Certification of energy service companies in Spain

The regulation of energy services is regulated in Spain by Royal Decree 56/2016 of 12 February, which transposes Directive 2012/27/EU on efficiency in relation to energy audits, Accreditation of energy service providers and auditors and promotion of energy supply efficiency. This regulation is kept in view of article 18.1 of the Directive 2012/27/EU, Member States should promote the energy services market by making available to the public and regularly updating the list of energy service providers the data in the list are published, which contain basic information on the company (mainly formal information: company name, identification number, address and contact details).

The list is coordinated by the General Directorate of Energy and Mines Policy of the Ministry of Industry, Energy and Tourism which may order the rectification of this listing at any time as a result of the checks it can make on compliance with the requirements required for the exercise of the activity.

To register in the list of energy service providers, you must first contact the competent body in your community or autonomous city and submit the responsible declaration (according to the model in Annex II of Royal Decree 56/2016) and the documentation requested in it.

The list is publicly accessible, in which the service providers of each of the autonomous communities are listed. In 2025, according to the list published, there are 3,351 energy service providers.

[11] https://www.idae.es/companies/energetic-services

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National specifics for Portugal

Current situation of energy efficiency and non-energy services in Portugal

Currently (in January 2025) there are not yet any support programs available for energy efficiency. However, the Environmental Fund is developing a support programme under the REPowerEU-Component 21- Creation of one-stop shops for citizens in the field of energy efficiency (Citizen Energy Spaces). This initiative was prepared with the aim of supporting citizens in the preparation and implementation of energy efficiency and renewable energy measures, as well as support services for the adoption of sustainable behaviour in terms of energy use, through improved energy literacy.

The milestones and targets associated with this reform include the creation and operationalisation of fifty physical Citizen Energy Spaces by the end of the first quarter of 2025, which are intended to last over time and space, as a first line of support for citizens, in line with the timeframe of the National Energy and Climate Plan (PNEC 2030).

The Citizen Spaces or simply Energy Spaces, consist of physical counters that work in a distributed network and provide services to support citizens in preparing and implementing energy efficiency and renewable energy measures, as well as services to support the adoption of sustainable behaviour in terms of energy use, through greater energy literacy.

At the moment no government financial support mechanisms are available to finance residential energy efficiency investments. In 2023 and 2024 there was the Sustainable Building Program (Programa de Apoio a Edifícios Mais Sustentáveis)[14] which provided financing aid to different home and condominium renovation measures like thermal insulation, renovation of the heating and cooling system and the installation of generation technologies like Solar PV and heat pumps. The grants reached up to 7500 EUR per building unit.

Last year, low interest bank loans were also available to improve thermal insulation and installation of solar PV are also available for are provided to citizens with limited financial resources under the Efficient Home program 2020[15]. At the moment it is not clear if this support mechanism will be available in 2025.

Smart meters installation status

Portugal has been actively advancing the deployment of electricity smart meters as part of its commitment to modernizing the energy grid and enhancing consumer services. By the end of 2023, approximately 86% of low voltage installations in mainland Portugal were equipped with smart meters, totalizing around 5.5 million units. Of these, about 4.7 million were integrated into a smart grid, enabling services such as daily remote meter readings, access to detailed consumption data, and billing based on actual usage[16]. It is expected that a full roll out will be reached by 2025 in the country. The proactive approach in rolling out smart meters positions Portugal as a leading example in the EU's efforts to modernize energy infrastructure and promote sustainable energy practices[17].

The legislative framework driving this initiative is outlined in Decree-Law no. 15/2022, dated 14 January, which mandates the integration of all low voltage consumers in mainland Portugal into a

14 https://www.fundoambiental.pt/apoios-prr/c13-eficiencia-energetica-em-edificios/05c13-i012023-paes-2023-1-aviso.aspx

15 https://www.sgeconomia.gov.pt/noticias/programa-casa-eficiente-2020.aspx

16 https://www.erse.pt/en/activities/regulations-electricity/smart-grids/

17 https://ses.jrc.ec.europa.eu/smart-metering-deployment-european-union

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smart grid by the end of 2024. This integration aims to provide consumers with advanced services, including real-time data access, remote adjustments of contracted power, and consumption alerts. The Smart Grid Services Code (RSRI), approved by the regulator through Regulation no. 817/2023 on 27 July, defines the services to be offered by network operators and suppliers to users within the smart grid.

The implementation of smart meters is a critical component of Portugal's broader smart grid strategy, which encompasses not only the meters but also the necessary Information and Communication Technologies (ICT) and data management systems. This comprehensive infrastructure is essential to deliver the full spectrum of smart grid services to end-users. To monitor and assess the performance of the smart grid, ERSE has established key performance indicators across ten dimensions, including network planning, quality of service, cybersecurity, and economic efficiency. These indicators are reported annually by electricity transmission and distribution network operators, ensuring transparency and facilitating the adoption of measures to achieve desired outcomes in smart grid development.

Call for proposals for battery storage systems under the Portuguese Recovery and Resilience Plan
In 2024 the Portuguese Recovery and Resilience Fund opened a call for proposals for network and storage flexibility[18]. This grant aims to install at least 500 MW of energy storage capacity in the electricity grid (both at the transmission and distribution levels) by the end of 2025.

The eligible projects for financing can go up 30 million euros, the call for proposals was launched to respond to the growing need to optimize and manage the electricity grid with increasing renewable generation, especially in light of the current geopolitical situation and its impacts on the energy markets. The installation of these storage systems will be battery-based, and their capacity must be allocated in such a way that maximizes the viability of potential interest within the framework of the previously allocated injection capacity reserve in the Public Service Electricity Grid. This call has a budgetary capacity of 99.75 million euros and was launched through the Environmental Fund. The call for proposals was closed in September2024 and the applications are still under review.

Certification of energy service companies in the Portugal
In Portugal, installers need to have adequate certification/qualification to run their companies. This is regulated by each economic sector and by the market regulation authorities (National Directorate of Energy, Economic and Food Safety Authority, etc.). The necessary certification schemes are in place as required by European/National regulations. Furthermore, additional certifications from Portuguese Government agencies (e.g. Environment or Energy) may be required to access public support programmes[19]. If the energy service company is providing an energy performance contract, the company need to be qualified[20] as a certified provider by the National Directorate of Energy.

18 https://recuperarportugal.gov.pt/2024/07/31/aberto-aviso-para-armazenamento-de-energia/

19 https://www.deco.proteste.pt/casa-energia/aquecimento/noticias/reembolsos-programa-apoio-edificios-mais-sustentaveis-2023-ainda-estao-por-pagar#que-equipamentos-e-obras-podem-receber-apoio

20 https://www.dgeg.gov.pt/pt/areas-setoriais/energia/eficiencia-energetica/empresas-de-servicos-energeticos-ese/

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6. National barriers, challenges and obstacles

National specifics for Czech Republic

Delayed legislation

In the Czech Republic, there is a considerable delay in the development of legislation. The implementation of the legal framework for accumulation, aggregation and flexibility should have been completed in 2021. However, the process has only recently moved forward, partly under pressure from the European Union, which threatened to cut subsidies from the modernisation fund if the measures were not implemented by the end of 2024. The amendment to the Energy Act lex RES III introduces the concepts of accumulation, aggregation and flexibility into Czech legislation.[21]

Insufficient capacity of the distribution network

Insufficient capacity of the distribution network: The current infrastructure is not ready to integrate a larger share of renewables and flexible services. Connection applicants often face limited grid capacity, which limits the possibilities for developing energy flexibility.

The current infrastructure has limited capacity to adapt quickly to changes in renewable energy supply, which is variable and weather dependent. Many parts of the grid were not designed to cope with the high share of decentralised sources such as solar or wind. This causes problems with congestion and ensuring grid stability.

Projects to upgrade or extend the distribution network often take several years to be approved, delaying the implementation of the necessary modifications. Despite the existence of support programmes, the scale of investment in infrastructure remains below what is needed.[22]

Limited capacity to connect new sources

In some regions of the country (e.g. South Moravia or South Bohemia) a "stop condition" has been declared for the connection of new renewable energy sources because the distribution network is not able to handle the additional generation. The process of connecting new installations, such as photovoltaic plants, is often very lengthy.[23]

National specifics for France

The installation of demand response devices in buildings helps reduce energy consumption by consumers.

To develop flexibility in buildings and enable large-scale flexible consumption, automation and remote control must be made accessible to consumers. This is achieved through demand-side response participation in the market via aggregation, offering a dual benefit:

- Encouraging consumption reduction at optimal times for the electrical system;
- Providing operators with revenue, allowing them to offer consumers automatic and remote control solutions for free, as Voltalis does in France. This makes demand-side response an accessible and rapid solution for everyone.

21 https://mpo.gov.cz/cz/rozcestnik/pro-media/tiskove-zpravy/nova-pravidla-trhu-s-elektrinou-prosla-prvnim-ctenim--lepe-ochrani-spotrebitele-a-umozni-jim-snizovat-vydaje--280699/

22 https://faktaoklimatu.cz/studie/2023-rozvoj-obnovitelne-energie-v-cesku-do-2030?utm_source=chatgpt.com

23 https://oze.tzb-info.cz/akumulace-elektriny/26393-akumulace-agregace-a-flexibilita-v-cr-pomalu-pratele

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By opening its market mechanisms to demand-side response, France has been a pioneer in this field. However, many barriers remain in place today and must be removed to allow demand-side response to participate in all markets as an alternative to production—without discrimination or entry restrictions—in alignment with the existing European framework.

Above all, the full potential of demand-side response cannot be realized without fully opening the market and eliminating these remaining barriers. The European framework, particularly Directive (EU) 2019/944 on common rules for the internal electricity market, emphasizes this need. Specifically, Article 17, which focuses on active demand participation via aggregation, should be fully implemented to support this goal.

While France has led the way in smart demand-side management, other countries are now accelerating their efforts. In the UK, a decision by the British regulator (OFGEM) in October 2023 opened the wholesale electricity market to demand-side response, recognizing the various societal benefits it provides.

Additional regulatory and technical barriers must also be addressed. For instance, in France, sub-measurement (i.e., measuring the load curve at the equipment level rather than the site level) cannot currently be used to assess flexibility. However, sub-measurement is crucial for developing flexibility in the tertiary sector. The global consumption data provided by DSOs does not allow for identifying demand-side responses at tertiary sites for specific types of equipment, as they are masked by other consumption variations on the site. Additionally, sub-measurement would enable different operators managing distinct devices (e.g., one for electric vehicles and another for radiators) to function on the same site efficiently.

Finally, an essential consideration is ensuring visibility and avoiding "stop-and-go" policies. In this context, multi-year calls for tenders should be maintained for a few more years, with operators committed to building and maintaining these capacities for at least ten years. The transition to a market-driven mobilization should then occur gradually.

National specifics for Slovakia

Legislation

From 1 April 2025, the new Building Act No. 25/2025 Coll. comes into effect that will remove ambiguous legislative requirements for permits related to the installation of photovoltaic technologies. This should advance the development of renewable energy (RES) use in Slovakia. The new legislation should bring clear and consistent application of rules across Slovakia. The rules will be clearer, more precise, and more understandable for those interested in using energy from renewable sources, thus speeding up the process of integrating these technologies into practical use.

Barriers

Distribution network limit capacity
Nowadays, a common problem arises for prosumers related to the insufficient capacity of the distribution network. Prosumers are forced to reduce their energy production plans and are often not allowed to connect to the grid due to its limited capacity. This situation reduces the potential for private renewable energy production by prosumers and affects their cost-effectiveness, considering the investments needed for renewable energy technologies and the potential income that would make these investments more cost-effective, allowing for a reasonable and faster return of investment. Another barrier in distribution is that the network does not address energy surpluses during favourable weather conditions, and therefore, to protect the network, it reduces the attractiveness of using photovoltaic technologies (PVT).

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Cost of Distribution Fees
Currently, no feed-in tariffs are charged, unless the prosumer is sharing the excess electricity with other consumer withing the grid managed by the same DSO. Distribution fees are paid for each kW re-distributed via the operator of the distribution grid. Distribution fees are not exempt from sharing, whether at the level of a transformer station, street, district, etc. This practice hinders the achievement of the basic goal of increasing energy efficiency, i.e., ensuring that the electricity produced is used at the place of its production. From 1 January 2025, an exemption is introduced for sharing excess electricity in apartment buildings, but the provision is so ambiguously stated in the regulator's (URSO) decree that it is not possible to enforce this relief.

Insufficient and slow support from the state (subsidies) for individual energy producers
The support that can be obtained from the state is subject to time consuming red tape. The period from the conclusion of the support contract to the actual payment of the subsidy takes at least four months, and currently, it often takes even longer. This causes distrust among interested parties and reduces their willingness to join the system.

Low awareness in society of effective use of RES and smart technologies
Citizens do not have sufficient information about the performance and parameters of photovoltaics, smart metering systems, and heat pumps. The information is mainly provided by agencies and non-profit associations with limited budgets. While some choose the design of the system based on the size of their current consumption, others consider the total area of the roof, for example, in the case of photovoltaics (PV). There is also low awareness among the population about non-financial benefits and a lack of environmental responsibility.

Electromobility and the low use of electric vehicles
Electric cars are not affordable for ordinary Slovak citizens. For this reason, the return of investment (ROI) of installed photovoltaics (PV) cannot account for the reduction in fuel costs by electric vehicles (EVs) when calculating the ROI, which means it does not reach an attractive level for customers. Electric cars are also not supported by employers, nor do they provide benefits associated with electromobility. An employee using an electric car cannot utilize the surplus electricity from the grid or use instantaneous energy production due to off-peak solar hours when they are at home. There is the possibility to use the ZSE Drive card, but this service is subject to additional fees. The development of electromobility, such as in combination with community energy, is not supported in any way. On the contrary, it is directly sanctioned by the exclusion of such a model from support schemes (Green for Households, State Housing Development Fund). For example, in an apartment building, photovoltaics are supported by the state only if the electricity produced is shared in common areas (e.g., lighting), not in households. If the project involves sharing energy in apartments or for a charging station for electric cars, this scheme is excluded from support.

Low use of battery storage
Due to the unappealing ROI, battery storage is not sufficiently utilized by ordinary residents in Slovakia, which could contribute to solving the problem of energy surpluses and shortages. Currently, purchasing battery storage worsens the return of investment rather than improving it. The poor return on investment in Slovakia is also due to the subsidization of electricity prices by the state.

Cost-effectiveness of heat pumps
The introduction and sale of heat pumps in Slovakia have been affected by several factors, including the price of electricity. In addition, the high and constantly rising prices of heat pumps, compared to the relatively low prices of gas boilers, discourage potential customers from purchasing them. Gas boilers could be subsidised from SPP (Slovak Gas Industry company) and other entities, such as distribution companies and boiler manufacturers and these subsidies further increase their attractiveness.

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Purchase costs of smart meters

Customers entitled to free installation of smart meters must meet the requirement of consuming at least 4 MW of electricity. A customer's request for the installation of smart metering infrastructure (SMI) may be rejected due to non-compliance with the technical requirements for the installation and operation of electricity metering, as well as the technical conditions for access or connection to the distribution system of individual distribution companies. Other reasons for rejection may include an unsatisfactory technical condition of the metering switchboard, a mismatch between the current rating of the main circuit breaker at the supply point and the contracted current rating of the main circuit breaker, or insufficient signal quality at the SMI installation site (if the SMI signal is evaluated as unreliable before or after installation).

Energy communities

The difficulty of creating energy communities

Establishing and operating an energy community is currently a complex process. To establish one, it is necessary to create an association with legal status and maintain its operation. Administrative requirements include statutes, regular general meetings, records, etc. Ordinary residents do not understand these requirements, and this discourages them from creating an energy community. This explains why only five energy communities have been established since the adoption of the law (i.e., 11/2022).

Schools, public benefit organizations, non-profit organizations, churches, interest associations, and sports clubs can also be part of the energy community, but they are currently excluded by legislation. Legal analyses have shown that contributory organizations in cities do not meet the definition of small businesses that carry out economic activities.

Main obstacles and challenges for energy communities

In Slovakia, members of an energy community are currently required to use the same energy supplier. This obligation came into effect in January 2025 through an amendment to URSO Decree No. 207/2023, which means that homeowners or apartment owners who wish to join the community must agree on the same supplier. This conflicts with the principle of free supplier choice.

The installation of smart meters (SMI) by the distribution company should be free of charge for all active customers and members of the energy community who are interested in producing, storing, sharing energy, or providing energy flexibility. Currently, the smart meter costs around 150€ for community members. The apartment buildings made of prefabricated panels, which have ideal prerequisites for setting up an energy community, face a disproportionate financial burden. For example, in an apartment building with 16 apartments, this would amount to 2400€.

All distribution and other fees (payment for system services, payment for system operation, payments for electricity losses, distribution tariffs, etc.) should be exempt for energy produced by the energy community if the public grid is not used for energy transmission, in the case of apartment buildings. If an apartment building shares energy within its own distribution system, it should be done without additional fees from the distribution company, as it does not participate in the management of the distribution systems, which are owned by the apartment building. The energy consumed on-site is not subject to additional fees, even in family houses. This will incentivize on-site energy consumption.

For members of the energy community who use the public network for energy transmission, distribution fees should be reduced in the case of short-distance transmission. Additionally, other fees, such as those for sharing within the same distribution branch or for one transformer, should be exempt from distribution fees, as they minimally burden the network.

There are shortcomings in the current regulatory framework. It is necessary to ensure the legislative obligation of the distribution company to create conditions for the establishment of an energy

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community in an apartment building, particularly from the perspective of the administrative "creation of a collection point" that is identical to the current consumption of the entire apartment building.

The law should include a definition of a community source that would have the advantages of a local source (preferential connection, free meter, etc.), but would not be linked to a single collection and supply point (CSP). Instead, it would be linked to a group of CSPs included in the sharing group or energy community. The purpose of a community source would be to cover the consumption of members of the sharing group or energy community.

Members of the energy community should also have the possibility to share energy with other energy communities. Such groups make sense, especially in the case of local municipalities, where, for example, it is not possible to create a single common community between the town/municipality and town dwellers who would like to share their excess energy with entities in municipal administration (for example, a street of family houses wants to share its excess energy with a kindergarten or a retirement home). At the level of self-government or the region, there should be the possibility of creating so-called "social sharing groups," where surpluses from different communities or communities that remain unshared could be directed. In this way, energy communities can contribute to reducing energy poverty.

Access to the Grid: In Slovakia, there are areas where, due to the poor condition of the distribution network, distribution companies refuse to connect renewable sources to the grid. It is necessary for the state, together with the network operator, to create the conditions required and ensure access to the grid for new renewable energy sources for all those who want to establish an energy community. Currently, it is necessary to apply to the distribution company for connection before installing new sources, and the entire process is very non-transparent. Those interested in renewable sources often have no idea whether it is possible to connect sources in their vicinity. People anywhere in Slovakia have the right to establish an energy community, which is not possible without access to the grid. Slovakia is currently facing infringement proceedings from the EU in this area. The European Commission has decided to send reasoned opinions to eight Member States: Bulgaria, Spain, France, Italy, Cyprus, the Netherlands, Sweden, and Slovakia, for failing to incorporate into national law the EU rules laid down in Directive (EU) 2023/2413. These rules aim to speed up the permit-granting procedures for renewable energy projects.

Information campaigns about the benefits of energy communities

Currently, most Slovaks are unaware of the benefits that energy communities offer. Therefore, it is necessary to launch an information campaign on energy communities, focusing primarily on municipalities and public institutions, but also on apartment buildings and individuals who already own renewable sources. It is also important for the state to integrate an agenda into existing state structures that would facilitate the development of renewable sources and increase energy efficiency for households (e.g., regional offices of the Renovate House program or consultation centres of the Green Households program), helping those interested in the process of establishing an energy community.

Financial aid

For many apartment buildings, investing in renewable sources is very expensive and unaffordable. A cluster of energy communities approached the relevant ministry to include energy communities as potential recipients of subsidies from the Green for Households and Green Solidarity programs. Additionally, they requested that the state create a special grant system specifically for energy communities, which would ensure that people at risk of energy poverty cover 100% of their eligible expenses or otherwise favour those energy communities that provide social benefits.

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National specifics for Germany

Regulatory Complexity: Implementing flexibility aggregation requires navigating complex regulations and ensuring coordination among various stakeholders. Household-level flexibility providers, such as virtual power plants (VPPs), often face challenges entering wholesale electricity markets due to high thresholds for participation (e.g., minimum bid sizes and technical requirements). Moreover, different rules and requirements across Transmission System Operators (TSOs) and Distribution System Operators (DSOs) create fragmented and inconsistent market participation frameworks. Households participating in energy flexibility schemes may face higher grid fees, taxes, and levies, which diminish the economic incentives for demand-side management. In addition, the role and responsibilities of aggregators—intermediaries that pool household flexibility—are not clearly defined in German energy law. This leads to uncertainty in their operational and financial models. Furthermore, strict compliance with the General Data Protection Regulation (GDPR) complicates data sharing and communication between households, aggregators, and grid operators. There is also a lack of clear and consistent incentive structures for demand-side flexibility can hinder investment and participation in aggregation initiatives.

Delay in smart meter rollout: The slow adoption of smart meters in Germany is evident, with only 1% of households equipped compared to other EU countries like Italy and France, which are significantly ahead. Figure X shows the smart meter rollout plan in Germany. Furthermore, an estimated expansion in 2024 is projected to involve approximately 1 million devices, with an anticipated increase to about 1.5 to 2 million devices from 2024/25 onwards. Lack of smart meter infrastructure in Germany hinders implementation of various new demand-side service such as flexibility aggregation [24].

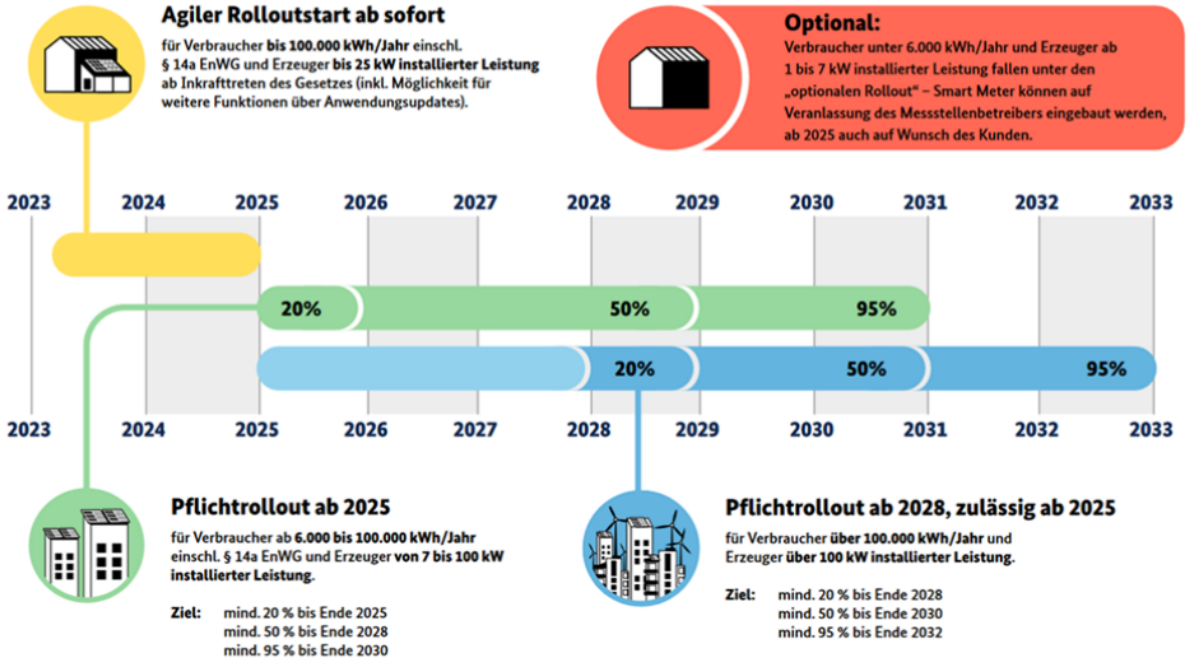

Figure 7 - Smart Meter rollout schedule

[24] Fraunhofer CINES. *Fortschrittsbericht Digitalisierung des Energiesystems*. Retrieved January 2025, from https://www.cines.fraunhofer.de/de/pressemitteilungen/fortschrittsbericht-digitalisierung-des-energiesystems.html

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National specifics for Spain

Delay in legislation

In Spain, there has been a considerable delay in the drafting of legislation. The implementation of the legal framework for cumulation, aggregation and flexibility should have been completed by 2020 with the inclusion of the independent aggregator as an essential figure in moving towards a more flexible market, Spain should have transposed the European legislation by the end of 2020.

The independent aggregator is currently scheduled to enter markets by the end of 2025, this is considered a significant step forward in putting the consumer at the heart of the energy transition. This process is intended to carry out a broader regulatory review driven by the CNMC that has opened for public consultation to review the wholesale electricity market methodologies. The revision seeks to integrate the figure of the independent aggregator and adjust the regulation to the reality of the current market, aligned with the objectives of decarbonization and energy transition of the European Union.

Energy communities

The energy communities are key in the transition of Spain based on a decentralized, sustainable and participatory model. The regulation is based on the "Clean Energy Package" of the European Union, thus promoting citizen participation in energy management. In Europe, two figures are distinguished: the Renewable Energy Communities (CER) according to the EU Directive 2018/2001, and the Citizens' Energy Communities (CEC) according to the EU Directive 2019/944.

DIFFERENCES	REC	CCE
EFECTIVE CONTROL	Physical people SMEs Local authorities, including municipalities	Physical people small enterprises Local authorities, including municipalities
ACTIVITIES	Renewable energy projects only	All activities of the electrical system except transport
PROXIMITY	Sources or members of sources located in the vicinity of renewable energy projects	This requirement is not required

The main barriers that energy communities face for their development in Spain are:

- Lack of time, knowledge and financial resources, since these require the constitution of a legal entity with its own.
- The benefits of energy communities remain largely unknown at the population level.
- The creation of an energy community requires a project.
- The energy community is a transforming agent of the territory. To log be a transforming agent, organisms with real properties are needed.
- Adaptation of financial institutions is needed for the solvency studies of energy communities.
- The development of a national legislation on local energy communities is necessary

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Insufficient capacity of distribution network

The current infrastructure is not prepared to integrate a higher proportion of renewable energy and flexible services. Connection seekers often face limited network capacity, limiting the possibilities of developing energy flexibility. Many renewable energy projects are currently being developed which encounter problems when connecting to the energy grid. This energy transmission and distribution infrastructure in Spain needs to be modernized to effectively integrate a greater proportion of renewable energies. There are many regions where the network is not prepared to manage bi-directional energy flows. This causes congestion problems and ensures network stability.

Storage capacity

The integration of renewable energy and flexibility due to its intermittence need storage systems support to be able to manage this energy. The plan in progress for storage in Spain is included in the PNIEC, the storage target previously set at 20 GW has been increased but has undergone an update in 2023 setting the capacity target at 22,5 GW, which is seen as a predisposition to promote renewables and focus more decisively on the energy transition.

National specifics for Portugal

In Portugal there are specificities (constraints) that make difficult a higher penetration of renewable energy systems including energy communities. Examples of such constraints are:

PV Systems licensing and electricity tariff

So far there are no barriers in terms of amount of electricity that can be injected into the grid. Consumers and prosumers pay the same network charges. However, facilities with capacity greater than 100KW are subject to submit an authorization request to the DSO. The deployment of photovoltaic systems is subject to different administrative requirements depending on their capacity. For capacities ranging from 700W to 30 kW the prosumers just need to notify the competent authority (national Directorate of Energy) which then informs the DSO. Larger systems are subject to control, registration, inspection and a certificate of operation. For capacities of 1 MW and above, a production license must also be issued. In general, PV installation procedures for medium/large installations seem to be demanding for consumers with little expertise or time.

In Portugal, dynamic tariffs were regulated a long time ago but were only available on the last quarter of 2024. The filed implementation of this tariff mechanism was delayed for unclear reasons.

Energy communities

The transposition of the framework for Renewable Energy Communities (RECs), is covered by Decree-Law no. 15/2022, of January 14. Collective self-consumption was only organized first by the Decree-Law no. 162/2019, of October 25. However, collective self-consumption was first regulated by decree-Law no. 162/2019, of October 25. Although the legislation incorporates the definitions provided for in the European directives, the proposed text is considered too vague, since certain details are not clearly mentioned, such as REC autonomy, ownership issues, insurance and community governance.

Connectivity issues might rise when it comes to the application of the conditions on connection between RECs, end users and the distribution grid, as well as the technical requirements like low voltage distance. Moreover, a power transformer might be necessary in some cases to allow the power transfer in order to establish a RECs. The power transformer role is to “handle” the surplus electricity produced and not consumed inside the RECs. While not presenting an important hurdle

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now, in the future with widespread adoption of PV systems, the power injection into the grid may become an issue.

Finally, authorizations and inspection by the National Directorate of Energy might be required depending on the REC size. Currently, the National Directorate of Energy is taking along time to authorize the deployment of RECs, which in some cases makes companies or end-user do give up.

Technical training and competences

Usually, the installers need to have adequate certification/qualification to run their companies. This is regulated by each economic sector and by the market regulation authorities (National Directorate of Energy, Economic and Food Safety Authority, etc.). The necessary certification schemes are in place as required by European/National regulations. Furthermore, a certification from Portuguese National Directorate of Energy may be required depending on the type of contract. Typically, the technical training is provided by both the employer (energy service provide company through internal/external technical training) and though the educational background (e.g. vocational school, polytechnical school, university, training companies, etc.).

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7. Conclusion

Deliverable shows a list of possible non-energy services and their benefits that can be offered under the model being developed. The aim was to create a detailed list of services that would describe the basic parameters of the service, links to the necessary technologies, financing, possible sources of revenue.

Deliverable builds on Deliverable D2.3 Status Quo Analysis of NEBs, extending the benefits found and creating a service for them. The resulting catalogue is an important basis for the follow-up steps, it is the source for the selection of services of the EES model being developed. There, the services offered will be selected and linked to the service model.

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