D2.3 – Analysis of socio-economic and regulatory obstacles to innovation

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Authors	Jose Manuel Longares (CIRCE), Juan Aranda (CIRCE)
Reviewers	George Bourdalas (IGM), Tasos Tsitsanis (S5)

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EXECUTIVE SUMMARY

The digital transition in many sectors of the economy is progressing fast, especially in the industrial sector, where cutting-edge companies are already implementing data-driven technology in what is known as “Industry 4.0”. The energy sector is already involved in this transition, but consumers and buildings are lagging behind. The understanding of the barriers that hinder the wider use and acceptance of big data analysis and data-driven business models for innovative energy services are key to develop a set of solutions that seek to avoid or mitigate those obstacles to innovation.

In terms of regulation, the main EU Directives governing data sharing and exchanges is the General Protection Data Regulation (GPDR) and the Electronic Identification and Authentication (eIDAS). However, there are still gaps about the regulation of the use of Blockchain Technology in Smart Contracts, and the parity with Physical Contracts. At the same time, the continuous increase of Artificial Intelligence Algorithms and the Ethics embedded in them are still to be regulated. The EU Parliament guidelines are drafted under the core principle of Human-centric approach, where technology is always subordinated to the prevailing decisions of humans. At the same time, these algorithms should be robust, safe, transparent, accountable and promote diversity and societal and environmental well-being.

According to the actors involved, different inquiries and participatory processes have been launched to ask BEYOND’s stakeholders the perceived obstacles towards a successful deployment of artificial intelligence solutions for new energy services that combine energy efficiency and demand response services for grid management. The final beneficiaries of these services are consumers, prosumers and building users. Building users in the surveys show a great acceptance to implement smart home solutions and share data with energy service providers to remotely control their energy use, under the principle of full data privacy respect. The main driver for them is the obtention of economic savings and revenues and they might be sensitive to high upfront costs for the new technological solutions.

Business stakeholders include different energy market actors such as Distribution and Utility companies, Energy Service Companies and Facility Managers. The barriers have been classified in groups according to nature: cultural and organisational, social, economic and regulatory. Again, economic barriers like long payback times seem to be the most impacting from their point of view, along with social barriers such as the lack of awareness of the new service opportunities by prosumers or the absence of socially fair benefit sharing models of the new energy services. From the regulatory point of view, the most worrying issue is the market openness for some services like demand flexibility provision in some countries. Data privacy and security are deemed

as important, but they do not seem to be a top impediment for new business models based on data analysis.

As a conclusion, BEYOND's development plan covers the main barriers identified in this analysis. Those regulatory gaps not covered will be the objective of a set of policy and market recommendations to be done at the end of the BEYOND project.

Table of Contents

EXECUTIVE SUMMARY **4**

INTRODUCTION **9**

1. OBJECTIVES AND SCOPE **9**

2. METHODOLOGY AND APPROACH **11**

2.1. Literature review and Initial Identification of Barriers 12

2.2. Identification of BEYOND Stakeholders 13

2.3. Participatory process techniques: Interactions with BEYOND´s stakeholders 15

2.4. Analysis of Results and Definition of Mitigation Strategies 17

3. OVERVIEW OF THE REGULATORY FRAMEWORK AT EU LEVEL **18**

3.1. Energy relevant EU-level regulations 18

3.1.1. Electricity Market Design Directives 18

3.1.2. Renewable Energy Directive 20

3.1.3. Energy Efficiency Directive. 21

3.1.4. Energy Communities Directive 21

3.1.5. Building Energy Performance Directive 22

3.1.6. EU initiatives in the Building Sector 23

3.2. Data and Artificial Intelligence relevant regulations 24

3.2.1. Data protection and data management Directive 24

3.2.2. Online data sharing platforms and Artificial Intelligence Directive 26

3.2.3. Ethic recommendations and regulatory trends in Artificial Intelligence 28

3.2.4. ISO 27001 31

4. REGULATORY AND SOCIOECONOMIC BARRIERS FOR BEYOND´S INNOVATIONS 33

4.1. High-level Overview of Regulatory Barriers relevant to BEYOND 33

4.1.1. Specific regulatory barriers in Spain 33

4.1.2. Specific regulatory barriers in Greece 34

4.1.3. Specific regulatory barriers in Finland 35

4.1.4. Specific regulatory barriers in Serbia 35

4.2. Business Stakeholders' barriers 36

4.2.1. Feedback gathering process for BEYOND's business stakeholders 36

4.2.2. Regulatory barriers 38

4.2.3. Social barriers 40

4.2.4. Economic barriers 43

4.2.5. Cultural and organizational barriers 46

4.3. Prosumers' and building users' barriers 52

5. STRATEGIES FOR BARRIER MITIGATION AND AVOIDANCE 54

5.1. BEYOND's demo site mitigation and avoidance strategies 54

5.2. Policy and market reform recommendations 61

CONCLUSIONS 66

REFERENCES 70

ANNEX 1. STAKEHOLDER INTERVIEW DATA GATHERING TEMPLATE 74

LIST OF TABLES

Table 1: allocation of roles to partners and demo sites 15

Table 2: Representation of roles by different business partners 15

Table 3. Summary of country level regulatory barriers for beyond. 36

Table 4. Detail interview schedule with BEYOND stakeholders. 37

Table 5 Relative severity of the regulatory barriers by location (green: low, orange: medium, red: high) 40

Table 6 Relative severity of the social barriers by location (green: low, orange: medium, red: high) 43

Table 7 Relative severity of the economic barriers by location (green: low, orange: medium, red: high) 46

Table 8 cultural and organizational barriers by location (green: low, orange: medium, red: high) 51

Table 9. social barriers mitigated by beyond 58

Table 10. economic barriers mitigated by beyond 59

Table 11. cultural and organizational barriers mitigated by beyond 61

LIST OF FIGURES

Figure 1. Methodological approach for the analysis of barriers to innovation in beyond. 12

Figure 2. Plan – do – check -act approach of the continuous improvement standards 32

INTRODUCTION

1. Objectives and Scope

Task T2.2 contributes to the definition of the project baseline by dealing with the end user requirements, data landscape and conceptual architectural design. More specifically, this task is devoted to the identification of present-day obstacles to BEYOND's innovations for energy services, policies and business models with several clear objectives: On one side, to become aware of what the potential of data market and Artificial Intelligence (AI) Technology is in the energy sector, making sure that BEYOND adapts to the existing European regulatory framework and market practices, and on the other side, to propose the necessary mitigation and coping strategies to work around those barriers and maximise the impact of the BEYOND breakthroughs for the stakeholders.

This task analyses the regulatory, organisational, cultural and socioeconomic aspects affecting BEYOND's intended business scenarios according to the usage partner institutions make of data streams and the role/s played in the energy sector by each partner. The regulatory analysis focuses on the regulations that govern data management and handling, including digital platforms and big data platform services. However, due to the novelty in many data platform applications, many issues are not fully regulated yet. In this case, this document refers to the recommendations and best practices about data handling ethics provided by relevant expert organisations in the form of white papers or briefings, some coming from the European Parliament and European Commission themselves.

This document does not focus on the detailed national specificities of the regulations since the global market of data makes local practices irrelevant. In the same way, regulations of parallel markets about energy market, energy performance in buildings and energy management are not covered in the analysis.

Apart of regulatory constraints, a special focus has been paid to the elicitation of perceived social and economic barriers to AI and digital big data platform deployment and use, like BEYOND's. The analysis is fundamentally addressed to business stakeholders as data users, and the range of business stakeholders has been selected according to the intended use cases previously identified in T2.1 Building end users have also been inquired at a different level of detail to check for their opinions and concerns in their role of data generators.

The outcomes of this analysis will be used not only to provide a set of analytic tools that comply with the European regulation in place but will also be the bases of T8.6

about Policy and Market reform recommendations, along with the lessons learned during the project execution tasks and demonstration activities.

2. Methodology and approach

This section describes the methodological approach that has been followed to identify and characterize the different barriers to innovation of companies and stakeholders, and how the BEYOND's outcomes could result affected by them. The first step consists of delimiting the scope and boundaries of the analysis. This analysis encompasses the identification of current policies and regulations on the energy and data management domains at the BEYOND's demonstration areas. Apart of regulatory barriers, other type of social, economic or cultural barriers for the main BEYOND stakeholders are addressed.

The methodology followed in this analysis comprises the sequential steps described below:

1. Literature review: A literature review on current policies and regulations on the energy and data management domains is first carried out at EU-level as a starting point. A review of EU-directives in force at both domains has been done. Where no regulation exists, such as smart contracts, data management ethics and blockchain technologies, recommendations and guidelines have been obtained from observatories and expert groups with relevant knowledge in the issues.
2. Initial identification of barriers based on the literature review.
3. Identification of the main stakeholders involved in the realization of the energy and non-energy services facilitated by the BEYOND Big Data Platform and AI analytics and, subsequently, participating in the new business models introduced by the project. In BEYOND, there are two main types of stakeholders, the building stakeholders (Prosumers and Building Managers), usually building users that benefit of the new services and provide access to the data they own (demand, generation, storage, IoT, smart devices, etc.), and the business stakeholders involved in the (building-relevant) energy system value chain, who take advantage of the BEYOND Big Data Platform and Analytics toolkit to advance their service provision while evidently optimizing their business operations.
4. Participatory processes: according to the type of stakeholder, different participatory techniques have been selected to gather their feedback.
5. Analysis of results: Analysis of results will be carried out segmenting per stakeholder role and per demo site country.
6. Mitigation strategies. With the main barriers in sight, the last point is to have a look at the preliminary overview of mitigation / avoidance strategies that should be planned in BEYOND.

The different steps of the methodology are further discussed in the following paragraphs.

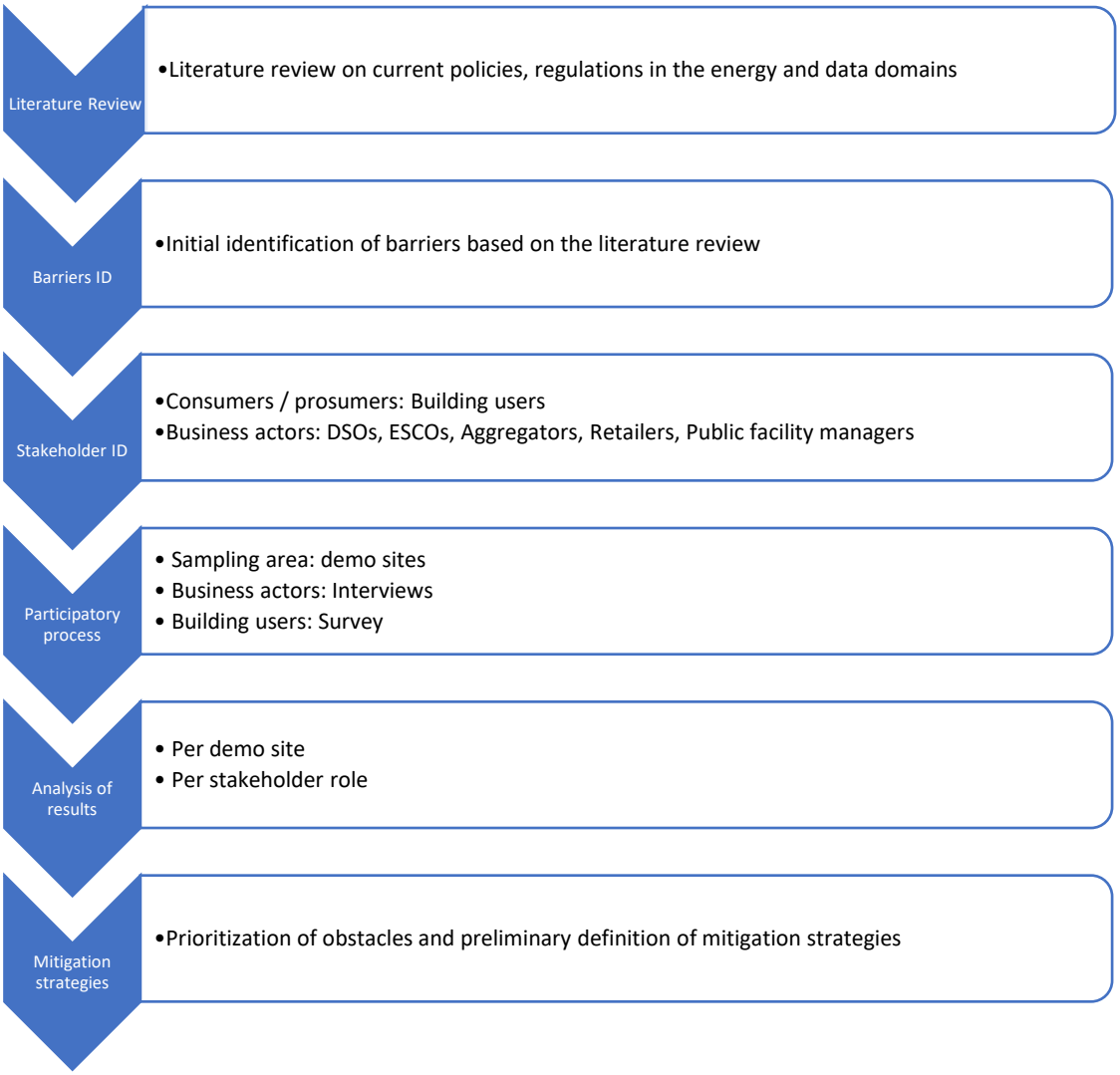

FIGURE 1. METHODOLOGICAL APPROACH FOR THE ANALYSIS OF BARRIERS TO INNOVATION IN BEYOND.

2.1. Literature review and Initial Identification of Barriers

The two first steps of the methodology focus on creating the baseline for the engagement activities that will be performed towards extracting expert knowledge from the BEYOND stakeholders and further analysing it with view to the identification of the most important barriers to be considered in the project implementation.

In this context and stepping on the BEYOND concept and demonstration cases, this step is focusing on the identification of the most relevant regulations around big data, artificial intelligence, data management and protection, while identifying EU-wide directives associated to the Energy Performance of Buildings, Energy Efficiency, Energy Markets functioning, Renewables' integration, Energy Communities creation, Renovation acceleration, etc. that are of direct interest of the BEYOND project and the end-user services and applications that will be developed during the project. As part of this step, an initial set of high-level barrier categories will be identified (e.g. missing regulations, delay in national transposition of EU directives, regulatory gaps and uncertainties) that will be, later on, instantiated when engaging with the demo partners.

On the socio-economic and organizational side, the consortium will attempt to define an initial list of barriers related to data management, data analytics and data sharing, stepping on the expertise of the technology partners of BEYOND and their previous experience in similar business and innovation contexts. This initial list will be used as input for the discussions to be performed during the participatory process execution with the BEYOND demo partners, towards revealing their main concerns and prioritizing their mitigation during the project implementation, with the delivery of solutions that appropriately tackle them.

2.2. Identification of BEYOND Stakeholders

According to the role the stakeholders play when dealing with data, there are two type of stakeholders in BEYOND.

- Data producers or data providers: Since the BEYOND Big Data Platform and Analytics toolkit aims at introducing intelligence and optimizing energy services to building users and occupants, they are the ultimate data producers as they interact with the building energy assets and provide input to the BEYOND Big Data Platform. Building users and Building managers are the data producers that feed data into the platform and benefit of the final energy services and benefits of the platform.
- Data brokers: These are business actors that do not generate the data but obtain it directly or indirectly, store, share or trade with the data.
- Data consumers or data users: They are business actors who do use the data, as raw, or as derivative data (resulting from the execution of advanced analytics). In BEYOND, these data consumers are energy market actors that use the data for different purposes. Depending on the purpose we can identify facility managers, Distribution System Operators (DSOs), Energy Service Companies (ESCO), energy retailers and aggregators, and local authorities or

companies delivering public services. Building Data Value-Chain Stakeholders (Business actors), could take a bilateral role producing data for others or consuming data from other sources.

The requirements for each type of data stakeholders are different. While consumers may be worried about a proper and transparent use of their data with full respect to data privacy and non-disclosure, business actors may be concerned about how to maximise the data value added for their customers and for themselves while keeping with the regulations in place and the ethical practices in due form.

The source of data for analysis of the different types of obstacles associated with the BEYOND implementation and validation is the BEYOND living lab, which acts as the main engagement and interaction instrument with the stakeholders linked to the project. Representative feedback and points of view are to be gathered from the different demo partners and demo site participants in Spain, Finland, Greece and Serbia. Separating by type of data producers, the main feedback providers are:

- Building users and energy consumers in buildings. The sample is taken from the customer base of the companies running every demo site per country on random basis. The survey was jointly carried out with T2.1 and the sample selection criteria and procedure are described in D2.1
- Business actors. A well-balanced group of actors with full knowledge of the BEYOND platform solution but representing a variety of data users in the energy sector is made up by the business/ demo partners in the BEYOND consortium. Each of them has taken a different role in the sample in order to cover the full energy sector providing services to building users and energy prosumers. The allocation of roles is shown in the table below.

Number	Partner	Demo site	Role played in BEYOND
1	FVH	Finland	Local authority, building manager
2	Mytilineos	Greece	retailer and ESCO
3	Cuerva	Spain	local DSO and retailer and potential aggregator and ESCO
4	VTT	Finland	Technology provider for EE in buildings and smart cities

5	Urbener	Spain	Retailer and potential aggregator
6	BEOELEK	Serbia	local DSO and retailer

TABLE 1: ALLOCATION OF ROLES TO PARTNERS AND DEMO SITES

This allocation of partners and roles enable to have a full representation of the main business actors in the building energy sector, having at least one representative per main role:

Network Operators	Cuerva (electricity), Beolek (Heat)
ESCO	Mytilineos
Building managers	FVH
Retailers	Mytilineos , Cuerva, Beolek
Aggregators	Urbener
Local authorities	FVH

TABLE 2: REPRESENTATION OF ROLES BY DIFFERENT BUSINESS PARTNERS

Since the nature and variety of these barriers may be diverse, they have to be bundled and tackled by topic or barrier type. The barriers that are objective of this analysis are:

- Cultural and Organisational barriers to digital innovation
- Regulatory barriers applicable to data management, as well as, to the realization of innovative energy and non-energy services.
- Social barriers applicable to data management.
- Economic barriers associated with advancements in digitalization and data intelligence-enabled differentiation.

2.3. Participatory process techniques: Interactions with BEYOND´s stakeholders

The participatory process is a process in which the selected representative sample of participants and relevant feedback providers are invited to express their opinion and concerns in a free and secure environment where their right to anonymity is guaranteed. In this sense, no direct reference to persons and participants can be made. Data is presented anonymously or in aggregated terms.

The techniques chosen depend on the type of data requested, the level of detail, the level of aggregation and the purpose this information is requested. We then identify two suitable techniques for each type of stakeholders:

- Building users: the level of detail is low, but the number of respondents may be high. No reasoning or debate is needed. Questions are univocal, short and specific. No expertise is required as only opinions are important. In this case, the most appropriate participatory technique is a generic survey distributed to the largest possible number of respondents meeting the selection criteria. Results will be statistically treated and analysed by sample segmentation categories.
- Business actors: In this case the sample of stakeholders is rather small and quite heterogenous. We aim not only at finding barriers but also understand the reasons of those barriers and enablers. A debate may proceed to get more in depth at certain aspects. In this case, a personalised and structured interview with each stakeholder is recommended.

Interview Technique for experts and qualified stakeholders:

This technique is specially tailored to extract specific and concrete information using prepared questions and debate them to make sure the interviewee understands the information request and to get in depth on the reasons and the rationale behind the answers. The guidelines for the BEYOND interviews are the following:

- Interviews are conducted by CIRCE but other partners are also invited.
- The interview is meant for the 5 demo project partners with participation in the task, with representantives in each business actor role.
- The interview script is sent to the interviewees beforehand, along with the online meeting link, so as that interviewees have time to prepare themselves and collect data in advance if needed.
- The generic demographic first points could be prepared offline in advance, to gain time for the discussion in the interview.
- The interview is made up by open questions for people to express opinions and views on behalf of the institution they represent and playing the assigned roles in the BEYOND project.
- Partners should make sure that the respondent knows well the project objectives, the company, the current business, and has a view of the innovative emerging business models in BEYOND.
- Interviews should last from 45 to 60 minutes. There are no wrong answers. Reasoning and illustrating data are appreciated.
- The notes taken during the interview will be made available for revision and approval by the interviewees, to ensure their views and opinions are correctly and accurately gathered.

The questions reviewed during the interview are available in Annex 1.

Results are analysed jointly when most of the interviewees share the point of view, or separately, when they diverge in the responses given. In this case, the reason of this divergence is studied in relation to the role played and making the difference between specific company issues or general sectoral concerns. Barriers with significant low or high impact are summarised as relevant outcomes of the exercise.

2.4. Analysis of Results and Definition of Mitigation Strategies

The two final steps of the methodology are intended to process the input collected during the engagement activities with the BEYOND stakeholders / demo partners, towards formalising and prioritising the different barriers involved in the project implementation, from a regulatory, social, economic and organizational point of view.

The formalisation and prioritisation of the relevant barriers is of critical importance towards proceeding to the final step of the methodology that focuses on the definition of mitigation and override strategies that will (i) facilitate the demonstration of the BEYOND solutions in the project's demo sites, while (ii) paving the way for the successful exploitation of the project results, following their validation and the satisfaction of ambitious impact goals. Such mitigation strategies will be defined in a two-fold manner:

- Design decisions and introduction of appropriate features to the BEYOND Big Data Platform and AI Analytics toolkit to address data-relevant regulatory barriers and (most importantly) organisational and socio-economic barriers related to data privacy, data security, data sovereignty and transparent, fair and trustful data sharing.
- Identification of missing regulations and regulatory gaps. Having this information in hand, BEYOND will define concrete recommendations to be promoted towards relevant regulatory bodies in the form of policy briefs (at national and EU level). Such policy briefs will utilize the current analysis' input, along with the findings of the validation activities in the BEYOND demo sites, as part of the activities of Task 8.6 (T8.6) and will consist in a set of concrete recommendations towards enabling the maximization of the multiple benefits offered by the wide replication of BEYOND solutions around the EU, the timely realization of EU short- and mid-term policy objectives (until 2030) and the speedier transition toward a decarbonised energy system with active citizens, smart buildings, improved energy system performance and reduced energy poverty.

3. Overview of the regulatory framework at EU level

3.1. Energy relevant EU-level regulations

This section makes a review of relevant EU-wide energy-related directives that affect BEYOND innovations and demo site activities. These directives affect the energy market, mainly electricity, energy efficiency, building energy performance and energy communities. Some relevant EU initiatives in the building sector have been deemed important and added separately.

3.1.1. Electricity Market Design Directives

The European Union's Clean Energy Package was issued in 2019 to set the basis for a future integrated and competitive EU unified electricity market that replace the currently fragmented national and local electricity markets. This package was made up of four main regulations to which BEYOND must adhere. They are the following:

- Regulation (EU) 2019/941 of 5 June 2019 [1] on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC [2] (Risk-Preparedness Regulation)
- Regulation (EU) 2019/942 [3] of 5 June 2019 establishing a European Union Agency for the Cooperation of Energy Regulators (ACER Regulation)
- Regulation (EU) 2019/943 of 5 June 2019 [4] on the internal market for electricity (recast) (Electricity Regulation)
- Directive (EU) 2019/944 of 5 June 2019 [5] on common rules for the internal market for electricity and amending Directive 2012/27/EU [6]

The objective of these directives towards the transition to a decentralised and decarbonised European electricity system is to transform today's in force market rules by means of three main action strategies: they consist of higher renewable penetration, energy storage, transport sector electrification ,building HVAC and demand flexibility. This way, this set of directives allow consumers, prosumers and energy communities to be active players in electricity markets, manager their behaviour according to market signals and become service providers to the grid by offering their demand flexibility in open markets of demand flexibility. To enable this direct market participation by consumers, dynamic electricity price contracts shall be available in all Member States to ensure consumers free choice of energy suppliers in a competitive way at no extra charge. Smart metering shall allow for more understandable billing information with clear and accurate metering to enable users to make well-informed decisions on energy usage. Prosumers must report the grid electricity consumption and supplied to the grid separately.

More relevant to BEYOND, aggregated demand response flexibility shall be accepted in all electricity markets, including generation, ancillary and balancing services. This Directive entitles customers to actively participate in flexibility schemes and energy efficiency schemes, either directly or through third party energy management companies. It also entitles consumers to operate in demand response markets, directly or through an aggregator. The importance of demand flexibility is stressed by the fact that consumers and prosumers are from now on, financially responsible for the imbalances they cause in the electricity system. This way, demand flexibility becomes a way to provide local grid balancing and avoid imbalance costs in a suitable and cost-effective manner.

Another interesting aspect introduced in the Regulation (EU) 2019/944 [5] of the European Parliament and of the Council of 5 June 2019 on the common rules for the internal market for electricity is the promotion by Member States of the roll out of smart meters in order to promote energy efficiency and to empower final customers to optimise the use of electricity. Smart meters should also enable the provision of advanced energy management services based on continuous and real-time metering, the development of new pricing models that contribute to change the energy behaviour of citizens. Smart metering systems shall be interoperable, in particular with consumer energy management legacy systems and with smart grids, in accordance with the applicable Union data protection rules. Additionally, the progressive deployment of smart metering systems in the Member State territories shall assist the active participation of prosumers in the electricity market. The smart meter rollout is mandatory but subject to a cost-benefit assessment.

The articles that affect the smart meter roll out in Europe are:

- Article 19: Smart metering systems, encouraged by Member States, to enable customers to take active participation in the electricity market in a transparent and non-discriminatory manner.
- Article 20: Smart metering functionalities. Smart meters shall comply with European standards and communication security rules, while ensuring end user's privacy and data protection. Users have the right to availability of their data and information about the potential of new services based on the smart meter installation.
  Article 21: Entitlement to a smart meter. Every final customer is entitled on request, while bearing the associated costs. Relevant to BEYOND, this article explicitly states that smart meter " is interoperable and able to deliver the desired connectivity of the metering infrastructure with consumer energy management systems in near real-time".

This favourable regulation for BEYOND demonstration activities should mean no barriers, since the Electricity Directive shall have been transposed at national level legislation before the end of 2020 in all Member States. However, delays are occurring in some countries such as Greece and Spain. The lack of open markets for aggregated demand flexibility and the different pace of smart meter rollout programmes may be a problem in some BEYOND demonstrators.

3.1.2. Renewable Energy Directive

The Renewable Energy Directive, also known as "RED II" corresponds to (EU) 2018/2001 [7] "on the promotion of the use of energy from renewable sources". This directive builds upon the former RED I and follows the same aim of increasing the EU target of RES in primary energy consumption from 20% to 32%, giving freedom to each Member State to apply support schemes. These support schemes go from reducing the cost of RES generation by using investment aids, tax reductions and refunds, or direct price support programmes such as feed-in tariffs or market premium prices, to creating renewable energy obligations all under non-discriminatory, competitive, and cost-effective principles.

RED II aims at promoting the installation of highly efficient renewable heating and cooling systems in buildings and opens local district heating and cooling to RES generators with a minimum annual RES increase of 1%. This RES participation can be done by replacing or expanding existing conventional heating and cooling systems with RES technologies. This aspect of the Directive might impact the Serbian demo site if a strict and imminent transposition were to take place.

RES II establishes that DSOs shall dispatch energy on market-based criteria, eliminating the so-far priority to RES dispatch set by RED I. The intention is to promote the cost-efficiency of RES technologies in use.

RED II makes an explicit commitment to allow consumers to generate, store and consume their own energy from renewable sources, selling the excess of energy to the grid through different mechanisms (Power Purchase Agreements (PPA), Peer-to-Peer arrangements (P2PA), compensation or other support schemes) while retaining their rights and liabilities as final consumers. This is an important impact of RED II for BEYOND.

Finally, RED II simplifies the legalization formalities for small installations smaller than 10.8 kW, reducing the administrative burden by allowing simple-notification procedures for grid connection of installations.

3.1.3. Energy Efficiency Directive.

The EU 2018/2002 New Energy Efficiency Directive (EED) [7] has entered into force in 2018 and the member states shall have incorporated it before June 2020. This Directive elaborates on the EU 2012/27 EED and the key change is the new energy efficiency objective for 2030 of at least 32.5%. This ambitious new target represents a decrease in the amount of energy consumption, that is, the EU energy consumption should not exceed 1,273 MToe of primary energy or no more than 956 MToe of final energy.

The revised Directive encourages a more efficient use of energy leading to:

- Reduced energy consumption for homes and businesses.
- Lower consumption in all industrial and domestic sectors.
- Incentives to energy efficiency.
- More investment in energy efficiency projects.
- Clearer and more transparent information availability and sharing.

Other elements of the amended Directive include stricter rules on thermal energy metering and billing, requiring Member States to establish transparent and publicly available national standards, monitoring efficiency levels, updating the primary energy factor for electricity generation to 2.1 from the previous 2.5, and a general revision of the former Energy Efficiency Directive.

This new Directive brings along the possibility of investing in and adopting innovative technologies, techniques or services that will stimulate the demand for measures to improve energy efficiency.

With the transposition of this new Directive, in addition to the use of new technologies, techniques or services, it is expected that the consumption in industries, tertiary buildings, transport and homes will become more efficient, which entails a very important contribution to the achievement of the climate objectives of the Paris agreement.

3.1.4. Energy Communities Directive

There is a new concept which has been created by the European Union which are the Energy Communities, within these we can find two branches, Citizen Energy Communities (CEC) and Renewable Energy Communities (REC).

The path to an energy transition is affected by the creation of this new concept, it ensures that citizens are in the foreground, and it also achieves greater public

acceptance of renewable energy projects, so investments in this sector are more attractive.

As previously commented, by having the citizen in the foreground, they enhance direct benefits by promoting energy efficiency, reducing the amount of electricity bills, a good restructuring of the energy system with a good use of energy and facilitating the participation of citizens. in the energy transition.

The Directive on common rules for the internal electricity market (EU 2019/944 [5]) includes new sections where consumer participation becomes more important, either individually or through citizen energy communities, in all markets, either generating, consuming, sharing or selling electricity or providing flexibility services through response to demand and storage. The objective of this directive is to improve the acceptance of energy communities and facilitate citizens to become active participants.

In addition, the revised Renewable Energy Directive 2018/2001 / EU [11] prioritizes renewable self-consumers and renewable energy communities. Energy communities will be ensured access to all suitable energy markets, directly or through aggregators in a non-discriminatory procedure. The consumers' individual rights should be also ensured at community level, where renewable energy communities will be allowed to participate in support schemes on equal basis with large participants for small RES installations.

If energy communities succeed in producing, consuming, storing and selling renewable energy, it will strengthen energy efficiency at home, support the use of renewable energy and help fight poverty by reducing energy consumption and lower utility rates.

3.1.5. Building Energy Performance Directive

The revised Energy Performance of Buildings Directive (EU) 2018/844 [8], also known as the new EPBD, is a thorough revision of directive (EU) 2018/2002 [7] the so-called Energy Performance in Buildings Directive (EPBD). The new EPBD specifies the technical requirements of energy systems in new and refurbished buildings, paying special attention to link financial incentives for energy renovation to the energy savings achieved in that renovation.

Besides, the new EPBD urges each Member State to set an annual building renovation target to achieve a gradual renovation of the European residential building stock. Renovation criteria must consider the energy consumption in the building use-phase following cost-effective criteria from a Life Cycle perspective. The target of public funding in the renovation effort is to leverage private investments in a

transparent and non-discriminatory manner. The renovation strategy started with the involvement of the public building stock towards nearly Zero-Energy Buildings (nZEB) as an exemplary action starting in December 2018. Public buildings shall be followed by private new buildings, that should be nZEB from 2021. The building stock that makes part of the BEYOND demonstration activities are neither public nor new, and hence, they are not liable to be nZEB.

Finally, the 2018 revision of the EPBD pays due attention to the building's adaptation to data-driven solutions and automation. The creation of a smart-readiness indicator (SRI) [9] aims at rating this readiness as a function of interconnection capabilities with the grid and other IoT intelligent devices. This indicator assesses the ability of buildings to adapt to automatic monitoring, control and automation applied to the energy consumption of the residents in relation with their energy demands (energy efficiency), by gathering and retrieving various intrinsic parameters, and others received from external systems such as the grid (energy flexibility) or the energy market prices (price-based scheduling). This indicator can stimulate the use of building automation and monitoring to provide both flexibility and efficiency by means of enhanced functionalities based on Artificial Intelligence algorithms. The EU-funded VITO project [9] paves the way for the development of the indicator and the implementation. were by The Commission services proposed a definition and calculation methodology in November 2019 [10].

3.1.6. EU initiatives in the Building Sector

Since BEYOND's solutions are focusing on buildings, it is relevant to mention some EU-wide efforts for promoting the improvement of energy performance in buildings and the utilization of building data such as the following initiatives:

Digital Building Logbook (DBL) [12], is very relevant and related to the BEYOND project, since it aims to support the widespread use of DBL throughout Europe. It also promotes the transparency and availability of data. This also contributes to a number of policy initiatives such as "A Europe Fit for the Digital Age", the "European Green Deal" and its Renovation Wave, the new Circular Economy Action Plan and the next Strategy.

Several European countries have developed and implemented DBL-type initiatives in recent years. A common European approach covering the entire life cycle and comprising all relevant information about buildings could increase learning and enable synergies, interoperability, data coherence and information exchange.

The Renovation Wave Strategy [13], created to improve the energy performance of buildings. The aim is to achieve the objective of doubling the renovation rates in the

coming years and that this leads to greater energy efficiency, in addition to improving people's quality of life.

One of the barriers identified for building constructors and facility managers relates to the recently published "Renovation Wave Strategy" [13], which forces all EU countries to prepare their Long-term Building Renovation Strategy (LTRS) as a measure towards accelerating and incentivizing the growth of the renovation rate at country level. At the moment, several countries have experienced significant delays in delivering these strategies, hindering the realization of the target set by the EC to double renovation rates until 2030. Even in the case that strategies have been delivered (as in the case of Greece), its actual implementation may have been delayed due to several reasons, among which the COVID pandemic, which further hinders the realization of the targets and the associated business growth in the sector.

The Smart Readiness Indicator [9], Finally, and very relevant for BEYOND, the 2018 revision of the EPBD pays due attention to the building's smart-readiness and how to rate it as a function of interconnection capabilities with the grid and other intelligent devices, by means of a smart-readiness indicator (SRI) [14]. This indicator rates the ability of buildings to adapt their energy consumption to the residents' needs (energy efficiency) and to the various signals received from the grids (energy flexibility). This indicator can stimulate the use of building automation and monitoring to provide both flexibility and efficiency by means of enhanced functionalities based on big data algorithms. Efforts for the development of the indicator and the implementation were completed in the EU-funded VITO project [9]. A definition and calculation methodology were proposed by the Commission services in November 2019 [10].

In addition, this indicator will serve to reassure occupants of the savings that can be achieved with building automation.

3.2. Data and Artificial Intelligence relevant regulations

This section makes a review of EU Directives that apply to data protection, management and sharing, data platforms and artificial intelligence, that should inspire BEYOND's developments and solutions.

3.2.1. Data protection and data management Directive

The General Data Protection Regulation (GDPR) [14] is a legal framework designed to give EU citizens the power to define how their personal data is used. The guidelines require companies to disclose how they use, store, process and move any personal data collected from individuals in the EU or Economic European Area (EEA). The policy applies to any site that attracts visitors from the EU regardless of whether they are

based in the region. The policy also gives individuals the right to request for their personal data to be amended or deleted at any time.

In the frame of BEYOND, all data and information collected and processed, should comply with Regulation (EU) 2016/679 of 27 April 2016 [14] on the protection of natural persons with regard to the processing of personal data. To this end personal data managed within BEYOND shall be anonymized and stored in a form which does not permit identification of users. Moreover, data processing will be done in respect to the purposes for which the data are collected or for which they are further processed, while ensuring appropriate protection for personal data stored for longer periods for historical, statistical or scientific use. BEYOND will need to establish a data management framework that guarantees security of collected personal data from potential abuse, theft, or loss.

Below are the definitions of selected terms as they are used in the GDPR and in this document.

- Data Subject: Any identifiable individual in the EU.
- Personal Data: Any information directly attributed to an identifiable natural person or data subject.
- Processing: any digitized operation carried out on or using personal data. This includes the collection, storage, transfer, conversion and others.
- Controller: a natural or legal party that determines the purposes and method to prove personal data is kept private and confidential.
- Data Processor: a natural or legal party that processes personal data under the direction of the controller.

As concerns BEYOND project, special attention should be given to the protection of energy consumption data that are collected automatically using smart meters or dedicated metering clamps. Information about installed equipment, ambience and occupancy sensors combined with information from smart meters can reveal personal consumption profiles, as well as behaviours, users' preferences or occupancy patterns. This personal information can compromise the privacy and security of users, especially when residential prosumers are engaged, as it is the case of BEYOND project.

Lots of information can be extracted from the energy usage data generated by smart energy systems, through analytics and predictive profiling. In addition to the use of the smart metering devices, the combined use of other control and monitoring equipment installed in houses, such as environmental and occupancy sensors, climate monitoring/control equipment, and actuators, can give not only a profile of the building residents' schedule but also preferences and habits that are sensitive data for the residents. On the contrary, individuals and businesses can both benefit

from sharing certain private sensitive data. For example, commonly valued benefits from data sharing to grid operators and energy service providers include proactive network maintenance, as well as improved operational efficiency and management of assets. In any case, individuals must be aware about the data they share and how they are used by the service providers and grant their prior consent for data collection and processing.

According to the Universal Smart Energy Framework (USEF), which is compliant with the GDPR, all data on energy consumption are treated as personal data and are subject to a Data Protection Impact Assessment (DPIA). Data streams based on necessity, such as public interest or a legal obligation, are separated from those based on consent, such as those involved in value added services. Within BEYOND, measures to prevent identification of individual prosumers by other actors will be implemented in the system. Moreover, processing of personal data collected from sensors will be automated and the output will be utilized by the respective components without displaying the user's identity or any unnecessary information to administrator managers.

3.2.2. Online data sharing platforms and Artificial Intelligence Directive

eIDAS Directive

Regulation (EU) 2014/910 of 23 July 2014 [16] on Electronic Identification Authentication and Trust Services for Electronic Transactions in the Internal Market, also known as eIDAS directive, provides a predictable regulatory environment to enable secure and seamless electronic interactions between businesses, citizens and public authorities. In particular, this directive:

- ensures that people and businesses can use their own national electronic identification schemes (eIDs) to access public services in other EU countries where eIDs are available.
- creates a European internal market for electronic trust services – namely electronic signatures, electronic seals, time stamp, electronic delivery service and website authentication – by ensuring that they will work across borders and have the same legal status as traditional paper-based processes.

eIDAS Article 8 deals with the safety standards of the electronic authentication systems. The provisions contemplated in this article must be observed in BEYOND for the design and deployment of the blockchain-enabled smart contracts for prosumers market participation and the trusted multiparty data sharing services envisaged in T4.4.

Directive on Fairness and Transparency for Business Users of Online Platforms

The management of data sharing by means of digital data platforms is governed by Regulation (EU) 2019/1150 [17] of the European Parliament and of the Council of 20 June 2019 on promoting fairness and transparency for business users of online intermediation services. It is also known as the Platform to Business (P2B) regulation and it is in force since July 2020 in all EU member states. It applies to online platforms and search engines providing services to business users that offer goods or services to consumers in the European Union.

Online service providers need to change their Terms and Conditions (T&C) to include information about minimum notice periods for changes and contract termination, user's right to terminate the contract, access to personal data after contract expiry and ownership and control of IP rights. [18]

Access to data

In the case of the BEYOND Platform, it is relevant to mention that Providers of online intermediation services shall include in their terms and conditions a description of the technical and contractual access of business users to any personal data, which business users or consumers provide for the use of the online intermediation services concerned or which are generated through the provision of those services.

The providers of online intermediation services shall adequately inform business users in particular of the following:

- Whether the provider of online intermediation services has access to personal belonging to business users or consumers.
- Whether a business user has access to personal data or other data in connection to the business user's use of the online intermediation services concerned or generated through the provision of those services to that business user.
- Whether a business user has access to personal data provided by or generated through the provision of the online intermediation services.
- Whether any data is provided to third parties, along with, where the provision of such data to third parties is not necessary for the proper functioning of the online intermediation services.

3.2.3. Ethic recommendations and regulatory trends in Artificial Intelligence

Ethics in AI

Artificial Intelligence (AI) use machine learning techniques on large volumes of data, robotics and automated decision-making systems (ADMS) to simulate human behaviour and reasoning and make autonomous decisions. At present, there is not specific regulation about Artificial Intelligence (AI) technologies and their increasing impact on society. However, the EU has proposed a 'human-centric' approach to AI that is respectful of European values and principles. The European Parliament made a call to update and complement the existing Union legal framework with guiding ethical principles, which were compiled in 2019 in a Briefing under the title: "EU guidelines on ethics in artificial intelligence: Context and implementation". [19]

These guidelines suggest some non-binding ethical rules that are recommended on civil law rules when designing, developing, implementing, or using AI products and services in the EU. The core principle of the guidelines is to put the human being first (human-centric approach). The key ethical requirements that all AI should comply with are:

Human agency and oversight

In practice this rule ensures that an AI system does not hamper EU fundamental rights, users should be able to understand and interact with AI systems to a satisfactory degree and that a machine cannot be in full control. Therefore, there should always be human oversight. Humans should always have the possibility ultimately to over-ride a decision made by a system.

Technical robustness and safety

It is important to have secure and reliable systems and software. Trustworthy AI requires algorithms to be secure, reliable and robust enough to deal with errors or inconsistencies during all life-cycle phases of an AI system. This requirement is about ensuring cybersecurity.

Privacy and data protection

All AI systems must comply with the General Data Protection Regulation (GDPR) by principle. The EU guidelines on AI advise the AI developers to ensure privacy and personal data protection. Citizens should have full control over their own data, and their data should not be used to harm or discriminate against them.

Transparency

Transparency is paramount to ensuring that AI is not biased. The AI guidelines introduce measures to ensure transparency, such as data sets and processes should be documented and traceable. Also, AI systems should be identifiable as such, and humans need to be aware that they are interacting with an AI system. As specified in the guidelines, "AI systems and related human decisions are subject to the principle of explainability, according to which it should be possible for them to be understood and traced by humans".

Diversity, non-discrimination and fairness

The guidelines pay specific attention to non-discrimination and fairness when AI products and services are designed. AI systems should be conceived with consideration for the whole range of human abilities, skills and requirements, and ensure accessibility to persons with disabilities.

Societal and environmental well-being

Positive social change, sustainability and environmental responsibility of AI systems should be used and enhanced. Social impacts of these systems must be monitored and considered. Moreover, the effects of AI systems on society and democracy should be assessed. The same applies, where possible on the assessment of the environmental impacts of AI usage along the life cycle.

Accountability

Internal and external independent audits should be put in place as mechanisms to ensure responsibility and accountability for AI systems and their outcomes. Reporting of the AI systems' negative impacts should be available, and impact assessment tools should be used to that purpose.

BEYOND's human-centric approach is in line with the ethical principles of AI. All BEYOND's system functionalities can be overridden on demand as per the end users' request. Additionally, participation in market events such as DR events are subject to the prior consent and smart contract signing by end users. Energy profiling engines operate with full respect to end-users' comfort preferences and monitor these changing preferences to ascertain the boundaries in which events take place without trespassing the users' comfort choices. In addition, blockchain-driven algorithms make sure that the users data privacy is safeguarded and protected. [19]

Smart data contracts

As blockchain and smart contracts become more widely used in digital applications and platforms, regulators and policy makers will need to give response to challenging

questions. These challenges are unavoidable and necessary as part of the natural processes of change in society. Moving ahead from those regulatory challenges, the European Union Blockchain Observatory and Forum, sponsored by the European Commission has prepared a thematic report on the topic, which is very innovative for the novelty of the technology, and it comes as a response from the fast penetration of the blockchain technology for smart contracts and businesses.

This report analyses the regulatory gaps about the use of this technology in data platforms and make some general recommendations to find out how policy makers could address this short- and medium-term adaptation. The main recommendations for future regulatory framework set up about blockchain technology are listed below:

Craft simple but usable definitions of the technology

A simple but potentially quite useful first step would be for policy makers to clearly define what blockchains and smart contracts are under the law at the European level in order to have a shared definition for EU and Member State regulators.

Communicate legal interpretations as broadly as possible

It is worthwhile for authorities to make an extra effort to communicate widely about new blockchain-related laws or binding interpretations of the law.

Choose the right regulatory approaches for the question at hand

regulators can choose from three basic approaches when regulating new technologies like blockchain: apply existing laws, amend existing laws or draft fully new regulations. The right balance between user protection and innovation booster has to be found at each case.

Harmonise the law and interpretations of it

It is paramount that blockchain and smart contract regulation be as harmonized as possible throughout the EU.

Help policy makers develop an understanding of the technology

It is important that the respective authorities and the full ecosystem understand this new technology and what can (and cannot) be achieved with it before setting about issuing new regulations on it.

Work on high-impact use cases first

Setting priorities will be key for the new blockchain regulation, beginning with those use cases where there is already a great deal of activity and hence the largest potential short- to mid-term impact. That would encompass the regulatory questions around digital assets as well as bringing clarity to blockchain and the GDPR.

Closely monitor developments in less mature use cases and encourage self-regulation

Intervening too early in novel use cases can be counterproductive.

Make use of blockchain as a regulatory tool

An excellent way for regulators to help monitor and regulate the industry is to get involved themselves.

BEYOND platform makes use of advanced blockchain technology and smart contracts to negotiate end users' participation in flexibility markets while observing the ethical recommendations to the use of this technology. The set up of this platform is a model of ethical use of the technology. The issues that will arise during the platform development, deployment and use will be relevant for the future regulation about the matter and will be put together at the end of the project in T8.6 "Policy and market reform recommendations".

3.2.4. ISO 27001

The ISO 27001 [20] standard deals with the certification on data security and data management systems. This standard is a continuous improvement process for corporate Information Security Management Systems (ISMS). This continuous-improvement quality system should be developed in a way that allows evaluating all types of risks or threats that could hamper the information protection of an organization, both own-produced data and third-party data managed internally.

On the other hand, the standard also encourages to settle down the adequate controls and strategies to eliminate or minimize these risks. The standard prompts the company to set up a Key Performance Indicators (KPI) system to monitor the performance of ISMS, report metrics and act to implement corrective measures towards deviations of targets.

Based on the PDCA (Plan Do Check Act) system, the ISO 27001 standard establishes the following phases to develop a corporate safe ISMS

- Analysis and evaluation of risks.
- Implementation of controls
- Definition of a risk treatment plan or improvement scheme
- Management scope
- Organizational context
- Concerned parties
- Setting and measuring objectives
- Documentary process

- Internal and external audits

FIGURE 2. PLAN – DO – CHECK -ACT APPROACH OF THE CONTINUOUS IMPROVEMENT STANDARDS

Getting a certification by the ISO 27001 is a way that many companies are choosing to take to prove full compliance with the GPDR directive, position themselves as a trustful partner about data management practices and tackle possible lack of confidence coming from customers or other stakeholders. At the same time, the application of the standard brings about a process of continuous improvement in data management by the continuous internal and external audits to the data handling processes and the application of corrective actions to minor and major incompliance findings. The BEYOND platform sets up the basis for a safe and fully compliant energy management system, in line with the ISO 27001 standard requirements.

4. Regulatory and socioeconomic barriers for BEYOND´s innovations

This chapter is devoted to the analysis of the barriers to BEYOND'S innovations based on a) the high-level overview of regulatory barriers at each demo site country considering the level of EU directive transposition into national laws, and b) the stakeholder participatory processes and the perceived barriers that they have towards the wide deployment and use of innovative AI and big data platforms for the provision of new services in the energy sector. Section 4.2 focuses on business actors, whereas section 4.3 deals with the analysis of the feedback provided by end-users (building residents, consumers and prosumers).

4.1. High-level Overview of Regulatory Barriers relevant to BEYOND

The status of EU directives' transposition in the four demo site countries impose a regulatory gap that may represent a setback for some BEYOND's demonstration activities and project deployment expectancies. This section identifies the main problems derived from this issue at country level.

GDPR has been fully transposed in the national regulatory framework in Finland, Greece and Spain. The same applies for Serbia regardless the status as a non-EU country. Though none other directives have been transposed and this needs further elaboration and effort on the regulatory side.

4.1.1. Specific regulatory barriers in Spain

In Spain, several regulatory barriers relevant to BEYOND have been identified:

Energy efficiency in buildings has been transposed only recently and partially in Spain, which mainly affect new buildings or large refurbishments. Hence, there is a **large stock of buildings not adapted to the new stricter regulation on energy efficiency.** The Real-Estate sector slowdown regarding the renewal of residential buildings has contributed negatively to the adoption of the new efficiency standards demanded in the new EPBD. Retrofitting and refurbishment strategies should be encouraged and supported to speed up the energy performance in the residential sector.

Electricity markets should be open to aggregated demand response in both the wholesale energy supply market and the ancillary service market. This is not possible today as the Energy Market Directive is not fully transposed yet. This market opening

is crucial for BEYOND actual demonstration in Spain, although simulation tests can be performed to assess the benefits of demand response in the Spanish demo site.

No actual access to real-time data is possible in Spain from the official DSOs' metering systems. Despite the full completion of the smart meter rollout in Spain, it was carried out by the distribution companies operating at regional and local level. Distribution system operators hold the connection rights to the devices, as owners of the equipment, and only issue the readings to the retail companies once a month for billing purposes only**.** Some DSOs give this data on a daily basis, 24 hours after the metering takes place. Although agreements can be negotiated with these companies to access the meters for real-time monitoring, it is not a common practice and service providers usually have to install their own metering equipment to ensure real-time readings. In the case of BEYOND the DSO is part of the consortium and this issue may be overcome, but in a country-wide deployment of BEYOND solutions, this is a real barrier to have access to real-time metering.

4.1.2. Specific regulatory barriers in Greece

In Greece, the barriers associated with the current regulatory framework are also associated to a poor transposition level of the current EU regulatory framework. Demand Response markets are not active yet, with minor initiatives implemented. In terms of self-consumption, investments are not yet financially attractive, since there is no option to offer flexibility for ancillary services to the DSOs and TSO. Neither can demand response participate in the wholesale electricity market via an aggregator to create extra revenues through demand-response market mechanisms.

In the area of self-consumption in Greece, the former incentives for PV roof top installations are now over with no further incentives in place. Only intensive consumers may find economic feasibility for their PV investments, which is contradictory with a demand reduction policy towards a decarbonized economy. In addition, DSOs do not have maximum deadlines for the approval and commission of self-consumption facilities. This often leads to prolonged periods that may reach over a year.

The deployment of smart meters is not complete in Greece and there is not a clear roadmap for the full completion. This barrier impacts directly the ability of consumers to benefit from the advantages of real-time metering, hindering self-consumption, and affecting IoT solutions based on real time metering. BEYOND demonstration activities should take this barrier into account.

4.1.3. Specific regulatory barriers in Finland

In Finland, no significant regulatory barriers have been identified. Finland is way advanced in the transposition of the EU Directives both in the domain of energy as well as in the domain of data management. Energy markets are legally open to Demand Response with limited participation in the Frequency Containment Reserve for Normal Operation and in the automatic Frequency Reserve Restoration (aFRR) mechanism.

4.1.4. Specific regulatory barriers in Serbia

The Serbian regulatory market has low implication for BEYOND, since this demo site involves a local market of district heating generation and distribution in the city of Belgrade. The Serbian state is doing a good effort to follow and transpose the EU Directive framework, as a preliminary step to homogenize the regulatory framework to qualify for EU membership application. In terms of Energy directives, the transposition status is well advanced in the electricity and energy efficiency domains, with improvements to do in the gas sector, due to the current wholesale market monopolistic and bundled situation. Environmental and climate protection regulations are in a moderate transposition status. In the data management area, compliance of Serbian regulation about cybersecurity in the energy market is assessed to be at 62%, according to the Serbian Annual Implementation Report of November 2020 [21]. The main reason is that the national energy regulator does not have powers in cybersecurity.

Although Serbia in not yet a full member of the European Union and the EU directives are not of mandatory transposition, the GDPR has been literally transposed into the new Data Protection Law on November 2018, and it has been in force since August 2019. However, few other directives about data management and transparency have been transposed. This needs further elaboration and effort on the regulatory side in Serbia.

Country	Barrier
Spain	Energy markets closed to aggregated demand response
	Smart meter rollout finished but data is not accessible to users on real time
	Low energy efficiency and refurbishment rate of the residential building stock

Greece	Energy markets closed to aggregated demand response
	Smart meter rollout uncompleted. No availability of real-time data for users
	Long lead times for self-consumption installation approval and commission by DSO
	End of PV roof top incentive schemes.
Serbia	Energy markets closed to aggregated demand response
	The TSO is not unbundled. Distribution is unbundled under Gob's approval
	Gas wholesale market is monopolistic and bundled, Gas Network Codes not transposed with no transparent and non-discriminatory capacity allocation
	Low transposition level of Climatic regulations
	The energy regulator does not have powers in cyber-security. GDPR has been fully transposed but it is not the case with other data management directives
Finland	Smart Meter Roll-out has progressed and DR market fully open but limited use of this mechanism. The regulatory framework is fully compliant with EU regulation.

TABLE 3. SUMMARY OF COUNTRY LEVEL REGULATORY BARRIERS FOR BEYOND.

4.2. Business Stakeholders' barriers

4.2.1. Feedback gathering process for BEYOND's business stakeholders.

Business actors are the target users of the new Big-Data platform and Analytics toolkit. These actors are relevant business players in the energy sector and may use the digital data platform to provide services to their final users (citizens, building residents, consumers, prosumers, customers) or for their own business and asset management (Electric and heat grid management). In the general case, these companies use the data generated by their customers and associates to provide high

quality services to them, create customer loyalty and deliver the maximum value added to increase their market share and benefits.

Although many of the involved business stakeholders are already using or planning to use big data technology to improve their service offer and expand their portfolio, there is a variety of potential barriers that hinder a further and enhanced exploitation of the technology. These barriers may be regulatory, social, economic, or even cultural and organizational. Albeit the sample of interviewed stakeholder is not complete and exhaustive, it gives a clear overview of how some barriers may be impacting in similar companies along the European Union.

The involved BEYOND stakeholders were interviewed online during March 2021. The interviews were held virtually with the responsible personel of the companies, in the dates shown below. A summary of the topics and questions was shared with them prior to the interview. General company overview data was provided by the company before the actual interview. Once the interviews had finished, a transcription of the debates and comments were confirmed and refined by the interviewees to ensure the correct understanding of the companies' views and position on the inquired topics.

Partner	roles	Meeting	Interview dates
Beolek	DSO, retailer	Online interview	10-03-2021
Cuerva	DSO, retailer	Online interview	16-03-2021
FVH	Building mgr., Local authority	Online interview	17-03-2021
Mitylineos	ESCO	Online interview	19-03-2021
Urbener	aggregator	Online interview	24-03-2021

TABLE 4. DETAIL INTERVIEW SCHEDULE WITH BEYOND STAKEHOLDERS.

In the next subchapters, the analysis starts by the identification of the potential barriers in every domain, followed by the discussion of the results based on the answers given by the stakeholder company representatives. Finally, a comparative analysis of the severity perception for each barrier identified is offered in relative terms. The importance or severity has been assessed as none or low (green colour in the tables), medium (orange) and high (red).

4.2.2. Regulatory barriers

This group of barriers relate to the obstacles imposed by the current regulation in force applicable to data management for B2B and B2C, according to the perception of the interviewed companies.

4.2.1.1. Potential Regulatory barrier identification

This section includes an initial overview of how different regulations are adopted per demo country and what generic barriers they may impose. In terms of data management, national regulatory authorities have replicated the contents of the corresponding Directives, especially concerning the GDPR and the eiDAS Directives. National regulations in general place consumers and their data privacy rights as the core principle of any subsequent regulatory development. Interviews start with the review of the regulations applicable to the current business scenarios.

The main risky areas in the field of regulatory barriers are the following:

- Penalties for non-compliance to regulation, e.g., EE obligations for retailers, are not so high to instruct the adoption of Innovative Energy Services. On the contrary, high penalty levels could hinder companies from entering a market and loose business opportunities, while limiting competition.
- Some energy markets are partially closed to Demand Response as an energy source to help in grid, balancing and congestion management.
- Remuneration of flexibility coming from the demand side has not become competitive in comparison with traditional sources.
- Current Incentive programmes for infrastructure investments such as renovation investments, EV chargers, RES and distributed generation, are more attractive and do take focus away from the need for big data and analytics solutions that can improve organization efficiency and operations.

These risks have been posed in the interviews for the companies to give their opinion and position on them. A discussion of the results follows.

4.2.1.2. Analysis of results and identification of specific barriers relevant to BEYOND

In terms of data management, all interviewed companies are fully aware of the compliance requirements of the GPDR and, although obtaining prior consent from clients for data usage may be hard sometimes, this is not perceived as an important barrier and the processes are fully embedded in the everyday operations.

In some countries, such as Greece, the regulatory framework related to net-metering schemes and battery storage services is identified as a barrier, as it does not allow

bidirectional movement of the energy produced via solar panels or other Renewable Energy Sources (RES) and stored in batteries. More specifically, the energy storage owned and operated by the prosumer can only be fed with energy produced from RES and not from electricity provided by the grid. Furthermore, the energy stored in batteries cannot be fed back to the grid. There is, nevertheless, a new regulation in progress, regarding this issue with no approval date in sight. Other than that, the current Greek regulatory framework addressing the ESCO market is not clear on the payback period linked to an ESCO service. This law is going to change by the end of 2021.

On the other hand, penalties for non-compliance to regulation, such as EE obligations for retailers, have not been pointed out as significant barriers. No information has been given about these potential penalties being high to instruct the adoption of new Innovative Energy Services. Neither did interviewees express their concern about alternative incentives for infrastructures taking the focus away from the need for big data and analytics solutions that can improve organization efficiency and operations as they think the two ways could be compatible with each other. Actually, the problem identified by some companies is indeed the non-existence of infrastructure incentives, for instance for distributed generation assets. Currently, companies claim that these incentives do not exist or are scarce in many of the countries. Hence, energy efficiency provided by big data platforms could have some room for development.

About the lack of regulation, it has been remarked the absence of a common European framework for demand response (DR) aggregation and a clear model for remuneration of flexibility coming from the demand side. Most stakeholders take for granted the incoming new market opening to demand management resources but the difference in implementation in the EU countries, and the uncertainty in the remuneration schemes do not allow companies to start investing in the technology to make it possible. Besides, some think that DR may not be competitive in comparison with traditional energy sources from the generation side.

Despite the regulatory limitations identified in section 4.1, the comparative analysis of the assessed barriers per country does not show any significant obstacle for the companies interviewed. These barriers are based on stakeholder perceptions about the regulatory potential obstacles and completes the analysis of regulatory barriers per country made in chapter 4.1.

		Greece	Finland	Spain	Serbia
Regulatory barriers	Penalties for non-compliance to are not so high for the adoption of Innovative Energy Services				

	Remuneration of flexibility from the demand side is not competitive				
	Incentives for infrastructures are more attractive and do take focus away from the need for big data and analytics solutions				

TABLE 5 RELATIVE SEVERITY OF THE REGULATORY BARRIERS BY LOCATION (GREEN: LOW, ORANGE: MEDIUM, RED: HIGH)

4.2.3. Social barriers

Social barriers are those that impact the society where the company operates and that are directly applicable to data management. They have to do with the corporate social responsibility and more specifically to the relationship between the company and some societal groups such as vulnerable groups, transparency towards customers, trustfulness and consumer empowerment, among others.

4.2.2.1 Potential social barriers identification

Among the obstacles that could impact BEYOND solutions and demo sites we can list the following:

- Lack of instruments for empowerment of consumers. Consumer empowerment is a powerful tool to turn them into active players, responsible of their acts and behaviour. These instruments range from market openness for small consumers and citizens to data ownership and freedom to share or trade this data. More engaged consumers will be more willing to take an active role in the energy transition and to share their data to enable new data-driven energy services.
- Lack of trust of consumers to energy market actors, such as electricity companies. Many utilities operate in a low competition environment and have a great negotiation power with their customers, thus becoming inflexible and not open to consumers demands. This lack of trust may hinder many users to collaborate with them and share their data.
- Lack of fair social models for sharing benefits out of advanced energy services. The sharing of benefits out of the traditional energy companies' business models may be perceived as unbalanced and unfair for many end users.
- Lack of awareness on the prosumer side regarding benefits and opportunities for new services. Many prosumers are not advanced technological users and

may have problems to grasp all the opportunities that the usage of big-data and Artificial Intelligence may imply for them.

- Exclusion of vulnerable groups from data-driven innovative service concepts. Usually most vulnerable citizens are way off the technological transition and cannot afford the investments needed to set up the big data platforms and infrastructure needed for the deployment of BEYOND's solutions.

These questions were covered individually with the business stakeholders. Their concerns about them are summarised in the following subchapter.

4.2.2.2 Analysis of results and identification of specific barriers relevant to BEYOND

In the interviews, different types of social responsibility policies have been identified that each company applies at its own discretion, such as transparency of information, pharmaceutical and hospital care programmes for workers and families, zero emission policies, etc. The Corporate Social Responsibility policies are decided by the company management, approved by the company stakeholders, and deployed by the different departments affected. They are clearly visible and available at the corporate websites.

In addition to these policies, there are different initiatives or commitments with society. Nowadays, there is an important environmental commitment as part of the social responsibility deal with society. This is being received with great enthusiasm and strength by the different companies in order to become eco-friendly. The trend is that social and environmental responsibility takes an increasing importance for companies in an extremely competitive environment.

The greatest concerns of the companies participating lay in this group of social barriers. To the view of the majority of the companies, there is a lack of instruments for empowerment of consumers, such as market openness. Consumers in the traditional energy market have little options. The alternatives in the retail market are wider but lead to little or no benefit for end users with no actual direct participation in energy markets.

On the other hand, data transparency is becoming a reality, there is an increasing demand for transparency from consumers to market players and service providers. According to the interviewees, data transparency policies and regulations make this possible, so they do not think there is a great lack of trust between consumers and companies. At least not in the case of the companies responding the questions.

Nevertheless, there seems to be greater social acceptance towards small utilities, distributors and cooperatives, as opposite to large monopolistic market actors. This perception of lack of transparency in the case of large utilities also leads to the belief

that benefits are not distributed fairly in the conventional energy market value chain. They show themselves confident that the BEYOND project ensures a fair share of these benefits by remunerating precisely according to the flexibility and efficiency provided by each consumer and verified through accurate and transparent measurement and verification protocols. The big data technology enables this fair share of benefits by means of a constant monitoring of data in order to bring tangible benefits in the pocket of each consumer.

Unfortunately, this is not going to reach all consumers. Most of the respondents think that the energy sector is a very traditional sector in which the lack of information about new services is scarce or null, which means that both prosumers and consumers are not aware of the benefits that these new services can provide to them and to society as a whole. An important effort needs to be made to convey this message of fairness and transparency to the target users of the new innovative digital services.

Finally, although important, the exclusion of vulnerable groups from data-driven innovative service models does not seem to be too worrying as the interaction of the user with the new technology is not a must for most of the new innovative services, according to the responses.

Looking at the barrier severity per demo site and country, these barriers seem more worrying in Greece and Finland. In Finland, despite of energy markets being most open among the four countries analysed, there is a perception of low citizen empowerment towards utilities and energy suppliers, where end users have a limited selection freedom. The situation is the same in other countries but, with the exception of Spain, the issue does not represent a serious obstacle.

There is unanimity in saying that consumers may not be in a position to take full awareness of the potential of data-driven energy services due to the limited understanding of the technical complexity of the digital technologies and the market approach. A special effort should be made in BEYOND to ensure this information is passed on to consumers in a clear and comprehensive manner.

		Greece	Finland	Spain	Serbia
Social barriers	Lack of instruments for empowerment of consumers (market openness, data ownership)				
	Lack of trust of consumers to energy market actors				

	Lack of fair social models for sharing benefits out of advanced energy services				
	Lack of awareness on the prosumer side regarding benefits and opportunities for new services				
	Exclusion of vulnerable groups from data-driven innovative service concepts				

TABLE 6 RELATIVE SEVERITY OF THE SOCIAL BARRIERS BY LOCATION (GREEN: LOW, ORANGE: MEDIUM, RED: HIGH)

4.2.4. Economic barriers

In this section the economic barriers to BEYONS's are identified and debated with BEYOND's business stakeholders.

4.2.3.1. Potential economic barriers identification

Economic barriers deal with the expectancy of economic gains in relation to the risks faced with the upfront costs.

- Upfront costs for data management and the setup of the analytics systems and infrastructure, since the big-data platform requires certain infrastructure in place to feed data for every manageable load in premises. The hardware procurement and the onsite installation costs may jeopardise the economic feasibility of the solution in some cases.
- Lack of financial support or budget allocated for the digital transition. Lack of financial resources is key to start up any projects, included BEYOND. Business actors may need external financing or rely on the assigned budget for development and digital transition.
- Lack of analytical tools to understand the value of new services. The value of services is sometimes difficult to grasp, but the value of data is even more difficult if there is not a clear strategy on how to optimally use the available data to provide value-added services that are worth paying for.
- Lack of commitment and patience for new services and tools, especially if the payback period is rather long or if they do not generate economic impact immediately. Some of the solutions may pay back in a long time. Many investors may prefer to divert their money to shorter payback opportunities.

- Perception that traditional business models are sustainable and there is no need for change in economic terms. If this was the case, there would be no reason to change the "business as usual" and investments in new technologies would render unnecessary.
- Perception that COVID-19 and similar events are rated, and the economic impact does not point out to the need for investing in digitalization. This barrier is particularly relevant nowadays, after 1.5 years of pandemic that has affected the way people and companies interact with each other.

4.2.3.2. Analysis of results and identification of specific barriers relevant to BEYOND.

This group of barriers are of moderate relevance for the group of companies interviewed. Decisions that involve capital expenditure are taken at top management level or need an approved budget item. More specifically, the companies taking part in the interview already have budget items approved for the digital transition. Although sometimes this budget item comes as a result of a public aid or subsidy grant, this is a clear sign of how important this issue is for the energy sector companies, with a clear bet on digital technology and artificial intelligence to become more competitive in a relatively close future. They do not think there is a lack of financial support or budget allocated for the digital transition, but they think it is insufficient for the challenge ahead.

CAPEX needs in digital technology is clearly a barrier. The digital transition budget in the analysed companies come from two main sources: equity and public aids in the form of subsidies, non-refundable financing or direct participation in public research programmes and competitive funds. Some companies partially finance these programmes with revenues coming from the newly created services and products.

Unfortunately, in some places, the lack of analytical tools to understand the value of new services for themselves but specially for the target consumers, becomes a barrier. However, the market is more and more open and diversified. This is an area BEYOND aims at contributing to.

Lack of commitment and patience in the development of new services and tools with long payback periods or if the outcomes do not generate economic impact immediately, are important barriers for some interviewees, but others see them as a minor item because there are mechanisms to facilitate financing, shorten return periods and because the assets' life is normally longer than the return periods.

When inquired about the perception that traditional business models may be sustainable enough to hinder any need for change in economic terms, the majority of opinions do not match this statement. On the contrary, they think that there is a

growing tendency to open the doors to new technological services as they become matured and ready to market.

When it comes to assess the economic impact that COVID-19 and similar events have had in the need for investing in digitalization, there is unanimity to say that these unprecedented conditions brought about by the pandemic have had a serious impact on economic activity overall but have impacted positively the acceptance and use of digital technology. In this context of uncertainty, some companies seek to mitigate the shock and turbulence caused by this unexpected crisis, but at the same time, they try to lay the foundations for further growth and better performance in the future, relying on digital technology and new business models created around it. The pandemic has been more a leverage than an obstacle. Companies are firmly working in this direction, keeping on their investment plan and focusing on digital transformation, climate neutrality and the revitalisation of the industry, which constitute the pillars of the international effort for economic recovery. Companies not able to cope with the change are likely to lag behind.

The comparative analysis per country shows that Spanish partners are the most concerned about economic issues in BEYOND, followed by Greeks and Serbian. However, almost all agree that the long payback periods are the real challenge to prove false in the demonstration phase.

		Greece	Finland	Spain	Serbia
Economic barriers	Upfront costs for data management and analytics systems and infrastructure				
	Lack of financial support or budget allocated for the digital transition				
	Lack of analytical tools to understand the value of new services				
	Lack of commitment and patience for new services and tools, especially if the payback period is rather long or if they do not generate economic impact immediately				

	Perception that traditional business models are sustainable and there is no need for change in economic terms				
	Perception that COVID-19 and similar events are rated and the economic impact does not point out to the need for investing in digitalization				

TABLE 7 RELATIVE SEVERITY OF THE ECONOMIC BARRIERS BY LOCATION (GREEN: LOW, ORANGE: MEDIUM, RED: HIGH)

4.2.5. Cultural and organizational barriers

This section analyses the feedback given by the interviewed company representatives regarding cultural and Organisational barriers to digital innovation within their organisations and management structure. This type of barriers is often underrated by companies as it is usually difficult to see organisational and cultural problems from inside the own organisation. However though, they are often paramount to assess the necessity of a cultural change to facilitate a digital transition process.

4.2.4.1. Potential cultural and organizational barriers identification

The internal risks associated to corporate culture and organizational barriers are usually the most impacting in the changes and projects that companies undertake, but at the same time, are the most difficult to be aware of. Since a self-assessment would be unfair and not relevant, interviewed company representants have been requested to assess the barriers in general for other companies in their sectors and countries.

The type of topics is very varied. Hereby is the list of potential cultural and organizational barriers assessed in the interviews with stakeholders:

- GDPR concerns. Data privacy legal requests might be a barrier for some companies to take up new business models based on the massive use of real-time data handling since explicit approval must be obtained from the end users, and specific data protection measures need be taken.
- The perception that the digitilization, cloud systems and data sharing increase vulnerability to cyber-attack or data security issues, may be a barrier for both data providers and data consumers as a security breach may affect the data protection and privacy.

- The lack of in-depth knowledge regarding new technologies (ICT, RES, EV, e,g) is a potential barrier that could either hinder the opening of new service opportunities, or make business more effective.
- Reluctance to adopt new business models or transform current ones based on the use of digital technology.
- Some companies are overfocusing on daily operations performed in traditional ways and neglecting the value of data for becoming more effective and innovative.
- Fear that data shared with others may affect competitive advantages or established structures of operation– Misperception of “advantage” or “power”.
- Perception that COVID-19 and similar events have not radically affected business and do not point out to the need for digitalization and better data management and analytics.
- Reluctance of some companies to allow their data leaving premises.
- Reluctance to rely on external analytics or business applications/ lack of trust to the capability of ICT companies to offer useful tools.
- Reluctance to share their data with external actors.
- Reluctance to abandon local and closed ICT systems and databases.
- Perception that sharing data means data leaving premises or losing control over them.
- Difficulty to understand or evaluate the value of data monetization and compare it against traditional business.
- Perception that data sharing is one-way, thus losing the whole picture that they can also get access to external data and optimize their services and functions.

In the following section the main concerns of the interviewed companies about the above potential issues are highlighted and discussed.

4.2.4.2. Analysis of results and identification of specific barriers relevant to BEYOND

None of the sampled companies see the lack of appropriate systems or professionals, as well as expertise for managing and analysing the available data as a problem within their organisations. In other words, they all think they have the necessary material and labour resources to recognise the value of data. Infrastructure for storing and processing data is not so expensive nowadays, and these services can be located in the cloud and hired on demand.

As an exception, some companies pointed out to the complexity of data or interoperability issues as a serious barrier to face. The different equipment manufacturers using their own incompatible communication protocols and sources of information increase the interoperability of the systems. This is also a challenge

faced by BEYOND. Policy recommendations for standard protocols are highly recommendable by leading industrial partners and the European Commission itself.

At a lower extent, the GPDR compliance requirements are perceived as a barrier because of the burden associated to obtain prior explicit permission from end users to use their data. However, companies already have the necessary processed implemented and they do not consider this regulation compliance as a barrier for innovation.

Companies in the sample do not usually release data out of their premises. They intake data from users and process it to deliver services. Hence, keeping the GDPR requirements is not a great deal for any of them. Most use their own processing and storage infrastructure and only occasionally rely on external cloud systems. This explains their perception of low risk associated to data sharing vulnerability to cyber-attacks or data security breaches.

Similarly, the interviewed companies do not report any lack of in-depth knowledge about new technologies (TIC, RES, EV, e, g) that could hinder new service opportunities or make the business more effective. These companies do not perceive reluctance to adopt new models of business or transform the current ones based on the adoption of digital technologies. There is a perception that COVID-19 and similar events have somehow affected business and hence, point to the need for digitization and better data management and analysis in companies.

In many companies the excessive focus on day-to-day operations performed in the traditional way may lead to neglect the value of data to be more efficient and innovative. This is not the case of the interviewed companies, but some see the opportunity to use new indicators to improve the efficiency of data processing and make them more relevant for efficiency and innovation.

On the other hand, the fear that data shared with others could affect competitive advantages or established operating structures is seen as a significant problem. This is the case of some DSOs that are used to share data per month with retailers, even though it would make no real difference in business terms, if the data were shared in real-time. This aspect is seen as a problem for companies that share data, as there is a risk of creating an advantage for competitors when information is shared. On the other hand, companies that do not usually share data are not afraid to give the competition an edge.

Internally, each company is different, and the main reason of this difference is the internal corporate culture. This culture affects the way companies deal with their customers' and stakeholders' data and their policy for data protection and sharing. In the sample there are different opinions about the reluctance to allow data leaving

premises. Companies showing a certain rejection to it do not have a need to share data with others. These companies select a limited number of trustful partners to share data with and protect data from other unknown third-party entities. Others have an open data policy in place (public entities) and do not see any problem in sharing data as part of their data transparency principle.

There is not an explicit claim that sharing data means losing control over them but there is a risk of misuse of such data by external actors. Companies deal with this risk by keeping in premises the sensitive data treatment belonging to customers. The same applies to the usage of external analytics or commercial applications that create a lack of confidence in the abilities of these third-party entities to offer useful tools. Some companies report bad past experiences with external applications, having sometimes fallen short in terms of capabilities and automation for machine learning applications.

Finally, companies agree on the challenge for some companies to cope with the difficulty to understand or evaluate the value of data monetization and compare it against traditional business, although it is not the case of the interviewed companies. This step to accommodate business models that assess the data monetization potential is a deep cultural change for many SMEs. The BEYOND demonstrators aim at testing this cultural shift and the difficulties of implementation derived from it. A first positive experience in the testing companies will make easier to develop data-driven business models towards the digital transition.

A different point of view of the stakeholder barrier analysis comes from the perspective of the roles of every interviewed company. The greatest concerns come from ESCOs and aggregators and the differential reasons with respect to DSOs and public entities reside in their perception of low customer awareness of the benefits of the new services and the long payback times of the solutions based on digital data platforms in buildings. Both ESCOs and aggregators are in need to attract external customers and end users and are concerned about how to show the benefits of the new energy services to engage the largest possible number of platform users of the Big-Data platform, as opposite to DSOs and public bodies, that would use the platform for internal purposes as grid management and balance. ESCOs and aggregators are also more concerned than other sector companies about the GDPR concerns and the lost of competitive advantages derived from data sharing.

From a country perspective, the perception of cultural and organizational barriers is higher in the Mediterranean countries (Greece and Spain), than in the rest of the countries. In these countries the cultural obstacle of the misperception of disadvantage coming from data sharing is larger. In Finland the open data policy is well extended, especially in the public sector. In Spain, DSOs do not share metering

data on real time with users or other companies, despite the advanced status of the smart meters' rollout.

		Greece	Finland	Spain	Serbia
Cultural and organizational barriers	GDPR concerns				
	Perception that the digitilization, cloud systems and data sharing increase vulnerability to cyber-attack or data security issues				
	Lack of in-depth knowledge regarding new technologies that could either open new service opportunities, or make business more effective				
	Reluctance to adopt new business models or transform current ones				
	Overfocusing on daily operations performed in traditional ways and neglecting the value of data for becoming more effective and innovative				
	Fear that data shared with others may affect competitive advantages or established structures of operation– Misperception of "advantage" or "power"				
	Perception that COVID-19 and similar events have not radically affected business and				

	do not point out to the need for digitalization and better data management and analytics				
	Reluctance to allow their data leaving premises				
	Reluctance to rely on external analytics or business applications/ lack of trust to the capability of ICT companies to offer useful tools				
	Reluctance to share their data with external actors				
	Reluctance to abandon local and closed ICT systems and databases				
	Perception that sharing data means data leaving premises or losing control over them				
	Difficulty to understand or evaluate the value of data monetization and compare it against traditional business				
	Perception that data sharing is one-way, thus losing the whole picture that they can also get access to external data and optimize their services and functions				

TABLE 8 CULTURAL AND ORGANIZATIONAL BARRIERS BY LOCATION (GREEN: LOW, ORANGE: MEDIUM, RED: HIGH)

4.3. Prosumers' and building users' barriers

The second group of BEYOND's stakeholders are the final recipients of the new technology-enabled energy services. They are consumers, prosumers and building users. They are also the data providers as they use the facilities and consume the energy. Their opinion and concerns about their data ownership and privacy are relevant for BEYOND system designers, to make sure that tool suit will have a great acceptability rate by end users.

For this reason, some questionnaires had been prepared in T2.1 where a sample of end users expressed their requirements for the creation of new energy services and the features and interactions with the Big-Data platform that makes them possible. BEYOND includes four demo sites in four EU countries, and the end-user samples have been taken from each of the living labs within BEYOND. Therefore, these end users are customers, associates and stakeholders of the companies running every demo site in Spain, Greece, Finland and Serbia. The final sample includes a wide variety of cultures as it encompasses citizens from the South and North of the European Union, and from a candidate country to join the Union eventually.

The survey was circulated internally among BEYOND partners' customers and clients, as well as a pool of proxy users with similar profiles. This has helped us to better shape the requirements by reaching out and landscaping the needs of a wider audience, which offers us, in addition, the capability of receiving even more unbiased feedback (in the case of proxy users) towards delivering results that may obtain a higher exploitation potential.

The methodology and the complete results of the surveys are available in BEYOND's D2.1. In this section the focus has been made to consolidate the information regarding regulatory, social, economic and cultural barriers to the adoption of data-driven technology and data sharing by building residents and consumers for the provision of innovative energy services based on AI algorithms with the objective to avoid, mitigate or just be aware of those barriers in the definition of the BEYOND system architecture.

82 consumers and prosumers took part in the surveys in the four countries. Most of the surveyed population is in an age range between 30 and 44 years, followed by the range of 45-64 years. In general, the majority of the people surveyed have a high level of education, with economic solvency and well-being.

Out of the survey results the overall main conclusion is that citizens are in a vast majority open to accept new business models based on the use of digital data platforms to provide energy management services in their buildings. As many as 78 % of the respondents would be willing to proceed with the installation of smart home

solutions to remotely control the energy use. This means that they are willing to share data with third parties to receive advanced services (77%). The main concern for over half of the respondents about sharing data with third parties for the provision of such services is data protection and privacy. Once ensured that data privacy is properly respected, there is an overwhelming majority (95%) that would accept the installation onsite of low powered IoT devices, such as sensors and actuators, for a period of time, even if this time is longer than a year (82%). Among other reasons, the high education level and the low age range of the sample may explain the results of such wide acceptance of the technological solutions.

With the installation of these devices, the possibility of controlling or automating the facilities for a higher level of comfort is open. There could be several options for this: a full automation, which does not have much support from the respondents (18%), or a semi-automation (an automation with user interaction) chosen by 51% of the consumers. A minimum automation with scheduling is only chosen by an 8% of the sample. The most preferred semi-automation option is interpreted as a preference for an automation with overriding rights and boundary definition by the end user so as to keep full control over the automatically driven systems. The possibility to customise the control boundaries of the automated control of the devices is selected by 82% of the surveyed people.

It is clear then, the full acceptance and support of the digital technology, as long as data privacy rights are kept. However, when being asked about the priority towards the design of a smart building, savings is the most ticked reason (45%). In line with it, the indicators that participants are more concerned about are energy consumption (72%) and energy savings (66%). This points towards the fact that the main motivation to support the use of digital data-driven technologies in buildings is economic. Understanding energy consumption is the most voted reason to install smart home equipment at home (87%). What is more, the majority of the surveyed building users would not be willing to spend more than 100 € in the platform setup upfront costs. This budget restriction could be a barrier and a challenging target for the full system customised installation in premises.

To conclude, there is great acceptance among respondents to implement a smart home solution to remotely control their energy use, under the premises of full respect of data privacy, and accepting the installation of devices such as sensors and actuators for a period of time to determine their power consumption, flexibility and comfort preferences, with the motivation of achieving economic savings.

5. Strategies for barrier mitigation and avoidance

Once the main barriers identified in section 4, the next step is to check how they affect BEYOND's intended targets and how BEYOND's system architecture should tackle them. There are three coping strategies according to the type of barrier:

- Avoidance strategies: the purpose of these strategies is to prevent the issue from happening before it actually takes place. It is the least impacting but often the most difficult type of coping strategies due to the large casuistic of issues and problems. For example: wrong data impacts the quality of AI algorithms, but filters and warnings can be put in place to avoid wrong inputs.
- Mitigation strategies: these coping approaches accept that the barrier or issue cannot be avoided and may have an impact on the acceptance and deployment success of the digital solutions. Hence, the focus should be paid to alleviate the expected impact and make it bearable for the end users and business actors.
- Fixing strategies: The problem identified will happen and cannot be avoided but the architecture has a solution for it. For example: wrong data has been entered in the data base but the algorithms can identify them and correct or eliminate the wrong entrances.

With the purpose of choosing the best coping strategy, the barriers to BEYOND solutions have been grouped in two bundles: barriers that can be handled by BEYOND's own means and barriers that lay BEYOND the project reach, like regulatory barriers or some cultural barriers. In this case only recommendations can be made either at market, policy or corporate level.

5.1. BEYOND's demo site mitigation and avoidance strategies

In this section, we list the main mitigation and coping strategies proposed by BEYOND to address the barriers highlighted as relevant in the different participatory processes with stakeholders.

The main cultural barrier is the fear to lose competitive advantages for data sharing. This barrier is directly addressed by BEYOND both in terms that the data owner can define who has access to their data, but also through the new business models that allow data owners to get monetary benefits by sharing their data. A fully controlled data sharing and the successful demonstration of the new business models based on data share and use shall put this barrier down.

Another important cultural barrier is the reluctance by some companies to allow data leaving premises. This is a key barrier that is directly addressed by BEYOND through

the development of the on-premises client of the platform, that allows data owners to avoid uploading their data to the cloud but instead, keep them locally and enjoy all the associated services by utilizing their own infrastructures.

The lack of trust on external ICT partners, analytics or business applications is als tacked by BEYOND. BEYOND gives the ability to business stakeholders to develop their own analytics in the Analytics toolkit, without having to rely in external companies or expertise that they do not trust.

An economic barrier is the lack of analytical tools for end-users to understand the value of new services as remarked by some business actors like ESCOs and aggregators. This lack of understanding may hinder the wide adoption of new innovative energy services by prosumers and end-users. BEYOND tool suite includes a number of monitoring and awareness modules that, jointly with a powerful visualisation framework, will enable end users to grasp the full potential of their energy consumption profile.

Another important social barrier identified is the lack of trust of consumers on energy market actors and the lack of a fair distribution of benefits. There is a clear need to introduce appropriate mechanisms for increasing transparency in energy market transactions and reinforcing trust of consumers / prosumers. In order to mitigate this impact from the point of view of BEYOND, a clear, transparent, accurate and fair Performance Measurement and Verification (PMV) methodology, based on dynamic baselining with a powerful short-term forecast engine is envisaged to be able to measure the exact amount of energy efficiency / flexibility derived from the user participation in an implicit or explicit event. With this system in place, a fair remuneration system can be achieved, proportional to the flexibility and efficiency provided by each consumer. BEYOND's big data technology enables this fair share of benefits by means of a constant monitoring of data in order to brings tangible benefits in the pocket of each consumer.

Fairness and Transparency needs to be tackled from a Data perspective as well. To this end appropriate mechanisms that reinforce trust in data sharing and data transactions shall be put in place in BEYOND so that data owners are fairly remunerated for the processing and use of their data by external stakeholders.

Within the social barrier group, BEYOND tackles the lack of instruments to empower consumers participation by providing the necessary instruments for flexibility providers to directly participate in open markets for demand response through an aggregator and be remunerated proportionally to their individual participation.

The upfront costs are a clear barrier for the deployment of data management systems and infrastructure. Sensors, meters and data capturing devices, as well as data loggers

and communication systems need to be catered for every prosumer involved. This is expensive and BEYOND is committed with the simplification and reduction of costs for these systems and devices, and the integration of compatible legacy systems in the platform to avoid costly refurbishments. This barrier is directly related to the operational capabilities and expertise in-house in the BEYOND stakeholders. From a technical point of view, BEYOND will attempt to minimize resource use, though it is imperative that relevant expertise is acquired by business actors. In addition, the increasing revenues coming from energy savings, demand flexibility revenues and the diminishing platform costs help to reduce the payback times, which has been pointed out as the main economic barrier identified by the business stakeholders.

Validation activities in BEYOND will attempt to highlight the value of new services (data-driven and data intelligence-enabled) and assess their cost-efficiency under new business models. It is expected that the acceptance will increase, though it is important that digitalization becomes a core part of organizational behaviour in order for this barrier to be effectively tackled.

Finally, data privacy requirement compliance, is seen as a hassle for many companies, and a real barrier for many data producers (prosumers). Security breaches and data leaks are among the top priorities for BEYOND tool developers. In this sense BEYOND plans to incorporate blockchain technology and other existing technological solutions to ensure data privacy and security. Among others:

- Data aggregation to present information only in groups and not per individual, towards enhancing privacy. In particular, aggregated flexibility data will be presented to the aggregator.
- Data sharing: In compliance with the GDPR regarding data sharing through human intervention, contracts between data controllers and data processors will specify exactly how the data will be used, the responsible persons, and the objective of processing.
- Authentication: it is the process of identifying users that request access to a system, network, or device. BEYOND components are designed to use the OAuth2 [1] industry-standard protocol in order to meet the authentication expectations that will be addressed by the security access control framework.
- Anonymisation: All the data that are gathered by the platform (sensors, gateway) will be anonymized upon storage in the platform.
- Pseudonymisation: this technique provides an ideal middle ground between the GDPR requirements and blockchain features. The maintenance of personal

[1] OAuth (Open Authorization) is a standard framework that allows login access to third-party websites and applications without exposing user account credentials and information.

identifiers off the chain allows the blockchain to process information without infringing the data subject's privacy rights and to meet the GDPR data privacy requirements without losing any of its operational advantages.

- Data encryption: it is a security method, which encodes data in a way that a correct key is required in order to access/decrypt them. Encrypted data appear scrabbled or unreadable to a person or machine accessing them without permission. The encryption of data at rest is a key protection against a data breach and should only employ strong encryption methods. Even though encryption is not mandatory for being compliant with GDPR, it is a proposed measure.

The following tables summarise the identified social, economic and cultural barriers that are addressed by BEYOND, either directly as a main project target, or indirectly, tackled by some of the BEYOND activities.

TYPE	BARRIER	PLANNED TO BE ADDRESSED BY BEYOND
Social barriers	Lack of instruments for empowerment of consumers (market openness, data ownership)	Yes – Relevant design considerations in (i) energy applications for Virtual Power Plant configuration and (ii) the Big Data Platform for enhanced data sovereignty through access control and sharing based on data contracts
	Lack of trust of consumers to energy market actors	Partially (only for data transactions) – Relevant considerations in the Big Data Platform for the configuration of trustful, transparent and fair data sharing mechanisms **Further Considerations** *Need to introduce appropriate mechanisms for increasing transparency in energy market transactions and reinforcing trust of consumers / prosumers*

	Lack of fair social models for sharing benefits out of advanced energy services	Partially (only for data transactions) – Relevant considerations in the Big Data Platform for the configuration of trustful, transparent and fair data sharing mechanisms **Further Considerations** *Need to introduce appropriate mechanisms for increasing transparency in energy market transactions and reinforcing trust of consumers / prosumers*
	Lack of awareness on the prosumer side regarding benefits and opportunities for new services	Yes – Establishment of a complete set of services that will be validated against their impact. Relevant results to be widely showcased towards energy prosumers
	Exclusion of vulnerable groups from data-driven innovative service concepts	Yes – No discrimination will be performed in BEYOND. On the contrary special focus will be given in prioritizing energy poor and vulnerable consumers/ prosumers in the demonstration activities of the project.

TABLE 9. SOCIAL BARRIERS MITIGATED BY BEYOND

TYPE	BARRIER	PLANNED TO BE ADDRESSED BY BEYOND
Economic barriers	Upfront costs (CAPEX) for data management/ analytics systems and infrastructure	Partially **-** This barrier is directly related to the DevOps capabilities and expertise in-house in the BEYOND Stakeholders. From a technical point of view, BEYOND will attempt to minimize resource use, though it is imperative that

		relevant expertise is acquired by business actors
	Lack of analytical tools to understand the value of new services	Yes – Directly in the scope of BEYOND with the provision of a complete service bundle for the design and execution of analytics. Pre-trained algorithms and models will be also provided and tailored to the needs of the BEYOND stakeholders.
	Lack of commitment and patience for new services and tools, especially if the payback period is rather long or if they do not generate economic impact immediately	Partially - Validation activities in BEYOND will attempt to highlight the value of new services (data-driven and data intelligence-enabled) and assess their cost-efficiency under new business models. It is expected that the acceptance will increase, though it is important that digitalization becomes a core part of organizational behaviour in order for this barrier to be effectively tackled

TABLE 10. ECONOMIC BARRIERS MITIGATED BY BEYOND

TYPE	BARRIER	PLANNED TO BE ADDRESSED BY BEYOND
Cultural and organizational barriers	Lack of personnel and systems to deal with complexity of data or interoperability issues. Lack of in-depth knowledge regarding new technologies that could either open new service opportunities, or make business more effective	Partially **Further Considerations** Need to introduce user-friendly tools and User Interfaces to facilitate the use of data management and data analytics tools. This does not eliminate the need for reinforcing current expertise in relevant issues.

	Inability to understand the value of data coming from external sources	Yes – This is a key target of BEYOND and will be addressed through the development of a robust framework allowing for search within data coming from external sources and analyzing them with the use of the analytics toolkit to be developed in the project.
	GDPR concerns	Yes – This barrier will be efficiently tackled through a holistic approach that will allow data owners to achieve data sovereignty through appropriate anonymization, access control and encryption mechanisms.
	Perception that the digitalization, cloud systems and data sharing increase vulnerability to cyber-attack or data security issues	Yes – This barrier will be efficiently tackled through a holistic approach that will allow data owners to achieve data sovereignty through appropriate anonymization, access control and encryption mechanisms.
	Reluctance to adopt new business models or transform current ones	Yes - Validation activities in BEYOND will attempt to highlight the value of new services (data-driven and data intelligence-enabled) and assess their cost-efficiency under new business models. It is expected that the acceptance will increase, though it is important that digitalization becomes a core part of organizational behaviour in order for this barrier to be effectively tackled

	Perception that data is the key "advantage" and "power" intra-organization and fear that sharing of owned data will lead to losing this competitive advantage.	Yes - It is directly addressed by BEYOND both in terms that the data owner can define who has access to their data, but also through the new business models that allow data owners to get monetary benefits by sharing their data.
	Reluctance to allow data leave premises	Yes - It is directly addressed by BEYOND through the development of the on-premises client of the platform, that allows data owners to avoid uploading their data to the cloud but keep them locally and enjoy all the associated services by utilizing their own infrastructures.
	Reluctance to rely on external analytics and services provided by 3rd parties with regards to data	Yes - BEYOND gives the ability to business stakeholders to develop their own analytics in the Analytics toolkit, without having to rely in external companies or expertise that they do not trust.

TABLE 11. CULTURAL AND ORGANIZATIONAL BARRIERS MITIGATED BY BEYOND

5.2. Policy and market reform recommendations

Some barriers are far from the scope of the BEYOND project. Many relate about the lack of regulation. In this domain, it has been remarked the absence of a common European framework for demand response (DR) aggregation and a clear model for remuneration of flexibility coming from the demand side. Most stakeholders take for granted the incoming new market opening to demand management resources but the difference in implementation in the EU countries, and the uncertainty in the remuneration schemes do not allow companies to start investing in the technology to make it possible. Besides, some think that DR may not be competitive in comparison with traditional energy sources from the generation side.

An important point where BEYOND needs to focus on, is the provision of practical recommendations towards the acceleration of the Renovation Wave Strategy Implementation and the establishment of the Digital Building Book. Findings from the deployment of the BEYOND Big Data Platform and associated applications, and their validation in the BEYOND demo sites will be properly summarized and formulated in technical policy briefs to be communicated in the form of recommendations towards policy committees and officers at EU and national level.

Some concerns were risen about the incentives for infrastructures being more attractive and taking focus away from big data and analytics solutions that can improve organization efficiency and operations. The right balance between infrastructure growth incentives and digital solution implementation should be attained by the regulating authorities.

Besides the recommendations to the regulatory gaps commented in the interviews by the stakeholders, it is important to mention the EU-wide efforts towards the acceleration of the renovation wave strategy and the digital building logbook implementation. This is specifically important in countries where these efforts are lagging behind targets, such as Greece and Spain.

Moreover, on the data regulation side, BEYOND will focus on providing input towards the adoption of EU-wide directives for

- Smart Data Contracts towards the fair remuneration of data owners and the creation of new opportunities for prosumers for the creation of new revenues.
- Ethics in AI, through relevant recommendations and technology approaches for algorithmic transparency and utilization of privacy-protected data.

The following table summarizes the identified regulatory barriers and defines preliminary mitigation plans to address them in the frame of the BEYOND project.

Country	Barrier	Planned to be Addressed In BEYOND
Spain	Energy markets closed to aggregated demand response	YES – a hybrid approach needs to be followed for the technical validation of relevant solutions through the emulation of respective signals from Network Operators and the application of VPP and DR strategies in the participating buildings. Though no

		market transactions will be implemented.
	Smart meter rollout finished but data is not accessible to users on real time	YES – Access to smart meter readings in BEYOND Demo Buildings is already secured.
	Low energy efficiency and refurbishment rate of the residential building stock	YES – Policy briefs and technical results of the BEYOND solutions will be communicated to relevant bodies to accelerate the implementation of the Renovation Wave Strategy.
Greece	Energy markets closed to aggregated demand response	YES – a hybrid approach needs to be followed for the technical validation of relevant solutions through the emulation of respective signals from Network Operators and the application of VPP and DR strategies in the participating buildings. Though no market transactions will be implemented.
	Smart meter rollout uncompleted. No availability of real-time data for users	YES – Smart meters and sub-meters are already available in the demo buildings from previous research projects.
	Long lead times for self-consumption installation approval and commission by DSO	NO – not relevant for BEYOND and the specific demo site
	End of PV roof top incentive schemes.	NO – not relevant for BEYOND and the specific demo site
Serbia	Energy markets closed to aggregated demand response	YES – a hybrid approach needs to be followed for the technical validation of relevant solutions through the emulation of respective signals from Network Operators and the application of VPP and DR strategies in the

		participating buildings. Though no market transactions will be implemented.
	Gas wholesale market is monopolistic and bundled, Gas Network Codes not transposed with no transparent and non-discriminatory capacity allocation	NO – not relevant for BEYOND and the specific demo site
	Low transposition level of Climatic regulations	PARTIALLY – relevant recommendations will be delivered to national bodies
	The energy regulator does not have powers in cyber-security. GDPR has been fully transposed but it is not the case with other data management directives	YES – subject to the technical development of the BEYOND Big Data Platform
General	Penalties for non-compliance to Energy Efficiency Obligations are not so high for the adoption of Innovative Energy Services	YES – New Business Models for the provision of data-driven services will address this issue under a holistic framework that allows stakeholders to comply with obligations, avoid penalties and enjoy additional benefits
	Remuneration of flexibility from the demand side is not competitive	YES – Residential Demand Response will be offered as a new product under a dedicated business model. BEYOND will validate reliability and effectiveness of this new product, along with its associated economics and will deliver specific recommendations based on the findings of validation.
	Incentives for infrastructures are more attractive and do take focus away from the need for big data and analytics solutions	YES – Validation of the effectiveness of big data and analytics towards avoiding costly investments (that are gradually dis-incentivized) and

		relevant findings will be delivered and widely communicated.

TABLE 12. SUMMARY OF REGULATORY BARRIERS AND BEYOND'S MITIGATION STRATEGY

Some companies pointed out to interoperability issues as a serious barrier to face. The different equipment manufacturers using their own incompatible communication protocols and sources of information increase the interoperability of the systems. Although this is mostly a technical issue rather than regulatory, policy makers may set the guidelines for an industry standardisation of the IoT communication protocols. Although BEYOND bets for an open-source standards based on widely adopted standards and data models, it is out of question that it is a challenge faced by BEYOND that could be addressed from a policy perspective, reaching an agreement with the main equipment manufacturers to standardise the communication protocols.

CONCLUSIONS

Regulation about data management and big-data platforms in the EU is still incipient. Due to the great advances that are achieved in a relatively short time, the relevant regulations are in continuous development.

At European level, there are several regulations in the energy domain that may affect BEYOND. They are:

- Energy market Directive (EU 2019/941 – 945) about common rules of the unified European Energy Market
- Renewable Energy Directive (EU 2018/2001), on the promotion of the use of energy from renewable sources (RED II)
- Energy Efficiency in Buildings Directive (EU 2018/844) with the revised Energy Performance of Buildings (EPBD)
- New Energy Efficiency Directive (EU 2018/2002) with the revised efficiency targets for 2030.
- Energy Communities Directive (EU 2019/944) about the definition of Citizen and Renewable Energy Communities in Europe.
- EU efforts in the Building sector such as the Digital Building Logbook, the Smart Readiness Indicator and the Renovation Wave Strategy.

Other regulations refer to data management and BEYOND should ensure full compliance. The most relevant directives are:

- GDPR Directive (EU 2016/679) [14] about the protection of natural persons with regard to the processing of personal data and on the free movement of such data,
- eIDAS Directive (EU 2014/910) [16] on Electronic Identification Authentication and Trust Services for Electronic Transactions in the Internal Market
- Digital platform Directive (EU 2019/1150) [21] about the promotion of fairness and transparency for business users of online intermediation services
- Internal Market for Electricity Directive (EU 2019/944) [5] that covers, among other things the access to personal data by consumers through the smart meter roll out in Europe, as a main source of metering data for the BEYOND platform.

Currently, the certification in data management by data consuming companies under the ISO 27.001 [20] standard is becoming more and more spread as a way to build trust on data management practices and data security with customers and key stakeholders.

Smart contracts are becoming more popular not only among companies (B2B) but also between a service provider and a consumer (B2C) and replacing physical contracts progressively. These smart contracts are being drafted using blockchain technology. At present, there is not active in-force regulations to regulate these new but widely spread technologies such as blockchain and smart contracts. However, as a preliminary step, some drafts or White papers have been issued to serve as a guideline for policy makers to draft the first regulatory pieces about it. These guidelines focus on the early communication, the harmonization with the existing regulatory structure, the use of the right initial approach, the progressive deployment of the first regulations and the close monitoring of the technology development and use by early adopters.

In addition, Ethics in the use of Artificial Intelligence is key to ensure acceptance by the society. To address the gap in the regulatory schemes about ethical issues a briefing has been issued by the European Parliament that states as a core principle the Human-centric approach for all ethical development and implementation of Artificial Intelligence. Other important principles that should be followed deal with the final decision and system override by humans, the robustness and safety of the algorithms, the data protection and privacy, the transparency of the systems, the fairness and non-discrimination, the social and environmental well-being and the accountability.

This task aimed at identifying the different barriers for technology-driven solutions in the field of energy management. For this purpose, a twofold approach has been followed. On one side the opinions of final end users, building consumers and prosumers has been obtained via a survey. On the other side, we asked our business stakeholders by means of interviews.

Building users in the survey show a great acceptance to implement a smart home solution and share data with energy service providers to remotely control their energy use, under the principle of full data privacy respect, and accepting the installation of devices such as sensors and actuators for a period of time to determine their power consumption, flexibility and comfort preferences, with the motivation of achieving economic savings. The main possible barrier is economic and refers to the maximum acceptable upfront costs for the digital platform setup, that should not exceed the 100 € threshold. This is a challenging target for a customised onsite installation.

In the sample of companies that went through the interview, social concerns for the adoption of innovative data-driven technologies in the energy sector are the most relevant, followed by economic issues. The top main barriers pointed out by these companies are:

- Lack of awareness on the prosumer side regarding benefits and opportunities for new services.
- Lack of commitment and patience for new services and tools, especially if the payback period is rather long or if they do not generate economic impact immediately.
- Lack of fair social models for sharing benefits out of advanced energy services
- Lack of instruments for empowerment of consumers (market openness, data ownership)
- Fear that data shared with others may affect competitive advantages or established structures of operation
- Complexity of data and interoperability issues

Some of these barriers are explicitly tackled in the BEYOND system proposal. The design of the architecture must make sure that awareness analytics for prosumers are clear and transparent to make the new services more attractive to end users. BEYOND solutions for the energy sector ensure a swift economic impact although business models need to pay special attention to reduce the long payback periods expected in some sectors like the domestic building sector.

BEYOND's Performance and Verification methodologies ensure a fair and accurate sharing of benefits between end users and service providers by means of dynamic baselining based on models trained with continuous data flows to encompass a variety of cases and scenarios on real time. The demand flexibility analytics and aggregation tools enable building users, tenants and residents to participate in open markets of demand response while keeping full privacy of their data and ensure that data is properly protected through blockchain-enabled technology.

BEYOND components also count on a set of technical tools and techniques to avoid data leaks and security breaches, comply with the GDPR about data protection and data privacy and minimise the reported fear to data losses and data sharing concerns. Among these techniques we can find authentication, anonymisation, pseudonymisation, data encryption, data aggregation and the use of standard secure protocols.

An issue that remains open and it is perceived as a problem is the variety of data flows and interoperability issues that arise from the use of equipment from manufacturers that develop their own inaccessible communication protocols. The standardisation of these communication protocols to leverage from the full potential of commercial smart building equipment available is a pending issue for policy makers and regulators.

As a conclusion, the main barriers identified are related to the cultural change that is needed in companies and end users to have the tools that enable them to grasp the

value of the data they generate or manage, and the additional value that could be obtained from the use of artificial intelligence. BEYOND target is to provide these tools and the associated business models for business actors while ensuring compliance with GPDR and other regulations in place and meet the highest standards of data management ethics.

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ANNEX 1. Stakeholder interview data gathering template

Goals of the task

- Description of the task: Identification of present-day obstacles to BEYOND's innovations for energy services, policies and business models
- Objective: Analyse regulatory, organisational, cultural and socioeconomic aspects affecting BEYOND's intended business scenarios according to the usage partner institutions make of the data and the role/s played in the energy sector.
- The role played by stakeholders from a data-driven point of view are:

Data owners (producers)	Building user, building managers
Data brokers (traders, sharers)	DSOs, ESCOs, retailers, aggregators
Data consumers (data users)	DSOs, ESCOs, retailers, aggregators, local authorities, building managers

- Building Data Value-Chain Stakeholders (Business actors), could take a bilateral role producing data for others or consuming data from other sources

Partners and stakeholder roles

The partners with involvement in the task and their proposed role within the consortium are:

Partners with participation in task T2.2: living lab			
1	FVH	Finland	Local authority, building manager
2	Mytilineos	Greece	retailer and ESCO
3	Cuerva	Spain	local DSO and retailer and potential aggregator and ESCO
4	VTT	Finland	Technology provider for EE in buildings and smart cities
5	Urbener	Spain	Retailer and potential aggregator
6	BEOELEK	Serbia	local DSO and retailer

The main stakeholder roles are:

Network Operators	Cuerva, Beolek
ESCOs	Mitylineos
Building managers	FVH
Retailers	Mitylineos, Cuerva, Beolek
Aggregators	Urbener
Local authorities	FVH

Some partners may address the interview with a dual role. Please clarify answers in case they are dependent on the role played.

Interview guidelines:

- Interviews will be conducted by CIRCE but other partners are also invited.
- The interview is meant for the 5 demo project partners with participation in the task, with representants in each business actor role.
- The interview script will be sent to the interviewees beforehand, along with the online meeting link, so as that interviewees have time to prepare themselves and collect data in advance if needed.
- The 3-4 first points could be prepared offline in advance, to gain time for the discussion in the interview.
- The interview is made up by open questions for people to express opinions and views on behalf of the institution they represent and playing the assigned roles in the BEYOND project.
- Partners should make sure that the respondent knows well the project objectives, the company, the current business, and has a view of the innovative emerging business models in BEYOND.
- Interviews should last from 45 to 60 minutes. There are no wrong answers. Reasoning and illustrating data is appreciated.
- The notes taken during the interview will be made available for revision and approval by the interviewees, to ensure their views and opinions are correctly and accurately gathered.
- Deliverable D2.3, where this interview is framed, is a “public deliverable”. In that sense, collected data will not be explicitly related to the individuals representing their companies/institutions but to the entities themselves, playing a specific role in the interview. No personal references will be made. However, if partners have concerns about the public disclosure of their

corporate opinions, they should state it at the beginning of the interview. Data privacy and non-disclosure is regulated as per the BEYOND Consortium Agreement signed by all partners.

Interview schedule

There are 5 interviews according to the table below. Partners are kindly requested to name one or two representatives and suggest time slot availability. Doodles will be sent according to this plan

Partner	**roles**	**representants**	**tentative date**
Beolek	DSO, retailer		2nd week of March
Cuerva	DSO, retailer		3rd week of March
FVH	Building mgr., Local authority		3rd week of March
Mitylineos	ESCO		4th week of March
Urbener	aggregator		4th week of March

STAKEHOLDER INTERVIEW SCRIPT

Presentation of the interview session, objectives, data privacy and participants

Do you or your company have any concern to publish these opinions in the framework of BEYOND's D2.3, making an express reference to the company/ institution name? (Y/N)

Company representant presentation and position.

Company demographics: size, turnover, active markets, clients, countries

Active markets, relevance for the company

Current product and service portfolio. Main customers

Company role/s in the interview: network operator, retailer, aggregator, ESCO, building manager, local authority, others

Areas of future development

Business development

Market expansion plans

Technology acquisition and development

Data management policies

Data driven role: producer, broker, consumer

Type of data used

Data provision and storage systems

Data sharing and trading. Use of own or 3rd parties' data platforms

Organizational and cultural barriers to digital innovation

Type of corporate structure and decision-making flow

- Lack of appropriate systems or professionals to recognize data value
- Lack of personnel or expertise for managing and analyzing the available data
- Lack of infrastructure for storing and processing data
- Lack of personnel and systems to deal with complexity of data or interoperability issues
- Inability to understand the value of data coming from external sources
- GDPR concerns
- Perception that the digitilization, cloud systems and data sharing increase vulnerability to cyber attack or data security issues

Organizational barriers to innovation

- Lack of in depth knowledge regarding new technologies (ICT, RES, EV, e,g) that could either open new service opportunities, or make business more effective
- Reluctance to adopt new business models (transform current ones)
- Overfocusing on daily operations performed in traditional ways and neglecting the value of data for becoming more effective and innovative
- Fear that data shared with others may affect competitive advantages or established structures of operation (e.g. DSO is used to share data per month with retailers, even though it would make no real difference in business terms, if the data were shared in real-time) – Mis-perception of “advantage” or “power”
- Perception that COVID-19 and similar events have not radically affected business and do not point out to the need for digitalization and better data management and analytics

Organizational and Cultural barriers to innovation

- Reluctance to allow their data leaving premises
- Reluctance to rely on external analytics or business applications/ lack of trust to the capability of ICT companies to offer useful tools
- Reluctance to share their data with external actors
- Reluctance to abandon local and closed ICT systems and databases
- Perception that sharing data means data leaving premises or losing control over them
- Difficulty to understand or evaluate the value of data monetization and compare it against traditional business
- Perception that data sharing is one-way, thus losing the whole picture that they can also get access to external data and optimize their services and functions

Regulatory barriers applicable to data management

Regulations applicable to your business scenarios

Current regulatory barriers to your business scenarios

- Penalties for non-compliance to regulation (e.g. EE obligations for retailers) are not so high to instruct the adoption of Innovative Energy Services

Opinion on future regulatory trends

- Remuneration of flexibility coming from the demand side has not become competitive in comparison with traditional sources (for aggregators)
- Incentives for infrastructures (e.g. renovation, chargers, RES) are more attractive and do take focus away from the need for big data and analytics solutions that can improve organization efficiency and operations

Social barriers applicable to data management

Social Responsibility policy of the company. Principles and standards

Current initiatives in SR. Role played by the company in the society

Opinion on future social trends about data management

Opinion on the social barriers of BEYOND's new services and business models

- Lack of instruments for empowerment of consumers (market openness, data ownership)
- Lack of trust of consumers to energy market actors
- Lack of fair social models for sharing benefits out of advanced energy services
- Lack of awareness on the prosumer side regarding benefits and opportunities for new services
- Exclusion of vulnerable groups from data-driven innovative service concepts

Economic barriers applicable to data management

Source of incomes in the current business model

Investment policies of the company and financial sources

- Upfront costs (CAPEX) for data management/ analytics systems and infrastructure
- Lack of financial support or budget allocated for the digital transition

Opinion on the economic and financial barriers of BEYOND's new services and business models

- Lack of analytical tools to understand the value of new services

- Lack of commitment and patience for new services and tools, especially if the payback period is rather long or if they do not generate economic impact immediately
- Perception that traditional business models are sustainable and there is no need for change in economic terms
- Perception that COVID-19 and similar events are rated and the economic impact does not point out to the need for investing in digitalization

Conclusions and summary

Additional inputs and remarks by the organization.

Closure