



**BD⁴
NRG**

Big Data for Next
Generation Energy

D10.3: Exploitation Plan (First Release)

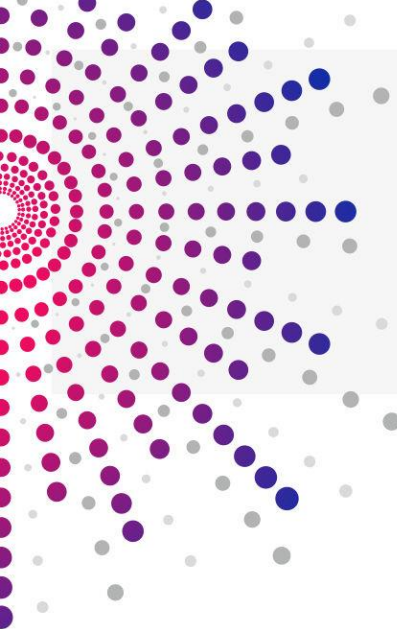
WP10 – Dissemination, Exploitation and
Standardisation



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www.bd4nrg.eu





Disclaimer

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Preface

BD4NRG focuses on addressing emerging challenges in big data management for energy sector with an innovative open holistic solution for smart grid-tailored, near real time, energy-specific and AI-based open Big Data Analytics modular framework. The vision is to deliver **holistic services for techno-economic optimal management of Electric Power and Energy Systems value chain**. Services range from optimal risk assessment for energy efficiency investments planning, to optimized management of grid and non-grid owned assets, improved efficiency, and reliability of electricity networks operation, while at the same time contributing to achieve fair energy prices to the consumers and laying the foundations for an EU-level energy-tailored data sharing economy. The **BD4NRG Toolbox** will be implemented and validated in real-life pilots in **12 large-scale demo sites across 10 countries** for:

- Increasing the efficiency and reliability of the electricity network **BD-4-NET**
- Optimising the management of assets connected to the grid **BD-4-DER**



- De-risking investments in energy efficiency and increasing the efficiency and comfort of buildings
BD-4-ENEF

Who We Are

	Participant Name	Short Name	Country Code	Logo
1	ENGINEERING – INGEGNERIA INFORMATICA SPA	ENG	IT	
2	NATIONAL TECHNICAL UNIVERSITY OF ATHENS	NTUA	GR	
3	RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN	RWTH	DE	
4	EUROPEAN DYNAMICS LUXEMBOURG SA	ED	LU	
5	INTERNATIONAL DATA SPACES EV	IDSA	DE	
6	EUROPEAN NETWORK OF TRANSMISSION SYSTEM OPERATORS FOR ELECTRICITY AISBL	ENTSO-E	BE	
7	PANEPISTIMIO DYTIKIS ATTIKIS	UNIWA	GR	
8	ATOS SPAIN SA	ATOS	ES	
9	FUNDACION CARTIF	CARTIF	ES	
10	UNIVERZA V LJUBLJANI	UNILJ	SL	
11	ENEL X SRL	ENELX	IT	
12	REN - REDE ELECTRICA NACIONAL SA	REN	PT	
13	CENTRO DE INVESTIGACAO EM ENERGIA REN - STATE GRID SA	RDN	PT	
14	UNINOVA-INSTITUTO DE DESENVOLVIMENTO DE NOVAS TECNOLOGIASASSOCIACAO	UNINOVA	PT	
15	ENERCOUTIM - ASSOCIACAO EMPRESARIALDE ENERGIA SOLAR DE ALCOUTIM	ENERC	PT	
16	FIWARE FOUNDATION EV	FIWARE	DE	
17	CENTRICA BUSINESS SOLUTIONS BELGIUM	CENTRICA	BE	
18	NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO	TNO	NL	



	Participant Name	Short Name	Country Code	Logo
19	ASM TERNI SPA	ASM	IT	
20	VIDES INVESTICIJU FONDS SIA	LEIF	LV	
21	COMSENSUS, KOMUNIKACIJE IN SENZORIKA, DOO	COMSENSUS	SL	
22	HOLISTIC IKE	HOLISTIC	GR	
23	INTERUNIVERSITAIR MICRO-ELECTRONICA CENTRUM	IMEC	BE	
24	TERRASIGNA SRL	TS	RO	
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26	ELEKTRO LJUBLJANA PODJETJE ZADISTRIBUCIJO ELEKTRICNE ENERGIJE D.D.	EKL	SL	
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35	EMOTION SRL	EMOT	IT	



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Executive Summary

With Big Data being one of the most discussed technological concepts of the recent years and energy sector activities such as energy usage analytics, energy consumption prediction, exploitation of IoT solutions and social media energy related information being constantly pioneered, it becomes more evident than ever before those big data technologies will have a significant impact in energy sector solutions that will dominate the market of energy data and services in the upcoming years.

BD4NRG project envisions to bring in the data and energy fields, solutions that will revolutionize the exploitation of big data technologies and analytics in the activities and businesses related to energy, by providing a definitive framework for knowledge extraction, as well as fine-grained business intelligence services to interested stakeholders.

The Exploitation Plan is considered a significant part of BD4NRG project as it envisions to turn the projects outcomes into business value. The overall aim of WP10-E Dissemination, Exploitation and Standardisation is to pave the way for business viability of BD4NRG assets and results. Specifically, Task 10.4. Business and Exploitation Planning focuses on providing solid foundations for successful valorisation of the project outcomes.

The deliverable D10.3 reflects the preliminary outcomes of Task 10.4 inside the WP10. It is the initial version of a set of deliverables (D10.3, D10.5 and D10.9) regarding the business and exploitation plan of BD4NRG project.

D10.3 Exploitation Plan (first release) aims at explaining the approach for undertaking the exploitation activities as well as providing an overview of the market landscape analysis to set the basis for the BD4NRG results exploitation and business models development. The methodology to be followed towards the BD4NRG business model development is also described. Finally, it gives a first presentation of the potential exploitable results and their customers and target markets.





1 Introduction

BD4NRG project focuses on addressing emerging challenges in big data management for energy sector with an innovative open holistic solution for smart grid-tailored, near real time, energy-specific and AI-based open Big Data Analytics modular framework. The Business and Exploitation Planning activities (T10.4), are very important, inside the project, for laying the foundation for a sound exploitation of the project key results. The T10.4 activities started at M5 in the project and they have been focused in the first five months to identify an early plan to be followed for implementing the exploitation activities.

1.1 Purpose of the Document

The D10.3 - Exploitation Plan (First Release) - is the initial version of a set of deliverables regarding the Business and Exploitation Plan of BD4NRG project. It incorporates all actions for setting up the foundations for a sound exploitation strategy at consortium level and ensuring the sustainability of the project outcomes. It also starts building the environment for commercialization of the BD4NRG assets. The main purpose of this document is to present a plan on the exploitation activities to be done for the project duration along to a view on the potential project results exploitation after the end the project, identifying the potential keys exploitable assets as well as their potential customers, target market. This deliverable aims to specify the steps of a continuous process for an effective Business and Exploitation strategy with maximized impact.

D10.1- Exploitation Plan (first realise) describes the work performed in the first ten months of the project, under Task 10.4-Business and Exploitation Planning activities, and to that context it aims to:

- Present a preliminary exploitation strategy for the project and provide a holistic overview of the exploitation landscape.
- Introduce the actors, markets and sectors that are relevant in the context of exploitation, and emphasize the importance of iteratively analysing their roles, needs and potential.
- Serve as a guidance document for project partners' initial exploitation activities.
- Stimulate exploitation engagement among partners.
- Give an early idea about potential exploitable assets that will derive through BD4NRG project.
- Introduce the BD4NRG business modelling methodologies to be used for the BD4NRG exploitable results.
- Act as a preliminary document that will be further developed within the project and updated by the next deliverables.

1.2 Document Structure

This report is divided into the following five sections:

- **Section 1:** Introduction





- **Section 2:** BD4NRG Exploitation Plan Approach
- **Section 3:** Market Landscape
- **Section 4:** BD4NRG potential offering analysis
- **Section 5:** Conclusion

In more details, this deliverable:

- Provides an overview of the objectives, scope, structure and updating versions.
- Explains the project exploitation approach, describing all the useful task to complete a Business Plan as well as the necessary and relevant actions to obtain commercial exploitation of the project results, including methodologies to be used for the market analysis and business modelling, IPR approach and exploitation roadmap.
- Describes the market landscape in which BD4NRG will exploit its outcomes.
- Focuses on provide a first idea about the potential BD4NRG results and the key exploitable results along potential target markets that can benefits from project results.

1.3 Updating the Report

This deliverable – D10.3 Exploitation Plan (First Release) - is the first version of three releases (D10.3, D10.5 and D10.9). It will be updated and advanced by the D10.5- Exploitation Plan & related Activates, Business Cases & IPR due at M18 and by the D10.9- Report on the BD4NRG Exploitation Activities towards Large-Scale Uptake & Overall Sustainability due at the end of the project (M36).





2 BD4NRG Exploitation Plan Approach

BD4NRG is an Innovation Action project, thus it is more important than ever, to maximise research results impact, through a series of dissemination and exploitation activities.

Both at project and individually level, the ultimate objective is to optimise the adoption of new knowledge, both for commercial and academic purposes. This will stimulate collaboration between the actors involved in these activities and with other subjects outside the consortium, ensuring business and societal benefits.

To this purpose, the BD4NRG project will engage in collaboration/clustering activities and events that stimulate the sharing of knowledge and innovation between related big data and energy projects or initiatives.

In order to achieve these objectives, the BD4NRG project consortium will gradually build a community committed to adopting and planning the exploitation of the results beyond the end of the project. The objective is to involve a critical mass of stakeholders in the initial phase of the dissemination, communication and valorisation of the project.

This chapter aims at providing an overview to the project exploitation activities approach, including the main tasks, methods and useful tools for performing a market and business analysis, Intellectual property rights (IPR) approaches during the project lifecycle.

2.1 Tasks to carry on Exploitation/Business Plan

The project exploitation strategy will comprise of a bouquet of exploitation activities:

- The identification of the innovative exploitable assets, whether these are technological or added value services which the project will deliver through its results to its target users;
- The conduction of a thorough market analysis (which will comprise of an initial and a final analysis) which will aim at the identification of the market towards which BD4NRG is targeted;
- The documentation of an analytical IPR management strategy based on the principles outlined in the project Consortium Agreement which will guide joint and individual exploitation capabilities of the project partners;
- The analytical definition of all possible commercial and non-commercial exploitation models, which have been preliminary identified from the proposal stage;
- The analytical definition and evaluation of the sustainability and viability of possible business models and alternative solutions that may be followed for the provision of the project solution and services to the identified stakeholders, including licensing schemes, pricing, etc.;
- The validation of the aforementioned exploitation activities through the relevant, market driven BD4NRG pilots.





2.1.1 Business/Exploitation Plan main tools

In BD4NRG, in order to define the Business Model for the commercial exploitation of the proposed solutions, several of the methodological tools described below will be used. The final Business Model will be submitted in the D10.9 – “Report on the BD4NRG Exploitation Activities towards Large-Scale Uptake & Overall Sustainability” at the end of the project. While an intermediate view of the market, key exploitable assets analysis and of the potential applicable business models will be given in the D10.5 “Exploitation Plan & related Activates, Business Cases & IPR”. The main objective will be to define the more appropriate business/sustainability plan taking in account of the players, their relationships and possible business models.

2.1.1.1 PEST analysis

PEST analysis (Political, Economic, Social and Technological) is a technique that considers the variables of the external environment that have the greatest impact on the future of the company in the field of Politics, Economy, Society and Technology. The company must understand how the main variables of the environment can act on the future of the business, how they change and how they interact with one another. Variables should not be considered as separate but interdependent entities.

Political factors

These variables cause consequences that vary from sector to sector and from one country to another. The intervention of the public authorities is not always knowable in advance with certainty, therefore it is not always possible to make predictions about the impact of a decision on political factors. Among the main policy variables, it is possible to identify:

- Competition, labour market and capital regulation Tax Policy;
- Political choices of Antitrust;
- Government stability;
- Special incentives;
- Privatizations.

Economic factors

Many economic variables affect the strategic choices and the conditions of the economy have a profound impact on the success of the company, in particular:

- Cost of money;
- Interest rates;
- Inflation rate;
- Unemployment level;
- Price controls;
- Availability and cost of energy.

Social factors





Social trends influence the demand for products of a company. Variables such as cultural and conscience aspects, health, population growth rate, age distribution, careers and safety attitudes have a decisive impact on consumer choices. Some of the most important social variables are:

- Changes in lifestyle;
- Career expectations;
- Consumer self-defence;
- Number of families;
- Population growth rate;
- Age groups in the population;
- Birth rate.

Technological factors

Technological progress can quickly bring out new products and production processes while making others obsolete at the same time. It can also create opportunities/threats by breaking down or raising barriers to entry of new competitors in the sector. Management must anticipate technological change in its sector and in those related to it.

Some technological variables are:

- Total public expenditure on R&D;
- Total sector spending on R&D;
- New products/processes;
- Increase of productivity through automation.

2.1.1.2 Porter's Five Forces Framework

The formulation of a winning strategy involves as a fundamental step the definition and study of the main characteristics of the sector in which it is to operate.

One of the most commonly used reference schemes for this type of analysis is the Porter's Five Forces Framework, which is based on some structural factors and describes the competitive system in which the organization operates.

Porter's Five Forces Framework is a tool that companies can use to assess their competitive position.

The competitive structure of a sector therefore depends on the simultaneous interaction of the five competitive forces Figure 1 that are:

- **Threat of new entrants:** subjects that could enter the market in which the company operates; the factors that can influence the strength of potential entrants are: the availability of capital, knowledge of the sector, reputation and brand, agreements with the distribution.



- **Threat of substitutes:** subjects who place on the market products other than those of the reference company, but which satisfy, in a different way, the same need of the customer/consumer. The strengths that can encourage the producers of substitutive goods are: better value for money, a good propensity to replace, the complexity of the need.
- **Bargaining power of customers:** the target of the output produced by the company that could possibly decide to integrate downstream; the factors that influence the strength of the customers are: the level of concentration of the competitors, how much it costs me purchases and sales, how much do the purchases cost customers, the information asymmetry, the level of specialization of my product, the possibility of substitution.
- **Bargaining power of suppliers:** those from whom the company purchases raw and semi-finished materials necessary to carry out the production process and which could decide to integrate upstream; the factors that influence the strength of the suppliers are: the level of concentration of the competitors, how much do purchases and sales cost, how much the sales costs to the suppliers, the information asymmetry, the level of specialization of my product, the possibility of substitution.
- **Industry rivalry:** Having an understanding of industry rivals is vital to successfully market a product. Positioning pertains to how the public perceives a product and distinguishes it from competitors. Potential factors are: sustainable competitive advantage through innovation, level of advertising expense, degree of transparency, powerful competitive strategy.



Figure 1:: Porter's Five Forces Framework

(Source: Mind Tools, <https://goo.gl/oXwbHj>)



The model aims to identify the forces that operate in the economic environment and that, through their action, erode the long-term profitability of companies. In fact, these forces act continuously and if not properly monitored and tackled, lead to a loss of competitiveness.

2.1.1.3 SWOT Analysis

The SWOT analysis (also known as the SWOT matrix) is a strategic planning tool used to evaluate Strengths, Weaknesses, Opportunities and Threats of a project or in a business or any other situation where an organization has to make a decision to achieve a goal (Figure 2).

Through the analysis of strengths and weaknesses, the organization looks within itself in search of its distinctive competences, that is, what it does better than others, the activities that distinguish it on the market.

Analysing the opportunities and threats, the company looks outside, towards the market, in order to grasp the aspects it could take advantage of, to improve its competitive position.

SWOT ANALYSIS			
Internal		External	
Strengths	Weaknesses	Opportunities	Threats

Figure 2: SWOT Analysis Model

2.1.1.4 Business Model Canvas

The Business Model Canvas, developed by Alexander Osterwalder [1], is a visual representation of current or new business models, generally used by strategic managers (Figure 3). It is presented in the form of a graphical diagram and is useful for developing new business models or improving existing ones. The Business Model is a set of organizational and strategic solutions that allow a company to create, distribute and acquire value.

The Canvas provides a holistic view of the business as a whole. It is especially useful in running a comparative analysis on the impact of an increase in investment may have, on any of the contributing factors.

Using the logic of "visual thinking", the Business Model Canvas creates a sort of universal language: this allows to share and simplify complex concepts that concern the functioning of a company, making them comprehensible to all.

The Business Model can be described with 9 basic elements:





- Customer Segments;
- Value Proposition, which is the value of the products or services offered for each segment;
- Channels, the channels through which to reach the customer;
- Customer Relationships, the relationships established with the customer;
- Revenue Streams, revenues generated;
- Key Resources, the organization/company's key resources;
- Key Activities, the key activities to make the business model effective;
- Key Partners, the key partners with which the company intends to join itself in order to create value for the customer;
- Cost Structure, cost structure for resources, activities and key partners.

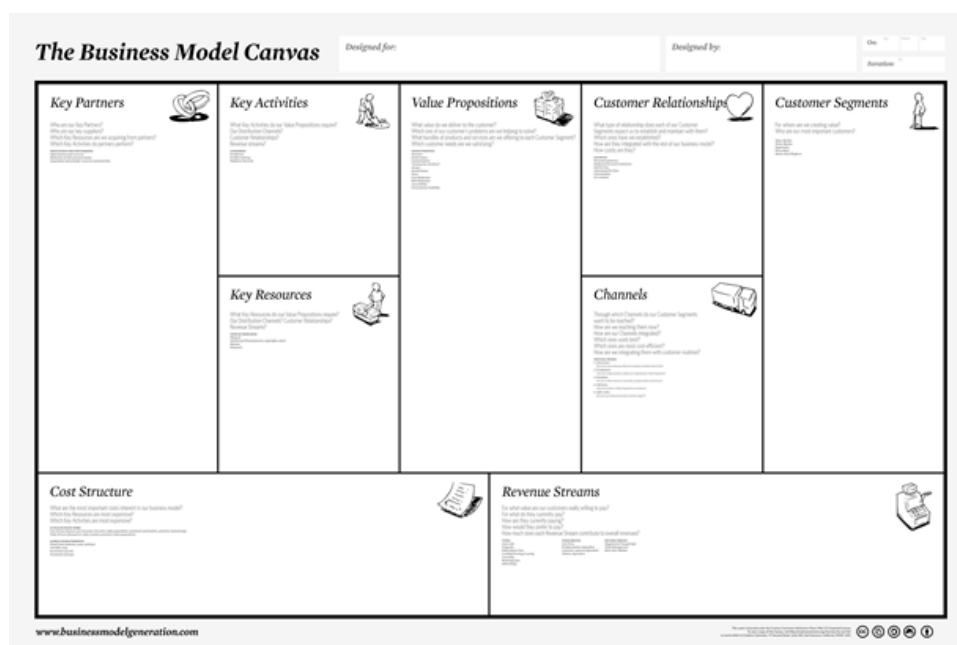


Figure 3: The Business Model Canvas

(Source: Business Model Generation, <https://goo.gl/7xyKvM>)

2.2 Actions to promote the exploitation of the results

The consortium, in order to undertake actions aimed at the project results exploitation and market uptake, first of all aims to involve potential end-users and other actors/organisations interested in the proposed solutions.

The dissemination, communication, standardization activities (inside the T10.1, T10.2 and T10.3) are expected to ensure that the project's advancements are widely diffused to the intended targeted audiences with appropriate mechanisms in a timely manner, and that the key stakeholders for the project's exploitation and market uptake are early engaged and actively participating to the various project's implementation phases.





The project's Consortium is implementing effective dissemination, communication and exploitation activities from the very early stages of the project's implementation. All partners are committed throughout the project to mobilise the appropriate stakeholders in order to multiply the effects of dissemination and exploitation activities. Taking into account the interrelation between the diverse activities to maximise the project's impact, the potential targeted audiences of BD4NRG along with their specific interest in the project have been identified since the early stage of the project (D10.1 Dissemination and Communication Strategy-Stakeholder Engagement Plan).

The project plans to address related industrial/scientific audience and strategic decision makers (such as stakeholders, EU energy ministers and general secretariats of investment, head of research departments, professors etc.) in related research facilities (both in industry and academia). The BD4NRG project is envisaged to be beneficial for various stakeholders that are either directly interested in the project or influenced by the project's outcomes. For this purpose, key messages to drive the effort to disseminate the project and boost the interest to the addressed target groups have already been identified in a manner to be specific, attainable and relevant to the specific target audience they refer to. For more information refer to D10.1 Dissemination and Communication Strategy-Stakeholder Engagement Plan.

Moreover, BD4NRG will be in contact with similar initiatives and sister projects including projects such as OpenDEI, BD4OPEM, BRIGHT, IoT-NGIN, PHOENIX, MATRYCS, I-ENERGY, OneNet, Platoon, RENERgetic. BIGG, INTERFACE. These synergies will allow knowledge exchange and possible cooperation by mutual invitations to events, organization of joint events, publication of articles or newsletter, references to each other's websites, mutual dissemination support in social media accounts etc.

BD4NRG will disseminate the BD4NRG research, concepts and provide guided research directions and stimuli via selected events, magazines, workshops and conferences

BD4NRG will address industrial targets at all levels (local, EU, international) exploiting already established contacts within the consortium, especially via the industrial partners and technology providers. Some of the currently planned activities include:

- Participation in major industrial and trade events to make presentations, distribute project dissemination material and built potential partnerships with other exhibitors.
- Participation in industry innovation events with exhibition stands to promote BD4NRG outcomes
- Publication in highly ranked international scientific journals and magazines
- Publication of press releases and articles in specialized trade newspapers & magazines;
- Organization of focused workshops, special sessions and public relations events, and inviting European/ international community to discuss issues of interest for the project;
- Maintenance of a lively, modern and regularly updated web site with short video clips along with continuous presentation in social media channels, with attractive informational material with specific key messages per target groups.

Finally, BD4NRG will promote new work items in relevant SDOs from the very beginning and throughout all the project lifetime and thereby actively participate in Industry Community





Associations to work towards standardisation of interfaces, APIs, business models and architecture relating to BD4NRG framework.

2.3 Project IPR approach

This section focuses on the post phase of BD4NRG project and examines the topic of Intellectual Property Rights (IPR) arrangements. In dealing with IPR issues, project partners must consider what is stipulated by the GA. The scope is to handle IPR issues and the ownership of results which will guarantee the rights of all the partners in the consortium and consequently the joint and individual exploitation capabilities of project partners.

Dissemination and use of knowledge generated in BD4NRG is governed by the terms of the Grant Agreement and the terms of the Consortium Agreement. Regarding ownership of the foreground, it is agreed that foreground will be the property of the beneficiary carrying out the work generating that foreground. Beneficiaries have also included in the Consortium Agreement, the background needed for the purposes of the project development. In order to make sure that these terms are followed, to avoid disputes and to facilitate business planning, the BD4NRG consortium is going to maintain an IPR Directory throughout the lifetime of the project. The directory will be shared inside the consortium and regularly updated by all partners.

This document aims at listing all the results developed in the project, and make explicit for each item its owner, nature, status and dissemination and protection measures if used. In particular, that table currently requested the follow information:

- i. Assets Owner
- ii. Assets Name
- iii. Short description
- iv. Pilot
- v. UC/UCs
- vi. Nature of the result
- vii. Other organizations directly contributing to development
- viii. Background needed to use this foreground
- ix. Rights to use the foreground
- x. Other project components needed to use this foreground

With the intent of maximizing the opportunities of exploitation of the results, IPR will facilitate the consortium in the comprehension of how work results could be exploitable by partners and third parties (i.e.: entities outside the consortium). During the project implementation and the development of the outcomes, a more detailed IPR strategy will be identified per outcome asset type.

2.4 Exploitation Activities roadmap



The envisaged exploitation activities inside BD4NRG project aims at creating a sound awareness about project key exploitable assets and results potentialities in terms of commercial, academic and research exploitation. Those activities will be supported by using well-known methodologies and tools, as explained in the preview paragraphs, for better addressing the market and business analysis inside the consortium. The Exploitation roadmap (Figure 4), during the project, envisages three main steps connected to the deliverables' submission (D10.3 at M10, D10.5 at M18 and D10.9 at M36).

The first steps want to create an early awareness about the relevant market trends, key exploitable results (KERs) linked to project results and their potential market target/customers. Giving, as well, a clear approach to the next activities to be done.

The second step represents an improvement of the first ones, with a specific interest to better define the KERs, their target markets/customers and the connected business cases and business models, also considering the pilot Use Cases implementation. Additionally, at M18 a first IPR assessment will be conducted taking in account the identified project results. Individual exploitation plans will be defined and collected and a first idea about the potential joint exploitation will be discussed.

The third and final step will be dedicated to consolidating the issued concepts in the first steps, in order to come up with a clear exploitation plan both at individual and joint way and assuring the project results sustainability.

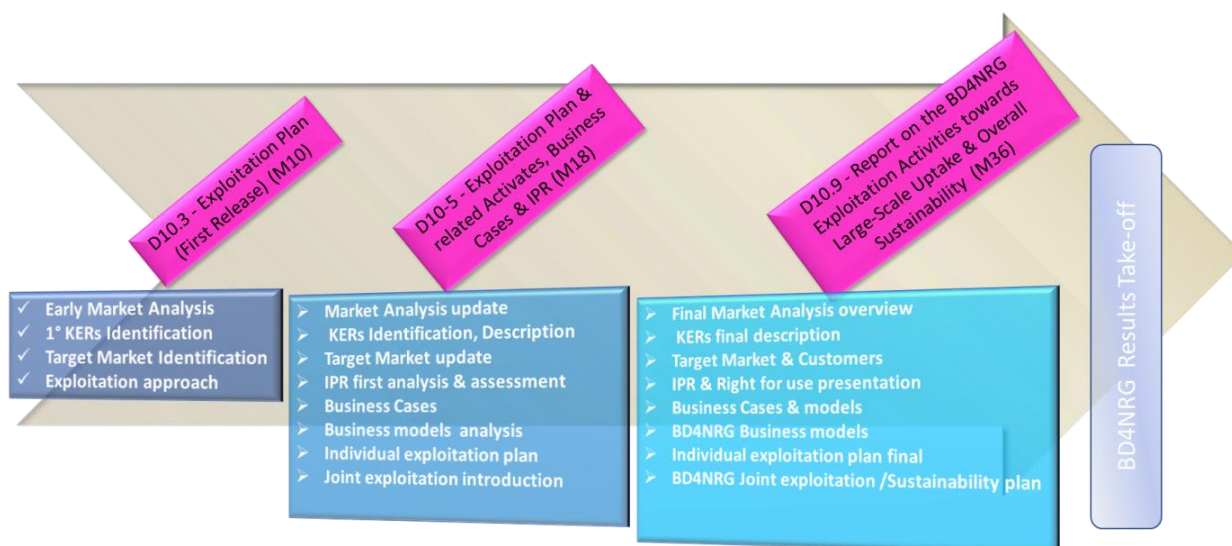


Figure 4: BD4NRG Exploitation activities roadmap

3 Market Landscape

3.1 BD4NRG reference markets

This chapter aims at giving an overview about the main relevant markets where the BD4NRG project results are placed. They are: Data, Energy and ICT Markets. The project results expect to have impact in different ways with its results on the listed markets and the follow paragraphs will provide an overview of their current status, trends and challenges

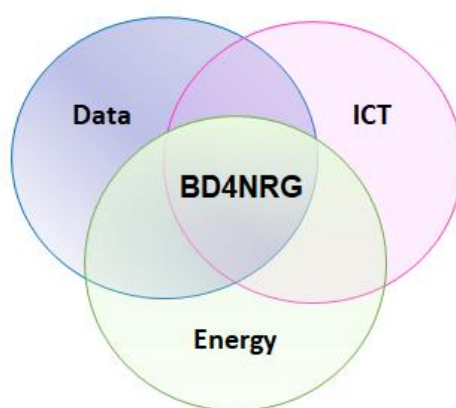


Figure 5: BD4NRG related markets

3.1.1 Data Market

Data is the new oil according to the statement of former Vice-President of the European Commission responsible for the Digital Agenda Neelie Kroes. Having said that, together with their overwhelming growth, their management, and their market become a strategic challenge for the EU and for the rest of societies in the world. Making a market out of it while preserving civil rights like privacy, trustworthiness and being sustainable is the untold story of this challenge.

According to the *European data market monitoring tool* “The value of the Data Economy, which measures the overall impacts of the Data Market on the economy as a whole, exceeded the threshold of 400 Billion Euro in 2019 for the EU27 plus the United Kingdom, with a growth of 7.6% over the previous year. The positive trend in the growth of the Data Economy is confirmed by the Data Market value in 2019 for the EU27 plus the U.K., which is displaying a growth rate above the one exhibited by the total IT spending, at 4.9% year-on-year, reaching 75 Billion Euro.”

“As far as supply and demand are concerned, data suppliers are estimated at more than 290,000 units in the EU27 plus the U.K. for 2019, exhibiting a year-on-year growth of 2.3%. Data users, instead, remained stable in 2019, amounting to nearly 716,000 units and registering a growth of 0.6% over the previous year. Following increasing growth rates over the prior four years, these figures confirm a consolidation of data companies in the EU.”

“Revenues generated by data suppliers increased by 9% to reach almost 84 Billion Euro in the EU27





plus the U.K., with the U.K. still in the leading position, Germany, France and Italy showing the highest share of data revenues per country - together accounting for two thirds (66%) of data revenues in the European Union plus the U.K.”

The current EU data market strategy aims at creating a single market for data will allow it to flow freely within the EU and across sectors for the benefit of businesses, researchers and public administrations. One element of this strategy is the increasing role played by the data spaces. A Data Space can be defined as a decentralized data ecosystem built around common tracts that are established when a given participant acquires the rights to access and use data. The concept and its implementations are in their early stages so evolution can be expected over the coming months. We could agree on four pillars for making success:

- i. Data interoperability. It is necessary a solid framework for the data to be successfully exchanged, and the adoption of a common lingua. This common lingua involves the sharing of a common API and the definition of common data models.
- ii. Data sovereignty and trust: Data spaces have to provide the mechanisms to ensure the participants are who they claim to be and to enforce the access policies to the data.
- iii. Data value creation. It cannot be taken for granted that the participants will find value on data spaces. This implies providing mechanisms for the creation of multisided markets. Therefore, facilities for the definition of terms and conditions to access the data and set a proper pricing should be available.
- iv. Data Space governance. This pillar deals with the operational agreements, in example to accept new members, set which chains of trust of identities will be accepted or how the participants will sustain the data space.

3.1.2 ICT Market

ICT market is one of the largest industries in the world. It is forecasted to reach a size of almost six trillion by 2023¹. The continuous growth serves as another reminder of the ever-increasing prevalence and importance of technology in today's society. In general, growth in traditional tech spending over the next few years will be driven foremost by big data and analytics, social, mobile, and cloud computing. The next part will focus on presenting the AI-based big data analytics and Big data technology market state and expected trends.

3.1.2.1 AI-based big data analytics technology market

Europe Big Data and Business Analytics market size is expected to reach 105.82 billion by 2027, growing at a Compound Annual Growth Rate (CAGR) of 11.5% in the forecast period 2020-2027 [2] .

The customer analytics segment is expected to Garner a significant share during the forecast period, owing to increase in competition among the key players to provide enhanced customer satisfaction and personalized experience. However, the risk & credit analytics segment is expected to grow at the highest rate during the forecast period, due to increase in complexities in business process and rise in business process automation.

The Europe big data and business analytics market is segmented into component, deployment

¹<https://www.statista.com/statistics/263801/global-market-share-held-by-selected-countries-in-the-ict-market/>





model, analytics tools, application, end user, and country. In terms of component, the market is fragmented into hardware, software, and services. Depending on deployment model, it is bifurcated into on-premises and cloud. As per analytics tools, it is categorized into dashboard & data visualization, data mining & warehousing, self-service tools, reporting, and others. The applications covered may include customer analytics, supply chain analytics, marketing analytics, pricing analytics, spatial analytics, workforce analytics, risk & credit analytics, and transportation analytics. As per end user, the market is segregated into manufacturing, Banking, Financial Services and Insurance (BFSI), healthcare, government, energy & utilities, transportation, retail & e-commerce, IT & telecom, education, and others. Country wise, it may be analysed across the different EU countries (UK, Germany, France, Spain, etc.).

Ability of big data analytics software to deliver better and faster decision-making and to provide competitive advantage by analysing & acting upon information in a timely manner propels the growth of the market. In addition, the demand for big data analytics software is continuously increasing, owing to the benefits offered such as easy access to vital business metrics, useful insight on customer behaviour, increased revenue, and improved efficiency of the organizations for faster data processing to gain valuable insights. Furthermore, companies are adopting big data and business analytics for real-time forecasting and monitoring of various occasions such as error detection, security breaches, and other attacks that may affect the performance of the organizations. In addition, ability of the solution to mitigate risks by optimizing complex decisions about unplanned events such as cyberattacks and other crisis more quickly propels the growth of the big data and business analytics market.

3.1.2.2 Big data technology market

Big data technology is gaining traction in the market owing to the rising investments and spending on various technological projects by the governments and key players. According to the Worldwide Big Data and Analytics Spending Guide, in 2018, key players and industries such as banking, process & discrete manufacturing, and federal /central government in the case of the US, spent around USB 81 billion on big data and business analytics projects. In addition, the rising internet penetration and growing adoption of technologies such as cybersecurity, Internet of Things (IoT), and 5G infrastructures are likely to drive the growth of the market.

In fact, the global big data technology market size was \$41.33 billion in 2019 and is projected to reach \$116.07 billion by 2027, at a CAGR of 14.0% in forecast period [3].

When talking about the situation in Europe, there is a growing demand for big data services. The combination of a considerable shortage of skilled developers and analysts and an increasing need for structured data drives this growth. Many big data tasks require specialist knowledge, and practically every company can benefit from big data in some shape or form, but most companies do not want/need to hire an in-house big data team. Hence, the surge in demand for cloud-based big data analytics software among small & medium enterprises positively impacts the Europe big data and business analytics growth. However, high implementation cost and dearth of skilled workforce are expected to hamper the market growth in Europe.

The European big data market was valued at €13.6 billion in 2019 and was expected to have an average annual increase of 25.7% from 2020 to 2025. However, it should be noted that this





prediction was made before the onset of the global COVID-19 crisis. Disruptions are expected, but the exact effect of the pandemic on the market is not yet clear and may vary across services and industries [4].

Globally, approximately 80% of the data generated over the next 5 years will be unstructured. These unstructured data have enormous potential for European companies, highlighting the need for analytical tools operated by skilled personnel in order to extract valuable insights.

3.1.3 Energy Market

Energy markets are commodity markets that deal specifically with the trade and supply of energy. Energy market may refer to an electricity market but can also refer to other sources of energy.

The Agency, for the Cooperation of Energy Regulators (ACER²), was created to further progress the completion of the internal energy market both for electricity and natural gas. As an independent European structure which fosters cooperation among European national energy regulators, ACER ensures that market integration and the harmonization of regulatory frameworks are achieved within the framework of the EU's energy policy objectives.

In accordance with the provisions of the EU legislation, each EU country should establish the national energy regulator. The regulators are providing the circumstances for development of competitiveness in the energy market and ensuring its operation considering the requirements for sustainable, reliable and high-quality supply.

Main entities involved into the energy market are Transmission System Operator (TSO), Distribution System Operator (DSO), Market Operator (MO) and Power Exchange (PX).

- TSO is an entity who carries out the function of transmission of electricity on high-voltage network and is responsible for operating, maintaining, and developing the electricity transmission network in a given area and, where applicable, its interconnections with other systems, and for ensuring the long-term ability of the transmission network to meet reasonable demands for the transmission of electricity.
- DSO is an entity who carries out the function of distribution of electricity on medium-voltage and low voltage network with a view to its delivery to customers and is responsible for operating, maintaining, and developing the electricity distribution network in a given area and for ensuring the long-term ability of the distribution network to meet reasonable demands for the distribution of electricity.

² <https://www.acer.europa.eu/en>





- The term “market operator” mostly refers to an entity which performs certain “system” roles in the electricity market, which may not even exist in every country (usually tasks performed by the TSO), like balance scheme management, recording of closed contracts and operational forecast, balancing the market, imbalance settlement. In the Network Code on Electricity Balancing and the Network Code on Emergency and Restoration the functions of traditional “market operators” were recognized as “third parties”.
- Power Exchange is an entity providing a competitive spot market for electric power trading on a day ahead or intraday organized marketplace. In terms of electricity trading, organized marketplaces complement bilateral physical contracting, often called Over the Counter markets (OTC). OTC markets will always be larger in size since market participants might always need to have tailor-made contracts and products.

In recent years, wind energy and solar energy have made the largest steps towards significant energy production. These sources have little impact on the environment and have the highest potential of renewable energy sources used today. Threat of climate change, cost, government funding, tax incentive and advances in technology, have all lead to huge steps towards the usage of Smart Grids.

3.1.3.1 Smart Grid Industry

The smart grid can be simply defined as an intelligent network that is automated and able to store, communicate, and make decisions.

By according to IEC TR 63097, Smart Grid (SG) is a term which embraces an enhancement of the power grid to accommodate the immediate challenges of today (such as the integration of distributed energy resources) and provides a vision for the future power. Its main focus is on an increased efficiency, reliability, observability and controllability of the power grid and connected users, for the benefit of all concerned actors.

In addition, the US National Institute of Standards and Technologies (NIST) describes the smart grid as “a modern grid that adapts bi-directional flows of energy” and utilizes two-way communication and control capabilities that lead to a wide range of new functionalities and applications. It adds, unlike today’s grid in which the energy is delivered from generation centers to demand centers, Smart grids allow a two-way flow of energy and data.

The smart grid shifts the current conventional grid into a more modernized grid that can function cooperatively and responsively. Users, generators, and consumers may intelligently be integrated into the grid to provide efficient, secure, and economically feasible supplies. The SG incorporates distributed intelligence, bi-directional-based infrastructure for communications, and power flow to improve system efficiency, reliability, and sustainability. Furthermore, the smart grid is a network that integrates digital computing capabilities and highly automated services into the already existing power system infrastructure. Empowering the transition toward the smart grid enhances the robustness and self-healing capabilities of the system, according to Reference. SGs require an effective deployment to the information and communication technology to have a successful implementation of this concept. Upgrading the conventional power grid toward an active network of a two-way communication capability is one of the main barriers in smart grids (SGs). In accordance with the diversification of the power network, a smooth transition to incorporate SG technologies has been done with appropriate categorical standardization.





The National Institute of Standards and Technology (NIST) has classified smart grids into seven categories and (sub-categories) that comprise actors and applications. Actors may include devices (e.g., renewable energy generation, and smart meters), control systems, programs, decision-makers (stakeholders), and telecom stations (data-exchange). The applications are known as the tasks that can be performed by actors within the category (e.g., energy management, site automation, and energy storage) or between different categories. Actors in the same category may interact with actors in other categories, and a specific category may contain components from other categories (i.e., distribution utility may contain actors from operation category such as Distribution Management System and in the customer category such as electric meters [5] .

Numerous technologies can be implemented to achieve successful control and automation in smart grids. Such technologies are imperative to facilitate the transition toward a well-functioned infrastructure from the perspective of grid designers and consumers. These technologies may include Automatic Voltage Regulation (AVR), Energy Management System (EMS), Automatic Generation Control (AGC), Advanced Metering Infrastructure (AMI), Meter Data Management (MDM), supervisory control and data acquisition/advanced distribution management systems (SCADA/ADMS), Geographical Information System (GIS), Outage Management System (OMS), Wide Area Management System (WAMS), and Demand Side Management (DSM) [6] .

The following bullet points briefly summarize the main characteristics of smart grids that have been reported in the literature [7]:

1. Integrable Distributed Resources (DER) that include sustainable energy sources.
2. Dynamic optimization of grid operation continuously.
3. Digitized information and control technologies to enhance the reliability and efficiency of the electric network.
4. Demand Side Response (DSR) programs and demand-side resources.
5. Integrable smart appliances.
6. Fortified against cyber threats.
7. Advanced storage devices and peak-shaving technologies, including hybrid and plug-in electric vehicles.

According “Research And Markets” [8], the smart grid market is estimated to attain a market size of USD 92.107 billion in 2026 from USD 29.336 billion in 2019, growing at a CAGR of 17.76%.



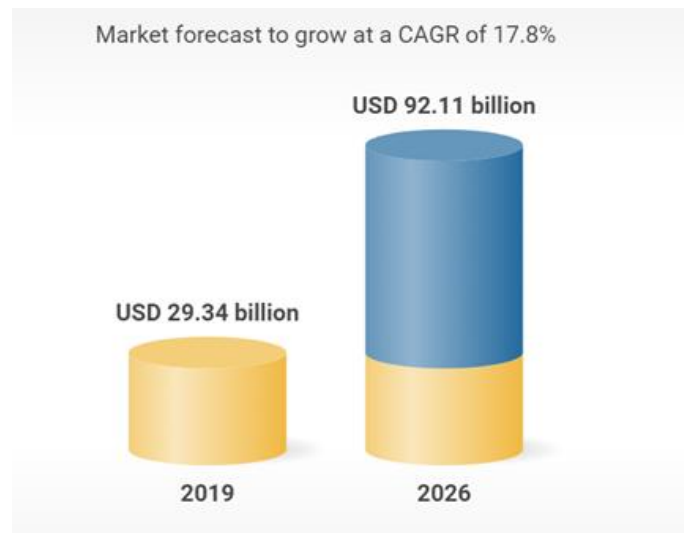


Figure 6: Smart grid forecasting 2019-2026

Source: ResearchAndMarkets

The smart grid market is expected to expand due to the increased investment in the market, deployment of the technologies such as smart meters, EV chargers, and other infrastructure technologies which are expected to boost the market growth of the smart grid market during the forecasted period. In addition, the governments of both underdeveloped and emerging countries are recognizing the smart grid technology as the strategic infrastructural investment which will aid in their long-term economic prosperity and thus will help them achieve the carbon emission targets. These factors are expected to boost the market growth and provide opportunities to the smart grid companies in the forecasted period.

3.1.3.2 EV Charging Station Market

When referring to the charging station market, it must be considered that it is made up of two main players: charge point operators (CPOs) and the electric mobility service providers (eMSPs).

Charge Point Operator (CPO) is the company, usually electric, which physically installs the charging station and connects it to the electricity network; CPO is the owner of the physical device and is the manager of the land on which the charging station is installed. CPOs generally manage a network of charging stations interconnected and operating through an application platform; CPO can enable one or more eMobility Service Providers to provide charging services to end customers. CPO can also interconnect and/or roaming with other Charge Point Operator networks to allow end customers to be able to charge the electric vehicle through a single eMobility Service Provider. They are legally responsible for complying with legal and technical requirements to ensure charging sessions are accurately recorded and tamper-proof; they can produce the charging stations themselves or have them supplied by a hardware provider.

The eMobility Service Provider (eMSP) is the one who takes care of EV customer database and starts the charging session when requested via card or app; eMSP is the server manager and is responsible for sending invoices after charging session. eMSPs offer the electric charging service to the end customer, managing the payment, caring, and offering value-added services, such as booking a charging session and viewing the available charging stations on a map; many CPOs also act as eMSPs.



The charging station market is highly fragmented with intense competition for market share and direct access to customers. The countries of Central Europe, in particular, have built impressive charging infrastructures. 70% of all charging stations in Europe are concentrated in just three countries: the Netherlands (66,665), France (45,751) and Germany (44,538). Together, these countries make up only 23% of the total EU area, therefore, the remaining 30% of charging infrastructure is scattered across the remaining 77% of Europe.

DISTRIBUTION OF ELECTRIC CAR CHARGING POINTS ACROSS THE EU

70% of all charging points:
Located in just 3 EU countries

29.7% Netherlands	20.4% France
19.9% Germany	

Top 5: Fewest charging points in 2020

Cyprus 70	Malta 96	Lithuania 174
Bulgaria 194	Greece 275	

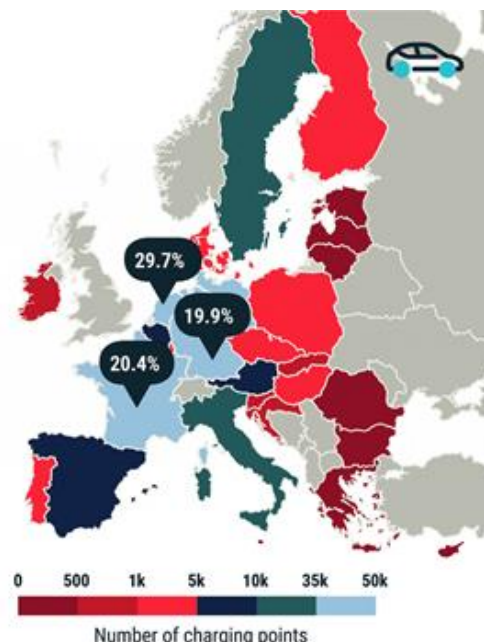


Figure 7: Electric car charging point in EU

Source: ACEA³

Based on the calculations of the European Commission, a further 50% reduction in CO₂ emissions from cars in 2030 would require approximately 6 million publicly available charging points; with less than 225,000 charging stations available in Europe today, this translates into a necessary 27-fold increase in less than a decade.

³ <https://www.acea.auto/press-release/risk-of-two-track-europe-for-e-mobility-with-sharp-divisions-in-roll-out-of-chargers-auto-industry-warns/>

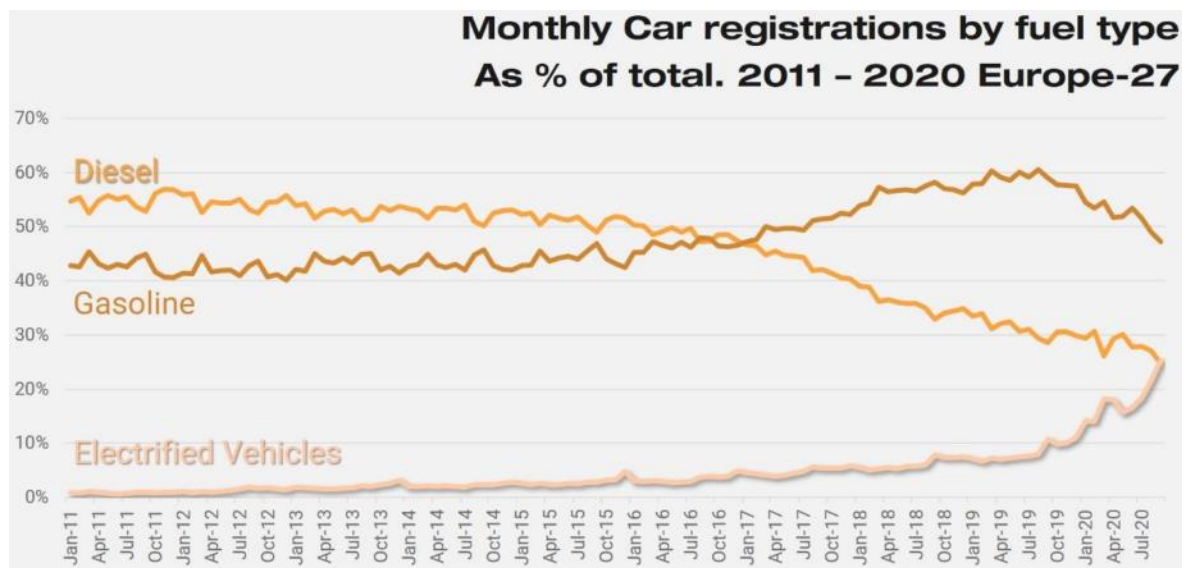


Figure 8: Car registration trend per fuel type

Source: Jato⁴

As for car sales, in 2020 there was a sharp decline in sales of internal combustion cars and a sharp increase in sales of electric cars. In particular, after reaching 7.5 million cars registered in 2019, the demand for petrol cars fell to 4.7 million units in 2020 (just 539,709 more units than in 2014); the number of diesel cars sold fell by nearly 2.6 million units over the same period. Electric vehicles increased by nearly 1 million units (to 1,045,082) over the seven-year period and it doubled, between 2019 and 2020, demonstrating that the transition to electric mobility is now underway.

Charging stations can be separated into two categories: normal and fast charge points. Normal ones charge below 22 kW (kilowatts) and fast ones above 22 kW. Fast chargers decrease the charging time significantly and the availability of such chargers plays a key role for the EV Charging infrastructure. However, of the 224,237 charging stations available across the EU today, only 24,987 are suitable for fast charging, while normal charging stations represent the vast majority (199,250); therefore, today only 1 in 9 charging points in the EU is a fast charger.

⁴ <https://www.jato.com/in-september-2020-for-the-first-time-in-european-history-registrations-for-electrified-vehicles-overtook-diesel/>

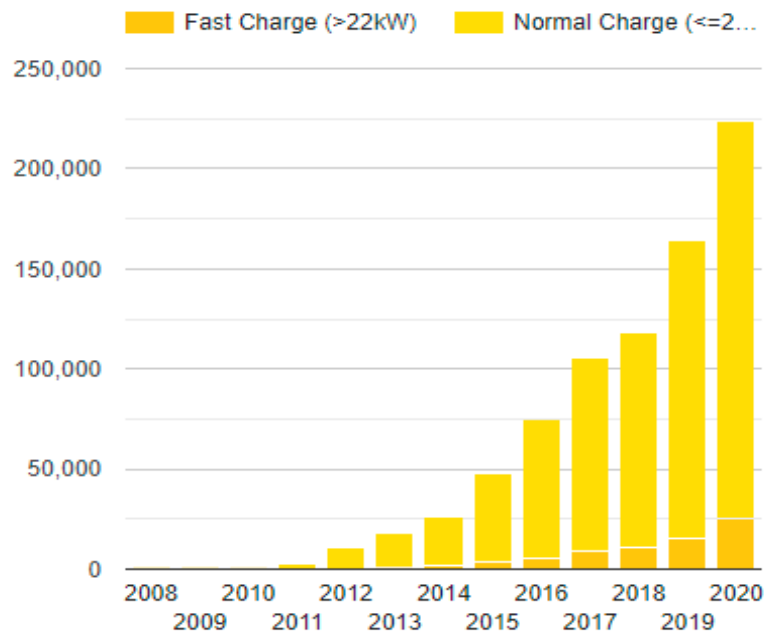


Figure 9: Electric charge

Source: Eaf⁵

Concerning political support, it is vital for the global charging station market. To date, most countries offer some form of subsidy or tax reduction for the purchase of electric vehicles by individuals or companies. Most also support schemes for deploying charging infrastructure and have largely left the vertical market alone to self-regulate. However, there are substantive policies and directives that aim to expand the electric vehicle charging infrastructure and standardize and regulate the overall market; in particular, reference must be made to three international directives:

- EU policy documents that aim to reach 30 million zero-emission cars by 2030, through the use of the CO₂ tax⁶;
- Energy Performance of Buildings Directive (EPBD), adopted by the EU in 2018, which stipulates that all new or fully renovated residential buildings with more than ten parking spaces must install pre-wiring for future charging points. For commercial buildings, every fifth parking space must be pre-wired and at least one charging point must be installed⁷;
- Alternative Fuels Infrastructure Directive (AFID⁸), which applies to charging point infrastructure for new and existing electric vehicles since 2018 and requires all CPOs to offer customers ad hoc access. This means that all new and existing public charging points must be accessible without entering into a contract.

⁵ <https://www.eafo.eu/electric-vehicle-charging-infrastructure>

⁶ <https://www.argusmedia.com/en/news/2167371-eu-wants-30mn-zeroemission-vehicles-by-2030>

⁷ https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/energy-performance-buildings-directive_en

⁸ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0094>





From a technological point of view, today practically all the new charging stations installed in public and semi-public contexts are equipped with IoT connectivity; in some European countries this is even mandatory. The operators remotely manage the charging stations or entrust the management to suppliers of white label solutions. Customers can locate chargers, initiate a charging process, track progress, and pay via online platforms. Networked charging stations are key to enabling widespread charging and accelerating the mass adoption of electric vehicles. Another important element that is undergoing a sudden technological evolution are the vehicle batteries, which, in addition to determining the autonomy of the vehicle, determine the required charging time. Battery capacity varies depending on the type and size of the car: for smaller battery electric vehicles (BEVs), capacity typically ranges from 20 to 40 kWh (kilowatt hours), while capacity for larger cars will exceed 100 kWh in the near future. Charging times are becoming less of a concern for long-distance travel, as there are new models that support a power output up to 500 kW.

In conclusion, Europe will continue to experience huge growth in the electric vehicle sector in 2021-2024, with double-digit percentage increases in most countries. Markets will see significant sales growth thanks to purchase subsidies, emissions directives, improved battery technology and the increased overall appeal of electric vehicles.

3.1.3.3 Big data and artificial intelligence in Energy sector

Artificial Intelligence is becoming more important in the energy industry and is having great potential for the future design of the energy system.

Increasing demand for energy efficiency across the globe has propelled the growth of artificial intelligence in energy market. In addition, the energy sector is facing pressing challenges. Policy, such as the Paris Agreement, is pushing the transformation to a low-carbon economy.

Artificial Intelligence in Energy market is valued at USD 2.30 Billion in 2018 and expected to reach USD 9.47 Billion by 2025 with the CAGR of 22.45 %over the forecast period [8].

Accordingly [9], the market size of global AI in energy field reached the USD 3.82 Billion in the 2020 and its CAGR between 2020 and 2028 is about of 23.6% (Figure 10).





Figure 10: AI in Energy market

Source: EMERGEN Research

Market revenue growth seems driven by increasing need to obtain operational efficiency to meet the energy requirement. As the energy industry continues to utilize more variable generation sources, accurate forecasts of power generation and net load are becoming essential to maintain system reliability, minimize carbon emissions and maximize renewable energy resources.

Energy grid is considered one of the most complex system ever built and requires split-second decisions to be made in real time. Consequently, AI algorithms seems to be a perfect mean to manage this complexity. Grid operators, developers and consumers are adopting AI, for a smooth transition to a greater use of renewables.

In fact, AI's ability to provide better prediction capabilities can enable to improved demand forecasting and asset management, while its automation capability can drive to operational leading, in turn, to competitive advantage and cost-savings for stakeholders.

Typical areas of AI application are electricity trading, smart grids, or the sector coupling of electricity, heat and transport. However, prerequisites for an increased use of AI in the energy system are the **digitalization of the energy sector** and a correspondingly large set of data that is evaluable.

On the basis of product offering, the AI in energy market is segmented into: support services, hardware, AI-as-a-service and software. This latter seems have the largest revenue share in 2020 and it is expected to growth more than the other segments in the considered period (2020-2028) (Figure 11).

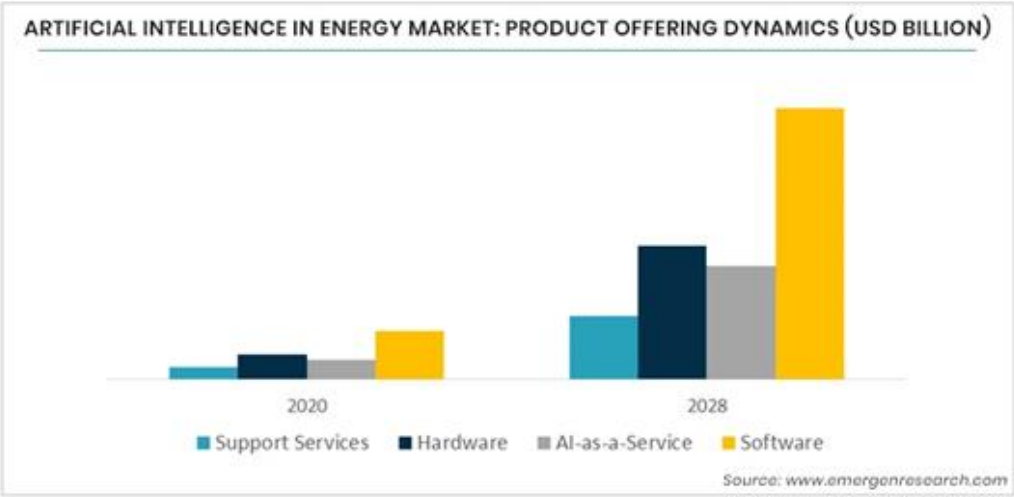


Figure 11: AI products in Energy market

Source: EMERGEN Research



4 BD4NRG potential offering analysis

This section aims at providing an overview of the BD4NRG project, its scope and main outcomes in order to introduce the potential BD4NRG exploitable results and their customers/target market.

4.1 Project results overview

BD4NRG project addresses emerging challenges in big data management for energy with an open holistic solution aimed at creating a European approach to the Business-to-Business platforms able to give a competitive edge to the European stakeholders operating in this sector and to open new market opportunities. The goal is to unlock and exploit the economic potential of big data enabling improved operation for all the stakeholders in the energy value chain.

BD4NRG project aims at delivering an **innovative smart grid-tailored** near real time energy-specific **open analytics modular framework** which leverages on an open source highly distributed interoperability reference architecture (Figure 12).

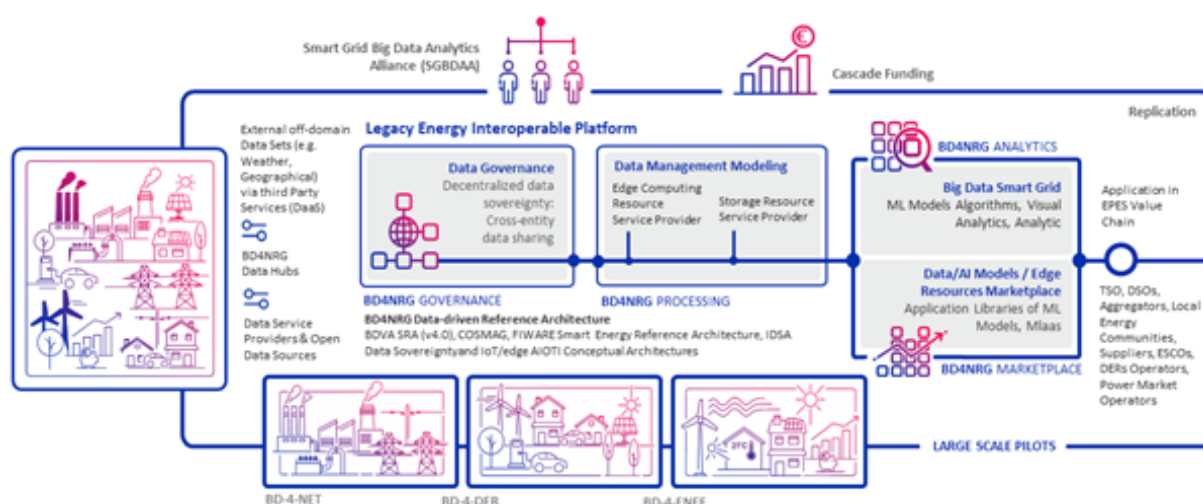


Figure 12: BD4NRG vision

BD4NRG vision is to enable an incremental **decentralized energy data-driven ecosystem**, consisting of a **federation of distributed Data Hubs**. Specifically, it aims to enable an incremental decentralized collaborative data sovereignty –preserving energy data-driven ecosystem, consisting of a federation of Energy stakeholders which are willing to federate some of their owned/operated datasets through distributed Data Hubs (BD4NRG Data Hubs) with a view to share data and accordingly improve their business operational performance.

To enable and realize the proposed vision, we will develop, adapt, deliver and deploy a distributed big data energy analytics loosely-connected interoperable reference framework “**BD4NRG Framework**”, which consists of:





- A number of distributed intelligent collaborative federated nodes – “BD4NRG Data Hubs”, which may act as Data Providers and/or Data Consumers, and will be deployed over:
 - A variety of energy and non-energy data (weather, geographical) sets and/or legacy energy interoperable platforms from Smart Grid Assets, Technologies and Components, hence representing sources of data owned/managed by DSO, TSO, Market Operators, ESCOs, aggregators stakeholders;
 - External datasets, such as other off-grid domain data, such as weather forecast or geographical data sets, simulated data as made available from research lab (i.e. RWTH), open datasets crawled over the Internet and/or linked energy datasets
- A graphically-enriched Open Modular Big Data Analytics Energy Toolbox, allowing energy stakeholders to design, develop and run custom big data analytics applications by leveraging on reusable tools, including analytics applications and ML models/algorithms, made available by BD4NRG ecosystem members
- A scalable big-data energy analytics environment, offering Asset Sovereignty-Preserving Data Governance, Big Data scalable Management for the federated data sets/platforms, and a Resource Marketplace, managing sharable assets made available by BD4NRG Data Hubs and BD4NRG Service Providers.

BD4NRG project, in addition, will combine DLTs/blockchain technologies with edge processing, Federated Machine Learning and Artificial Intelligence, to operate the data-driven energy ecosystem.

The overall BD4NRG service analytics reference framework will be applied, implemented, demonstrated and validated in real-life pilots, in 12 large-scale demo-sites across 10 countries.

4.2 BD4NRG Key Exploitable assets

BD4NRG envisages to provide a variety of tools and services starting from the project developments. The identification of the BD4NRG Key exploitable results (KERs) is currently on going and will be better outlined in the next months but considering the project vision and the main project developments activities, it is possible to give a first idea about them. The Table 1 list the potential KERs, along its potential target markets

Table 1: BD4NRG Key Exploitable Results

BD4NRG KER	Target User/Market
BD4NRG solution as whole (or part of it: BD4NRG-GOVERNANCE, BD-PROCESSING, BD-ANALYTICS, BDMARKEPLACE)	Energy/utilities companies, Data Industry, Researchers
BD4NRG Individual technologies/ components	Energy/utilities companies, Data Industry,



	Researchers, IT companies
Best practices and added value services (training, consultants, support, solution extensions, etc.)	Energy companies, Data industry, Public Authorities, Policy Makers,

The **BD4NRG solution offers a standardized way of managing, sharing and using data and related AI services**, overcoming barriers hampering the exploitation potential of energy Big Data.

It includes different building blocks in three main layers as described below.

Table 2: BD4NRG building blocks

Data Governance Layer 	A middleware to act as a mediator between data users and data providers who may want to decide case by case whether to disclose their data or not. State of the art solutions to guarantee traceability, provenance tracking and accountability but guaranteeing confidentiality as well.
Scalable Big Data Management & Processing Layer 	Smart management and processing of data by an intelligent information broker. The content of multiple data sources, being generated, managed and stored in the data management systems and the data hubs of the different operators and actors by innovative components and technology enablers.
Applications Layer 	Analytics-centered applications tailoring power network improved cross-functional decision-making to improve power network reliability, optimize management of flexibility assets, address building-scale energy efficient comfort management and dynamic situated renewable investment risk assessment. It will include: a Big Data Analytics Toolbox and a Marketplace.  Open Modular Smart Grid Big Data Analytics Toolbox aiming at providing a working space for self-service capabilities that give autonomy to the end-user combining data that come from different sources.  Data / Models / Resources Marketplace A virtual workbench with a variety of assets, including data, third party services, machine learning models, computing resources and storage resources as tradable assets providing off-the-shelf tools, library of reusable AI-based machine learning models, external off-domain data sets and reusable data-driven analytics applications.



4.3 BD4NRG target market

The identification of the BD4NRG target market starts from the analysis of the potential project exploitable results both considering the project as whole and the individual exploitation early plan. The main target markets are showed in the Figure 13 below. They are grouped together according the specific industry/domain and they are described in the next section in terms of needs and benefits achievable through BD4NRG results and potential offering.

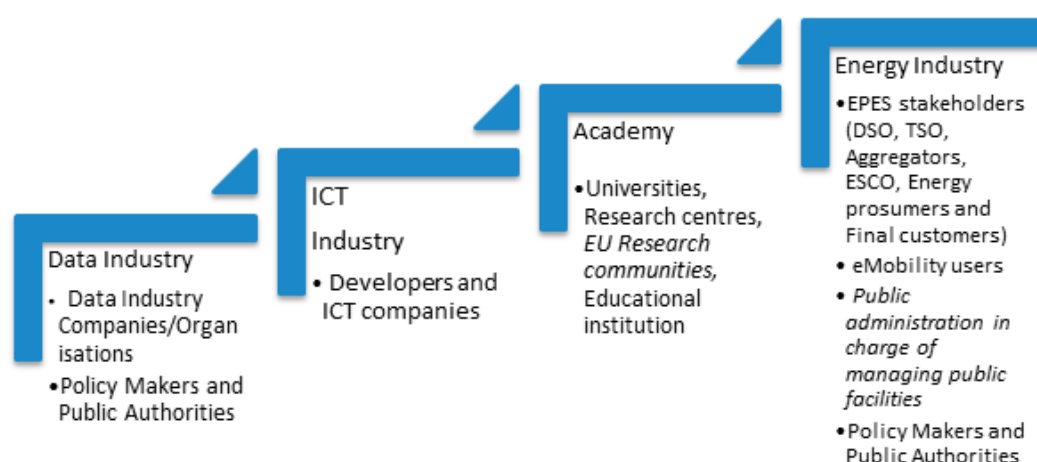


Figure 13: BD4NRG Target market

4.3.1 Target market in Data Industry

The main target markets inside the data industry fields are all the companies and organisation that have to manage data as well as the policy makers and public authorities. This paragraph aims to present those main potential customers in the data industry, for the BD4NRG results taking in account their needs and how the project results will be able to bring benefits to them.

Table 3: BD4NRG Data Industry Companies/Organisations target market

Target market name	Data Industry Companies/Organisations
Target market description (including the needs they have for using solutions like the	Data (A.I. and Analytics) Industry is a booming industry evaluated to over 50 billion EUR in 2020. This industry is becoming center of various verticals, including energy. The need of this industry is to be capable to process and produce intelligence in near real





ones proposed by BD4NRG)	time, using a heterogenous huge amount of data from different sources, to serve for strategic, operational and risk-based decision. This is requiring optimized infrastructure, business logic, algorithms.
Benefits achievable by the target market through BD4NRG	Main benefit is the usage of distribution of OpenSource components specialised in handling geospatial data (indexing, processing, distributing, etc) where components are pre integrated and pre-configured, as well as related algorithms. Other benefits are: (a) reduced runtime and (b) the cost for deployment of standard geo-spatial services or components, on cloud infrastructure or on premises, and (c) an environment for developing, manage and monitor new application. Applications can be front-end (for final users) or backend (for data logic and processes)

Table 4: BD4NRG Policy Makers and Public Authorities in data industry target market

Target market name	Policy Makers and Public Authorities
Target market description (including the needs they have for using solutions like the ones proposed by BD4NRG)	This group includes policy makers, regulators and standardization authorities among others. They are responsible for setting the overall policy and regulatory framework; are typically in continuous dialogue with representatives of stakeholder groups through several established or ad hoc fora; project partners can interact with them through these fora, either on an individual basis or via established associations representing the various stakeholder groups Policy makers and public authorities need proofs of concept that the proposed solutions are robust and can work under different conditions. The validation of the proposed solutions through the project pilots can provide the necessary feedback to policy makers and public authorities. Acceptance of the solutions by involved actors can also act as a driver.
Benefits achievable by the target market through BD4NRG	• Establishment of standards for exchange and processing of big data • Definition of common vocabulary • Pan-european solutions leading to more efficient and robust system operation • Suggestions for new standards, policies, regulation

4.3.2 Target market in Energy Industry

The main target markets inside the energy industry fields are all the so called EPES Stakeholders (DSO, TSO, Aggregators, ESCO, Energy prosumers and Final customers), eMobility and public administrations in charge of managing public facilities users, as well as the policy makers and public authorities. This paragraph aims to present those main potential customers in this industry, for the BD4NRG results taking in account their needs and how the project results will be able to bring benefits to them.





Table 5: BD4NRG EPES Stakeholders target market

Target market name	EPES Stakeholders (DSO, TSO, Aggregators, ESCO, Energy prosumers and Final customers)
Target market description (including the needs they have for using solutions like the ones proposed by BD4NRG)	The main objective of DSOs and TSOs is to ensure a reliable and secure supply of electrical energy to the end-users. For this purpose, they should ensure the balance between demand and supply to maintain frequency stability and avoid congestions in their system to ensure the flow of energy from the production units to the end-users, as well as ensure the technical limits of the system, e.g., voltage limits and voltage stability, to prevent damage to equipment and humans. To ensure a reliable and secure supply of electrical energy, the grid assets should be in good shape to avoid outages and power interruptions. Aggregators combine distributed assets, such as flexible demand, storage units, renewable energy production units, in virtual power plants. Aggregators need adequate control algorithms to steer their portfolio of flexible assets, as well as adequation optimization strategies to bid in energy and flexibility markets. Energy service companies (ESCOs) develop, design, build, and arrange financing for projects that save energy, reduce energy costs, and decrease operations and maintenance costs at their customers' facilities. Energy prosumers both consume and produce energy at their site. Energy prosumers may want to optimise their self consumption and reduce their consumption peak. Final customers are pure energy users and do not produce energy at their site.
Benefits achievable by the target market through BD4NRG	DSOs and TSOs: - Limit investments in measurement equipment - Predictive maintenance of assets to prevent asset outage - Improve operational efficiency - Improved forecasting Aggregators: - Increase the efficiency of determining asset control policies - Improve bidding strategies in reserve and flexibility markets - Improved forecasting ESCO: - Improve the estimates of the given customer's situation to improve tailor-made solutions and reduce the risk of energy-efficiency investments Energy prosumers: - Maximization of self-consumption - Reduction of consumption peak - Maximize profits from flexible demand and local RES production within operational limits of devices - Improve thermal comfort of building when using flexible demand Final customers: - Improve thermal comfort of building when using flexible demand



Table 6: BD4NRG eMobility users target market

Target market name	eMobility users
Target market description (including the needs they have for using solutions like the ones proposed by BD4NRG)	This target group includes electric vehicle (EV) users, charging point operators (CPOs) and electric mobility service providers (eMSPs). EV users want a simple way to charge their vehicle, as well as affordable pricing and renewable energy for charging. CPOs, in collaboration with the eMSPs, wish to attract as many EV users as possible, so as to increase the number of daily charges in their charging stations; moreover, they are interested in participating into flexibility mechanisms, helping network operators to manage renewable energy integration and avoid grid instability, obtaining economic incentives.
Benefits achievable by the target market through BD4NRG	BD4NRG helps to process data from electric vehicles, charging stations, as well as the electricity grid, resulting in greater predictability of energy consumption and energy production, allowing therefore more effective demand response (DR) campaigns for all actors involved.

Table 7: BD4NRG Public administrations in charge of managing public facilities market

Target market name	Public administrations in charge of managing public facilities
Target market description (including the needs they have for using solutions like the ones proposed by BD4NRG)	This target group includes all the public administrations that have the possibility to operate their own buildings. Usually, the local entities are the ones that can carry this out. When it comes to larger scale entities, administrations already at regional level for example, do not have a figure in charge of managing facilities, so the use and implementation of BD4NRG tools is more complex. • Need to make it simpler and easier to monitor the overall operation and status of all facilities they manage. • Improve and update the management of the facilities. • Facilitate the analysis of the buildings' data as it requires a considerable amount of work.
Benefits achievable by the target market through BD4NRG	• An improvement of the performance of the installations. • BD-based analytics. • An upgrade of the management systems.

Table 8: BD4NRG Policy Makers and Public Authorities in energy industry target market





Target market name	Policy Makers and Public Authorities
Target market description (including the needs they have for using solutions like the ones proposed by BD4NRG)	This target group includes entities at national and European level. The scale of this group varies from those which are driven by political approach (eg. National ministries, European Parliament) to those that are decision making authorities with legal and technical expertise (such as Regulators). • Policy Makers and Authorities seek for inputs which support the process of developing new policies and regulations • Amendment of regulatory frameworks & policy agendas is a constantly ongoing process which can be assisted by insights from market players and research institutions
Benefits achievable by the target market through BD4NRG	For this target group the knowledge building value is more relevant than the technical innovation the project BD4NRG aims for. The benefits which could be achieved by the project are: • Recommendations regarding the regulatory framework • Identification of regulatory barriers • Insights from the demo pilots which are relevant to the policy agendas

4.3.3 Target market in ICT Industry

Also inside the ICT industry, some ICT companies and developer can be interested to the BD4NRG results. Consequently, it represents for BD4NRG another relevant target market to be taken in account. This paragraph aims to present those main potential customers, for the BD4NRG results taking in account their needs and how the project results will be able to bring benefits to them.

Table 9: BD4NRG Developers and ICT companies target market

Target market name	Developers and ICT companies
Target market description (including the needs they have for using solutions like the ones proposed by BD4NRG)	This target group includes mainly developers and companies providing services and applications for the energy domain based on the exploitation of energy data. There is a need of available datasets coming from reliable and heterogeneous data sources and need of advanced and domain-specific data analytics tools that could ease the development of algorithms and specific software aimed at giving solution to very specific needs in the energy sector.
Benefits achievable by the target market through BD4NRG	For this target group, the availability and accessibility to datasets and domain-specific data analytic tools is of key importance in order to improve the performance of today's available data analytic services and to develop and test innovative approaches to data processing.





4.3.4 Target market in Academic context

Finally, the Academia and Research users can be also potential customers for the BD4NRG project results. This paragraph aims to present this main potential customer, for the BD4NRG results taking in account their needs and how the project results will be able to bring benefits to them.

Table 10: BD4NRG Academia and Research target market

Target market name	Academia and Research
Target market description (including the needs they have for using solutions like the ones proposed by BD4NRG)	This target group includes a wide range of potential users for BD4NRG from academic and educational institutions, research centres and research communities to Individuals engaged in research initiatives. • Researchers need access to high quality curated data sets during the course of their research. This is often challenging as these data sets may be available from a variety of sources, in a variety of formats and at varying degrees of quality levels. • Researchers also need access to controlled environments where they can test their models in a controlled manner. • For carrying out their research, researchers often need easy access to storage and computing resources. • Finally, availability of reusable components can greatly reduce the complexity and time span of research.
Benefits achievable by the target market through BD4NRG	• Researchers will get access to a variety of energy and non-energy data (weather, geographical) sets which are curated and easily access. This will allow themto focus on developing their research instead of having to trawl through the internet looking for data or spend their time gathering data which might be already available. • Scalable big-data analytics environment provided by the BD4NRG platform will allow them quick and easy access to computing resources, storage resources, AI-based ML models/algorithms reducing the research cycle. This will also allow for reusability of components and assets enabling researchers to access essential tools and resources for their research in a simple manner. • This ease of use combined with re-utilisation of project results and research know how acquired during research activities will enable reuse of the project’s innovative technologies to other application domains supporting a strong cross-fertilization of knowledge.





5 Conclusion

This D10.3 as first version of the BD4NRG Exploitation Plan, has provided an overview of the consortium approach for facing the exploitation activities during the project lifecycle and for assuring the project results sustainability. This document focusing on the first market analysis where to place the project exploitable results, gives an idea about the market trends in order to understand the connected opportunities and risks that may have impact in the future exploitation of the BD4NRG assets.

It has also provided an early idea about the main BD4NRG key exploitable results taking in account the potential customers as target market and the envisaged advantages/benefits for them by the introduction of the BD4NRG potential offering.

Since the project is at an early stage of its life, the main objective is to increase the involvement of partners in the search for effective solutions to define the value proposition as well as the final business model. Each partner will be increasingly involved in identifying the optimal results expected and their commercial exploitation plan, in order to contribute to the achievement of a sustainable business model.

The results obtained in this initial market analysis and exploitation plan will constitute the basics for further studies and analysis, and then be updated according to market evolution during the life of the project.

Starting from this document, all partners will provide their specific and updated exploitation/marketing plan related to the exploitable project result.





References

- [1] O. Alexander, Y. Pigneur, T. Clark e A. Smith, *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*, 2010.
- [2] P. Borasi, S. Khan e V. Kumar, *Europe Big Data and Business Analytics Market*, Allied Market Research, 2021.
- [3] «The global big data technology market,» *Fortune Business Insights*, Oct 2020.
- [4] G. C. CBI Ministry of Foreign Affairs by B.V., « The European market potential for big data services,» Oct 2021. [Online]. Available: <https://www.cbi.eu/market-information/outsourcing-itobpo/exporting-big-data-services-europe/market-potential>. [Consultato il giorno 5 Oct 2021].
- [5] e. Office of the National Coordinator for Smart Grid Interoperability Engineering Laboratory, «NIST framework and roadmap for smart grid interoperability standards,» 2012. [Online]. Available: https://www.nist.gov/system/files/documents/smartgrid/NIST_Framework_Release_2-0_corr.pdf. [Consultato il giorno Sep 2021].
- [6] S. Mei e L. Chen, «Recent advances on smart grid technology and renewable energy integration,» *Science China Technological Sciences* , vol. 56, p. 3040–3048 , 2013.
- [7] M. E. El-hawary, «The Smart Grid—State-of-the-art and Future Trends,» *Electric Power Components and Systems* , vol. 42, n. 3-4, pp. 239-250, 2014.
- [8] «Smart Grid Market - Forecasts from 2021 to 2026,» *ResearchAndMarkets*, March 2021.
- [9] «Artificial Intelligence In Energy Market Size, Share Outlook Growth By Top Company, Development, Application, Segmentation, Trends And Forecast 2020-2025,» *BrandEssence*, Feb 2020.
- [10] «Artificial Intelligence in Energy Market By Product Offering (Hardware, AI-as-a-Service, Software), By Industry Stream (Power Industry, Oil & Gas Industry), By Application (Demand Response, Fleet & Asset, Renewable Energy), and By Region, Forecast to 2028,» *EMERGEN Research*, Feb 2021.

