



**BD⁴
NRG**

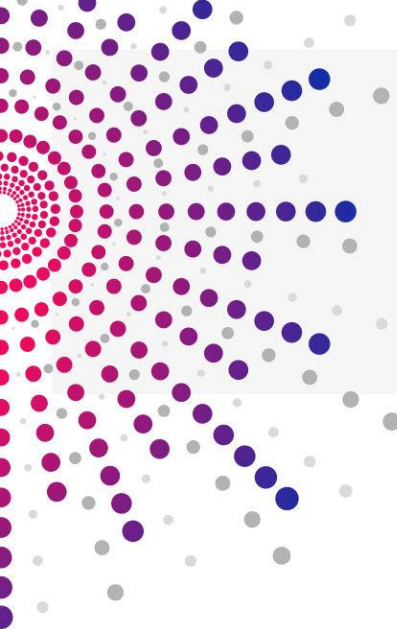
Big Data for Next
Generation Energy

BD4NRG Open Call Guide for Applicants

September 2022

<https://opencall-bd4nrg.cintechsolutions.eu>
<http://www.bd4nrg.eu>





Disclaimer

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8	ATOS SPAIN SA	ATOS	ES	
9	FUNDACION CARTIF	CARTIF	ES	
10	UNIVERZA V LJUBLJANI	UNILJ	SL	
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16	FIWARE FOUNDATION EV	FIWARE	DE	
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22	HOLISTIC IKE	HOLISTIC	GR	
23	INTERUNIVERSITAIR MICRO-ELECTRONICA CENTRUM	IMEC	BE	
24	TERRASIGNA SRL	TS	RO	
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35	EMOTION SRL	EMOT	IT	



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Definitions

Term	Definition
BD4NRG	BD4NRG is a H2020 36-month Research and Innovation action. BD4NRG project is funded by the European Union and the Horizon 2020 programme under Grant Agreement no 872613.
Cascade funding	<p>Cascade funding or also known as Financial Support for Third Parties is a European Commission mechanism to distribute public funding in order to assist beneficiaries.</p> <p>This funding method aims at simplifying the administrative procedures, creating a light application scheme, by allowing that some EU-funded projects may issue, in turn, open calls for further funding. This scheme was first introduced by the European Commission in Horizon 2020, the Framework Program for Research and Innovation (2014-2020).</p>
Third Parties	Other legal entities which participate in Horizon 2020 by carrying out some tasks in an action, but which do not sign the Grant Agreement (including entities linked to the beneficiaries) are considered as "third parties involved in an action" (Article 8 of the General Model GA - multi-beneficiary). They are not bound by the terms and conditions of the Grant Agreement and consequently, the European Union (represented by the Commission or another funding body) has no obligation vis-à-vis third parties. If necessary to implement the action, beneficiaries may use contracts and sub-contracting for the purchase of goods, works or services, in-kind contributions provided by third parties and also linked third parties carrying out tasks under an action.
Cascade funding partner	The BD4NRG partner responsible for the cascade funding grant.
Support team	A project body, composed of certain partners that are connected to the Open Call, responsible for the management of the evaluation procedure.
Mentoring Team	A project body, composed of certain partners connected to the Open Call that support the selected applicants during the development phase.
SMEs	Entities having up less than 250 employees and up to an annual turnover of 50 million € or up to a balance sheet total of 43 million €. Small and medium-sized enterprises (SMEs) are defined in the EU recommendation 2003/361. (https://ec.europa.eu/growth/smes/sme-definition_en)
Start-up	A startup is an independent, organisation, which is younger than five years and is aimed at creating, improving and expanding a scalable, innovative, technology-enabled product with high and rapid growth. Detailed definition of a start-up is sited on the following link: https://europeanstartupnetwork.eu/vision/
Contract Agreement	Funding A legal contract signed between the Cascade funding partner and the Third Parties selected to be funded. The Contract Funding Agreement regulates (i) the conditions of transfer and usage of the cascade funding, (ii) the IPR rules, and (iii) the other collaboration mechanisms. More information available in Section 7 of this Guide (Contract Funding Agreements process).
Lump Sum	Horizon Europe uses lump sum funding to reduce administration and financial errors. Lump sums make the programme simpler by removing the need to report actual costs. Lump sums are defined up-front and fixed. They are paid out upon completion and approval of activity and a technical report. Detailed information is sited on the following link: https://op.europa.eu/en/publication-detail/-/publication/cc123397-b6ea-11ec-b6f4-01aa75ed71a1/language-en/format-PDF/source-254704739





1 About BD4NRG Open Call

This document outlines the main aspects of the BD4NRG Open Call under the BD4NRG project that will be launched on **20 September 2022** with a deadline of **15 December 2022** at **17:00h CET** (Brussels time).

It provides additional information for the submission of proposals and the evaluation procedure in the framework of the BD4NRG project. It supplements the *Open Call Announcement* and the *Proposal Template* documents and their annexes. This document serves as a helpful guide and does not supersede the *Open Call Announcement* and *Contract Funding Agreement* documents.

BD4NRG is a project funded by the European Union's Horizon 2020 Research and Innovation Programme DT-ICT-11-2019 - Big data solutions for energy under Grant Agreement N° 872613. BD4NRG envisions to confront big data management challenges for the energy sector, giving a competitive edge to the European stakeholders to improve decision making and at the same time to open new market opportunities.

BD4NRG aims to enable an incremental decentralised energy data-driven ecosystem and a collaborative data sovereignty driven ecosystem. The goal is to unlock and exploit the economic potential of big data & AI technologies and give to Energy Sector stakeholders, the opportunity to improve their business operational performance.

BD4NRG solution will be demonstrated to three main pillars:

- BD-4-DER: Management of Distributed Energy Resources
- BD-4-NET: Operation of Electricity Networks
- BD-4-ENEF: Investments & Efficiency in Buildings

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. The BD4NRG project started on 1st of January 2021 and has a duration of 36 months.

The BD4NRG Consortium is coordinated by Engineering Ingegneria Informatica S.p.a. (ENG). The project consortium consists of 35 partners from 11 Countries and involves organisations with complementary expertise from the research and industrial area across Europe.

With this Open Call, BD4NRG is looking for applicants that will introduce new services by adopting the BD4NRG infrastructure and framework. Applicants are asked to submit proposals under one of the following 4 topics with the initiative to promote the development of new tools, services and activities.

The topics that the proposals shall address are:

- i. Efficiency and reliability of electricity networks operation improvement
- ii. Optimisation of grid and distributed assets
- iii. Energy efficiency investments planning
- iv. Cross-Cutting Applications

To achieve the fulfilment of the aforementioned topics, which aim to enhance the current work of demonstration efforts and tools to elevate the BD4NRG overall framework, BD4NRG Open Call will distribute up to 500.000€ among up to 10 SMEs and Start-ups. Selected applicants will be given a 6-month period (maximum) to develop their proposal with the support of the Open Call Mentoring





Team.

Full documentation and information available: <https://opencall-bd4nrg.cintechsolutions.eu>

BD4NRG Open Call Helpdesk: bd4nrg_opencall@cintechsolutions.eu





2 BD4NRG Technical Description and Scope

2.1 BD4NRG Scope & Technical Framework

BD4NRG will deliver 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. It will enable edge-level AI-based cross-sector analytics for integrated and optimised smart energy grid management (including operation and planning), based on seamless data-information-knowledge exchange under respective sovereignty and regulatory principles. BD4NRG aims at evolving, upscaling and demonstrating an innovative energy-tailored Big Data Analytics Toolbox (BD4NRG Toolbox) which will significantly contribute to achieve a techno-economic optimal management of Electric Power and Energy Systems (EPES) value chain.

The technical advancements of BD4NRG, aim to facilitate and enable seamless open multilateral B2B cross-stakeholder data sharing, trusted data exchange and handling, while allowing full data sovereignty and control of respective data ownership, access, security and protection. A technology enabler for advanced edge AI-based big data management, learning and analytics will be deployed for privacy-preserving federated learning, cross-stakeholder transfer learning combined with dynamic self-learning, and edge/IoT big data management enablers including elastic streaming data capturing management, distributed computing parallelisation and coordination, edge-level near real time semantics and orchestration of BDVA-compliant micro-services. These technological enablers and data governance stack will result in the BD4NRG Open Modular Energy Analytics Toolbox.

BD4NRG will also provide an open adaptable tokenised marketplace on the top of data governance, edge AI learning capabilities to enable cross-stakeholder multi-party data, third party services, reusable AI ML models, reusable analytics applications and edge storage/computing resources incentive-based sharing and access.

Below the three main BD4NRG technology components (Data Governance and Management, Data Modelling & Open Modular AI-based edge-level Analytics Toolbox, Marketplace) are described with more detail, providing information regarding the ongoing activities within the technical framework. Detailed information can be found in the technical Annex, at the end of this document.

Data Governance and Management

The architecture that BD4NRG will follow for its Governance and Management layer is depicted in the following figure 1. The architecture intends to support data quality, data stewardship, data integration, data provisioning as well as system collaboration among applications and data repositories.

The architecture describes the BD4NRG data system. Specifically, it shows – in left-to-right order – how the data flows from raw datasets, through the various layers of transformation (Interoperability & Homogenisation Functions) and quality checks (Data Quality & Compliance) to obtain the Golden Data Source, through data integration tasks (Dynamic Data Provider Functions), through operational data store (HTAP), all the way to the business intelligence, analytics and decision support applications that use the Integrated Query Engine for querying optimised data structures for data processing.



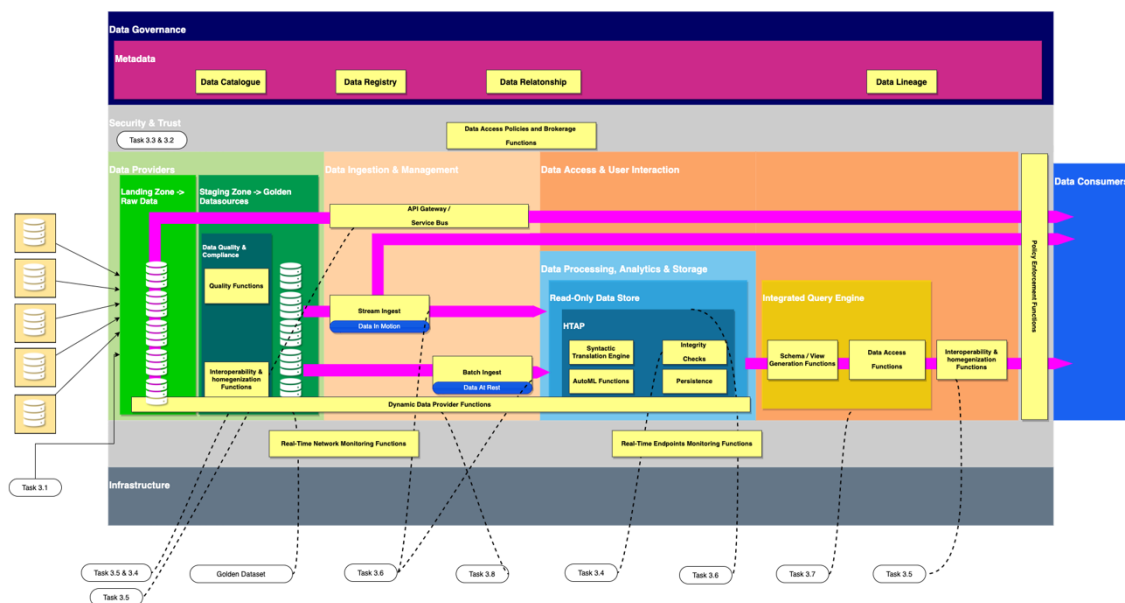


Figure 1: BD4NRG Data Governance and Management architecture

The architecture is organised around three vertical layers that cover specific aspects along the data processing chain and two horizontal layers that are responsible for cross-cutting issues that have impact on the vertical layers. Everything is built upon a common infrastructure. Similarly, to the Big Data Value Reference Model the vertical layers do not imply the adoption of a layered architecture model since data can be served to consumers/client applications without being processed.

The purpose of each layer is here briefly described:

- Data Providers:** introduces new data into the BD4NRG Data system for discovery, transformation, analysis, and access. The data can come from different sources such as static files (e.g., Comma Separated Values or JavaScript Object Notation), social media, third-party services as well as sensory data from intelligent devices. Raw data is – within this layer – properly processed to create the so-called golden datasets. These datasets are unique data, including all the necessary meta-data, the necessary quality and following the created interoperability standards to be ingested by the BD4NRG data system.
- Data Ingestion & Management:** where the data starts their journey i.e. how data can be delivered and distributed within the BD4NRG data system for immediate use or storage. Two main mechanisms are considered, namely: real-time streaming ingestion (for data in motion) and batch ingestion (for data at rest). The specific data ingestion mechanism strictly depends on the application use case.
- Data Access & User Interaction:** facilitates access and navigation of the data, allowing to the generation of different business views to be represented by the data. At the center of this layer lies a high-performance real time analytics database to support interactive dashboards and analytics platforms while being used as data warehouse. A query engine is also part of the layer and serves as Rapid Application Development (RAD) by presenting fast logical views of data to consumer applications.



- **Data Governance:** all considered data will be channeled through data governance processes to ensure data stewardship, data classification, data transparency, data discovery, data ownership and data quality by adding business and technical metadata.
- **Security & Trust:** is responsible to support and maintain security and trust beyond anonymisation and privacy. Data access policies are here defined and enforced as well as dedicated monitoring functions will be also deployed at infrastructure level.
- **Infrastructure:** is the core infrastructure of the BD4NRG data system. The layer deals with networking, computing and storage needs to ensure that large and diverse formats of data can be stored and transferred in a cost-efficient, secure and scalable way. The key requirement of any Big Data storage is that it can handle very massive quantities of data and that it keeps scaling with the growth of the organisation, and that it can provide the input/output operations per second (IOPS) necessary to deliver data to applications.

Within each layer a set of high-level functional components and features are being developed. These components are presented in APPENDIX I.

An overview of the implementations technologies, APIs and Libraries being used or considered is presented in the following table. These are technologies that are explored and evaluated as candidates for implementing the prototypes, some of them can be considered as final and some others not. These technology choices could change during the on-going implementation of the envisioned components.

Table 1: Implementation Stack

Technology	Description & Remarks	URL
Data Providers		
MINIO	It is a High-Performance Object Storage released under GNU Affero General Public License v3.0. It is API compatible with Amazon S3 cloud storage service. It can handle structured, semi-structured and unstructured data such as photos, videos, log files, backups, and container images with (currently) the maximum supported object size of 5TB	https://min.io
JSON/XML tools (e.g., JAXB)		https://docs.oracle.com/javase/8/docs/technotes/guides/xml/jaxb/index.html
Data Ingestion & Management		
Apache Kafka	It is a distributed event store and streaming platform. It is an open-source system developed by the Apache Software Foundation written in Java and Scala. The project aims to provide a unified, high-throughput, low-latency platform for handling real-time data.	https://kafka.apache.org
druid-kafka-indexing-service	Supervised exactly-once Apache Kafka ingestion for the indexing service.	https://druid.apache.org/docs/latest/development/extensions.html





druid-s3-extensions	Interfacing with data in AWS S3, and using S3 as deep storage.	https://druid.apache.org/docs/latest/development/extensions.html
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Data Access & User Interaction

Apache Druid	It is a real-time database to power analytics applications. It is one of the most popular open-source solutions for Online Analytical Processing (OLAP).	https://druid.apache.org
Zookeeper	It is a centralised service for maintaining configuration information, naming, providing distributed synchronisation, and providing group services	https://zookeeper.apache.org
Trino	It is a fast distributed SQL query engine for big data analytics that supports data provisioning and exploration.	https://trino.io
Superset	Apache Superset is a modern data exploration and visualisation platform	https://superset.apache.org/

Security & Trust

druid-basic-security	Support for Basic HTTP authentication and role-based access control.	https://druid.apache.org/docs/latest/development/extensions.html
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Cross-cutting components

DataHub	It is a data discovery application built on an extensible metadata platform that helps you tame the complexity of diverse data ecosystems.	https://datahubproject.io
MongoDB	Document database. Used as configuration storage for the dynamic data provider.	https://www.mongodb.com/
New Code	Data Pipeline optimiser, a wrapper API around the DRUID REST API. Adaptation engine for the dynamic data provider component.	

Data Modelling & Open Modular AI-based edge-level Analytics Toolbox

The Analytics Toolbox will provide a design environment that makes it easy to chain together a series of components (workflows), by connecting data sources to and then connecting those models/algorithms to adapters that actually operate equipment, or provide other common functions like filling in spreadsheets or performing any developer-defined steps to create a simple and efficient decision tree.

Models/algorithms will be onboarded to the Analytics Toolbox platform and packaged as distinct microservices with a component blueprint describing the microservice API and dependencies.

The Toolbox will allow to package a workflow, along with the appropriate runtime libraries, into a working application, by creating a deployable file (docker image), which can be installed directly into



a supported cloud service or downloaded to a local machine as a bundle which can be separately delivered and deployed into any Docker-compliant environment.

Eclipse Graphene is being investigated as a potential starting point for the implementation of the Analytics Toolbox. The goal of Eclipse Graphene is to make AI and machine learning accessible to a wide audience by creating an extensible marketplace of reusable solutions, sourced from a variety of AI toolkits and languages that developers, who are not machine-learning experts or data scientists, can easily use to create their own applications. It provides a launchpad for training and validating both individual components and integrated, or composite, solutions, and then securely distributing the results to targeted communities through an electronic catalogue, from which components can be selected. Eclipse Graphene includes a graphical tool, called AcuCompose, for chaining together multiple models, data translation tools, filters and output adapters into a full end-to-end solution that can be deployed into popular runtime environments, including several commercial cloud services, mostly Kubernetes-based.

The designated technology components are described in APPENDIX II.

Marketplace

BD4NRG Marketplace integrates and coordinates different services to provide the required functionality. They are loosely coupled, collaborating services. Components are expected to expose their functionality through a REST API (Microservices).

- Promote Data Sharing to improve services.
- Facilitates services to small or medium actors.
- Resources management and registry.

The marketplace architecture is depicted in the following figure.

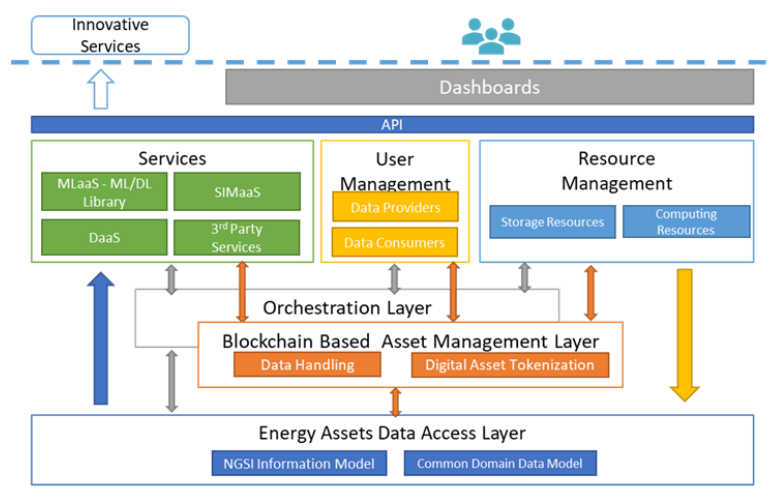


Figure 2: Marketplace Architecture

In order to make communication between modules available the orchestration layer is a necessary component that will manage the user's configuration and check which resources are available. For every action that takes place from the user side, the user configuration will be validated against the different components the user is trying to access. If the user has access, the orchestration layer redirects the original petition to the chosen service.

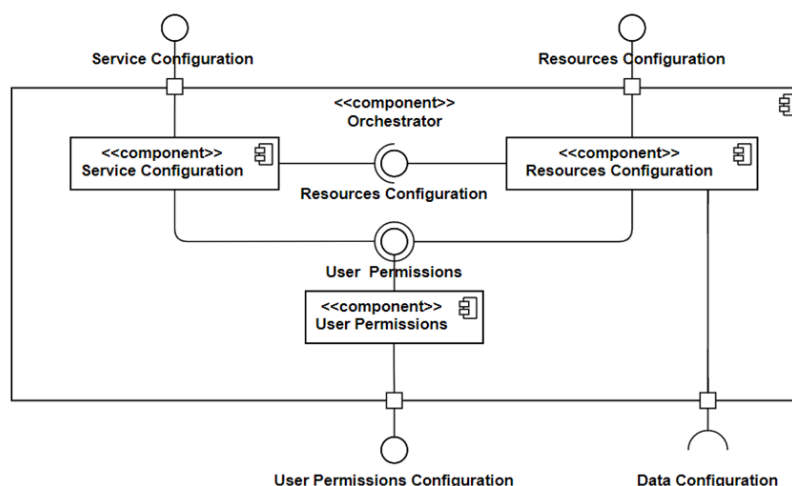


Figure 3: Orchestration Layer Module Diagram

ML models inside the BD4NRG marketplace will be a service of its own. The storage and provision of these models is core to the usability of this module. The project therefore offers a service with a set of models to train, test and make predictions over preloaded data.

The modules will be initially available for loading, if the model hasn't been previously trained this can be done by assigning a training task with an assigned dataset the user has access to. The model will be trained with the default training configuration if a new configuration is not given. To finalise, the model will use the dataset to give performance and accuracy metrics of the training and offer the option to save such model.

If what we are loading is an already pretrained model, the inference task can be used to make predictions over a new unseen dataset. These predictions can be saved (DaaS) or explained (EAI Component) for further investigation.

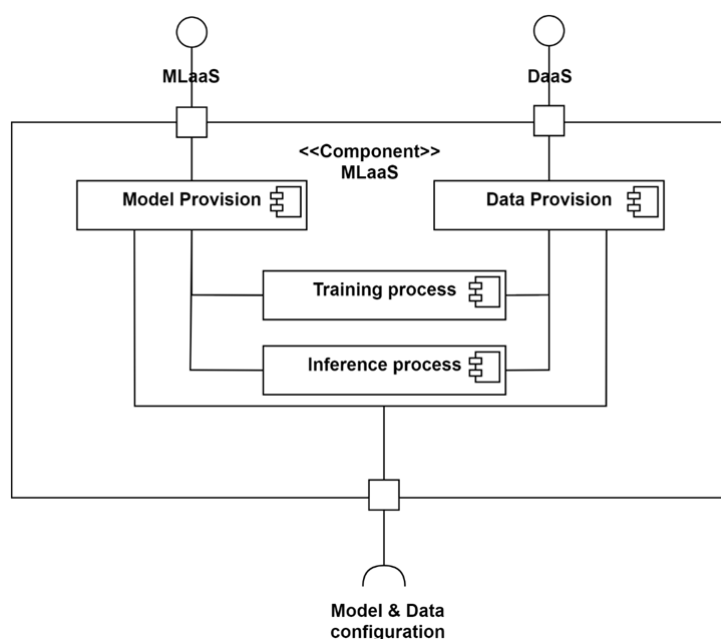


Figure 4: MLaaS Component Diagram

Not all ML models from MLaaS can be reused. Some ML models are brittle and necessitate retraining (if supported) or even training from scratch. In these scenarios exporting and reusing predictive models is not a viable solution. One particular class of ML methods which usually have this type of brittleness are unsupervised methods. This is the main reason we also include a specialised service tailor made for training unsupervised ML methods for anomaly detection. Our definition of anomalies is quite broad as to encompass as many use-cases as possible. By detecting anomalous instances from tabular (even time-series data) we can give greater insight into a wide range of problems ranging from Industry 4.0 Cyber Physical systems (predictive maintenance, pattern detection etc.) to performance related anomalies in large scale distributed systems.

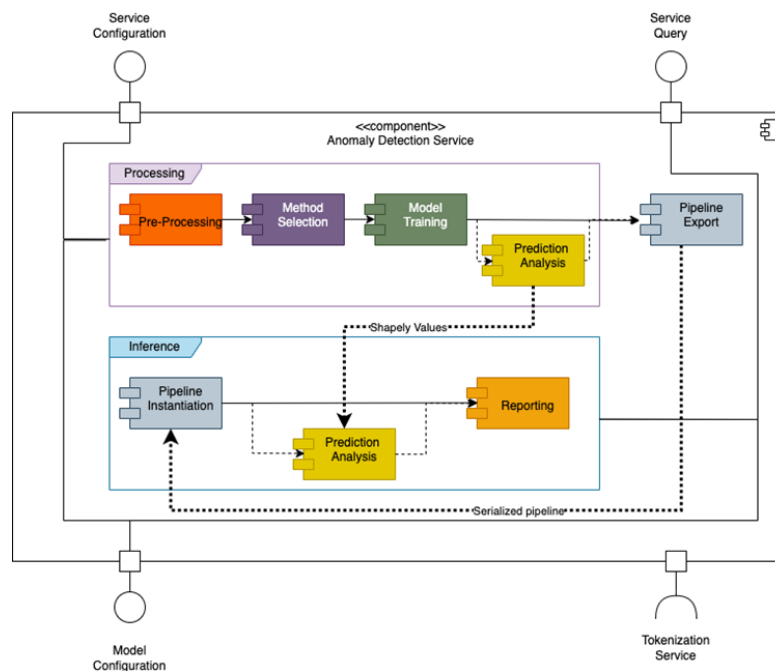


Figure 5: ADS Component Diagram

Unsupervised ML methods have an additional shortcoming compared to supervised methods. It is difficult to see why a particular event is marked as an anomaly. This ultimately leads to limited actionable information based only on predictions. To handle this issue we also added some explainable AI methods which try to give some insight into each prediction. We compute Shapely values for each prediction which in essence give a ranking of how each feature value influenced the prediction outcome.

Shapely values can also be used for feature engineering and model optimisation for a wide range of ML methods. Because of this we also develop a specialised explainable AI containerised service inside the BD4NRG marketplace.

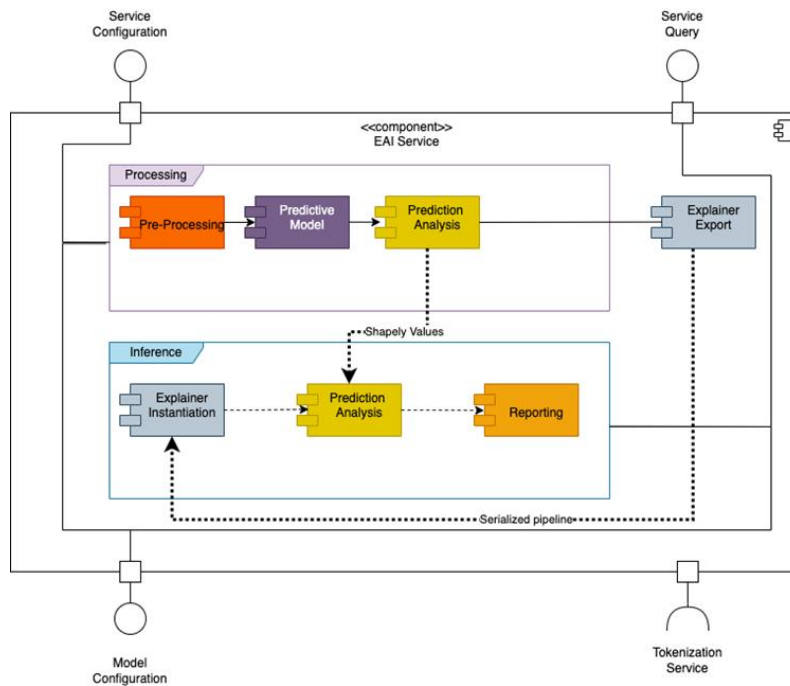


Figure 6: EAI Component Diagram

In the case of satellite image processing one of the core issues is data pre-processing and augmentation. When a DNN predictive model is trained we need to make sure that the resulting model has a good out of sample performance. There are several ways of solving this issue. One of the most successful methods is data set augmentation which can increase the number of training samples by modifying the original data. These modifications are done by image processing operators such as: image rotation/flipping, morphological operations, image channel operations, adding noise/filters etc. From a user's point of view, once the data set has been configured (uploaded to the server or linked via stream) the service applies various augmentation operations on the available data. The sequence of operations is defined using the services REST API.

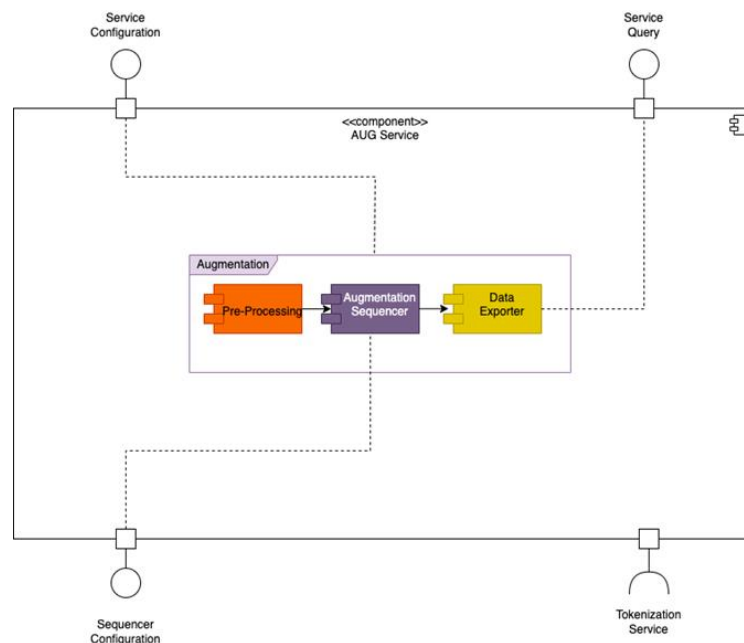


Figure 7: AUG Component Diagram

The diagram illustrates the component architecture for Data Service Configuration and Provision. It features three main components: **«component» Data Service Configuration and Provision**, **«component» Data Discovery**, and **«component» DaaS**. The **«component» Data Service Configuration and Provision** component has a provided interface (half-circle) at the bottom and a required interface (square) at the top. The **«component» Data Discovery** component has a provided interface (half-circle) at the bottom and a required interface (square) at the top. The **«component» DaaS** component has a provided interface (half-circle) at the bottom and a required interface (square) at the top. The **«component» Data Service Configuration and Provision** component is connected to the **«component» Data Discovery** component via a **Resources Discovery** interface. The **«component» DaaS** component is connected to the **«component» Data Service Configuration and Provision** component via a **Data Service Provision** interface. The **«component» Data Service Configuration and Provision** component is connected to the **«component» Data Discovery** component via a **Data Service Configuration** interface. The **«component» Data Discovery** component is connected to the **«component» DaaS** component via a **Discovery Service** interface. The **«component» Data Service Configuration and Provision** component is connected to the **«component» Data Discovery** component via a **Data Provisioning** interface.

In the scope of BD4NRG, we will not be able to integrate all of the models we have at our disposal through available libraries. It is therefore important for us to implement a service for 3rd parties to provide their own models, new models and models we haven't implemented on other services.

The diagram illustrates the Cloud Native Architecture using UML Component Diagram notation. It features several components and their interactions:

- MLaaS**, **DaaS**, **ADS**, **EAI**, **SIMaaS**, and **AUG** are provided components, each represented by a circle with a vertical line (provided interface).
- Tool Uploader** is a required component, represented by a rectangle with a horizontal line and a semi-circle (required interface).
- <<Component>> Resource Configuration** is a provided component, represented by a rectangle with a horizontal line and a semi-circle (provided interface).
- <<Component>> 3rd Party Services** is a provided component, represented by a rectangle with a horizontal line and a semi-circle (provided interface).

The diagram shows the following relationships:

- Tool Uploader** depends on **MLaaS**, **DaaS**, **ADS**, **EAI**, **SIMaaS**, and **AUG** (indicated by solid lines with open circles at the provider end).
- Tool Uploader** depends on **<<Component>> Resource Configuration** (indicated by a dashed line with a semi-circle at the provider end).
- Tool Uploader** depends on **<<Component>> 3rd Party Services** (indicated by a solid line with a semi-circle at the provider end).
- <<Component>> Resource Configuration** depends on **<<Component>> 3rd Party Services** (indicated by a solid line with a semi-circle at the provider end).





The marketplace API will be the gateway to all of our functionalities inside the BD4NRG ecosystem. Two methods will be available, an initial Marketplace API which will be a REST application with the exposed services, and a second iteration offering a GUI Dashboard to visualise use all the exposed functionalities of the Marketplace API.

In order to make more accessible BD4NRG to final users a GUI will be implemented. This will use the Marketplace API previously described offering a frontend to interact with it and expose it to the final user.

A detailed description of the Marketplace components can be found in APPENDIX III.

2.2 Open Call Initiative

BD4NRG project makes use of the cascade funding mechanism that offers Financial Support to Third Parties to “enable agility and reach out to new or key actors in the innovation chain (such as SMEs and mid-caps)” and “support experiments and smaller projects” (<https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/dt-ict-11-2019>). BD4NRG Open Call will distribute up to 500.000 EUR among up to 10 SMEs and Start-ups with the initiative to bring new application experiments, by taking up and validating the results gained in the first phase of BD4NRG. The selected applications of BD4NRG Open Call will contribute to the impact of BD4NRG project on the energy ecosystem and the generalisation and validation of BD4NRG framework.

2.3 Benefit from the Open Call

The selected applicants with their participation in this Open Call will have the opportunity to:

- Fund their innovative ideas and the execution of their projects.
- Receive technical mentoring services provided by the core partners.
- Be part of BD4NRG wider network and connect with key EU stakeholders of the Electric Power and Energy Systems (EPES).
- Receive max. 60.000EUR funding

2.4 Open Call Topics

Applicants are asked to address one of the 4 topics described below.

● Efficiency and reliability of electricity networks operation improvement

The ability to analyse and manage vast volumes of data is increasingly important in order to improve operational efficiency and the reliability of the electricity network. Predictive analytics use the massive amounts of data available today and to inform realtime decisions that have a significantly positive impact on reliability and performance. In particular, predictive analytics provide early warning of equipment failure and abnormal operating conditions that may go unnoticed within the realm of traditional maintenance practices. Therefore, it can be used to





enable smart energy grid management, minimise outages as well as improve equipment reliability and performance while avoiding potential failures.

● **Optimisation of grid and distributed assets**

In the last two decades, the energy sector has undergone a significant transition. The proliferation of distributed renewable energy resources, the increasing penetration of plug-in electric vehicles and the growing usage of battery energy storage systems have given the electrical load an entirely different character. It is critical to leverage the available data to better understand the energy demand and ensure optimisation of the grid and the distributed assets. Therefore, there is a need for:

- i. Edge-level network loads, RES generation prediction and demand forecasting for efficient operational planning
- ii. Improvement of the energy storage management
- iii. Evaluation of EVs impact and their smooth integration on distribution grids
- iv. Optimisation of energy flexibility with energy prosumers and demand response applications for local energy communities

● **Sustainable energy investments**

Reducing energy demand is of growing importance to the EU. One aspect to be considered is buildings' demand, which are responsible for almost a third of final energy use, therefore it is important to increase the energy efficiency and comfort in buildings. Another aspect is the need for sustainable finance solutions towards enhanced environmental, societal and economic impact. In this context, there is the need for AI applications to increase energy efficiency investments, reduce risks and support the decision-making process, as well as to support economic growth, while reducing pressures on the environment and taking into account social and governance aspects.

● **Cross-Cutting Applications**

Cross-cutting applications can also be considered under this Open Call scope, such as data governance and data valorisation in energy services. Applications not directly addressing one of the three main topics can also be proposed by applicants, under the Cross-Cutting Applications.

2.5 Technical Recommendations

It is preferred that selected applicants will rely on their own resources for the development of their small-scale applications. BD4NRG will deploy its technical stack in a microservices and open-source approach that will be easily integrable with third party applications. The applications to be developed by the selected applicants could be in several forms, such as a web-based application demonstrating the solution or trained and reusable analytics models with documentation. The core idea for the applications is to be made available through BD4NRG's Marketplace and act as additional assets in its Toolbox for AI analytics applications in the Energy Sector.

BD4NRG will release technical documentation via its deliverables in due time, for the selected applicants to connect their applications to its infrastructure. This process will be facilitated by BD4NRG consortium, upon identification of the state of publicity of the expected outcomes. The ability to use





BD4NRG's components and other assets (e.g., analytics applications, data, etc.) will also be considered, pending on their state of implementation and BD4NRG Consortium's approval.

2.6 Example of Prospective Proposals

The proposals we are seeking are those exploring innovative data-driven applications in the Energy Sector. Using proprietary new AI algorithms or services and prototypes and utilising both own private and open resources (e.g., open-source EU databases), the proposal should aim to produce tangible results, addressing key challenges (as described in the topics) in the energy sector using state-of-the-art tools, technologies and/or methodologies and providing data-driven solutions. The preferable initial TRL (Technology Readiness Level) should be TRL3-4. Evidence via Github or similar appreciated. Applications at lower TRL can be accepted as long as the applicant presents the road map to reach the attempted TRL5-6 level within the 6 months of the programme.

Example of exemplary proposal:

A small start-up from Portugal develops AI models for the identification of failures of network assets (e.g., MV transformers). The service is integrating TSO/DSO data (e.g., open data from ENTSO-E), weather data from third parties and its own methodologies in its algorithms to predict assets' failures before critical damage. The service could be offered through the SW product, i.e., the model with documentation or a small prototype of a real-time tool of the network and it would be integrable with BD4NRG's platform (Marketplace and/or Toolbox) through dedicated APIs.





3 Eligibility Criteria

In order to be considered eligible, applicants will have to abide to the requirements described in this chapter. The proposals that do not comply with the criteria enlisted will be excluded and marked as ineligible. The eligibility criteria will be checked during the whole evaluation process.

3.1 Eligible for Financial Support

Financial support will be provided to SMEs and Start-ups legally established in an EU Member State or in an Associated Country (as stated in Article 7 of the Horizon2020 Regulation). Only single entities are eligible to this Call. The legal entity is required to possess a validated Participant Identification Code (this code is provided for interested parties to participate in EU funding programmes and procurements). However, at the moment of submission, the entity can apply with the provisional PIC. Please advise the definitions of SMEs and Start-ups on pp. 8-9 of this document.

List of countries eligible for receiving H2020 funding grants:

https://ec.europa.eu/research/participants/data/ref/h2020/other/wp/2016-2017/annexes/h2020-wp1617-annex-a-countries-rules_en.pdf

Associated to H2020 countries:

http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/3cpart/h2020-hi-list-ac_en.pdf

3.2 Type of Projects and Activity

Applicants must use the provided BD4NRG proposal template. Applications must either directly address one of the first three Open Call topics described in section 2 or propose and deliver cross-cutting applications that complement the ones developed in the framework of the BD4NRG project. It should be considered that applications shall not be offered as stand-alone solutions but integrate and make use of the services and data offered through the BD4NRG platform.

3.3 English Language

The official language of BD4NRG Open Call is English. Proposals must be written in English to a full extent. If any part of the proposal is written in any language other than English, the entire proposal will be rejected.

English is the only official language during the whole procedure of BD4NRG Open Call. Any requested deliverables and/or reports shall be submitted in English, otherwise not accepted.

3.4 Multiple Submissions

Only one proposal per applicant can be submitted to BD4NRG Open Call. If more than one proposal per applicant is identified, only the first one submitted in order of time, will be evaluated.

3.5 Submission Tool

Only proposals submitted through BD4NRG Open Call portal (<https://opencall-bd4nrg.cintechsolutions.eu>) within the given deadline will be accepted. Proposals submitted by any





other means, will not be considered for funding. All potential applicants should register beforehand to the portal to receive additional material and updates (if any) regarding the process.

Only the documentation included in the *Proposal Template* and the attachments to the above Template will be reviewed by Evaluators. The *Proposal* and its attachments can be only in PDF format. Please note that the information included in attachments will not be scored by Evaluators (as it is only considered as additional information supporting the proposal).

It is Applicant's responsibility to have all necessary information included in the *Proposal Template*. All information provided should be actual, true and complete and therefore allow the assessment of the proposal.

3.5.1 Complaint due to technical error of BD4NRG Online Submission System

If you experience any problem with the application submission system prior the deadline of the BD4NRG Open Call you should send an e-mail to bd4nrg_opencall@cintechsolutions.eu and explain your situation.

If you believe that the submission of your proposal was not entirely successful due to a technical error on the side of the BD4NRG Open Call online submission system, you may lodge a complaint by emailing to bd4nrg_opencall@cintechsolutions.eu and explain your situation. For the complaint to be admissible it must be sent within 4 calendar days following the day of the call closure. You will receive an acknowledgement of receipt, the same or next working day.

Important notice: You should secure a PDF version of all the documents of your proposal holding a time stamp (file attributes listing the date and time of creation and last modification) that is prior to the call deadline, as well as any proof of the alleged failure (e.g., screen shots) as you may be requested by the BD4NRG Helpdesk to provide these items.

For your complaint to be upheld, the IT audit trail (application log files and access log files) of BD4NRG Open Call online submission system must show that there was indeed a technical problem at the BD4NRG Open Call side which prevented you from submitting your proposal using the electronic submission tool. Applicants will be notified about the outcome of their complaint within the time indicated in the acknowledgment of receipt. If a complaint is upheld, the secured files (provided to the IT helpdesk) for which the investigation has demonstrated that technical problems at the BD4NRG Open Call side prevented submission will be used as a reference for accepting the proposal for evaluation.

3.6 Deadline

Only proposals submitted before the deadline will be accepted. Online submission system will automatically block after the deadline. Applicants will be able to resubmit their proposal until the deadline.

The deadline for BD4NRG Open Call is the **15 December 2022** (17:00h CET Brussels time).

Applicants are strongly recommended not to wait until the last minute to submit their proposal. Failure of the proposal to arrive in time for any reason, including extenuating circumstances, will result in the rejection of the proposal.





3.7 Absence of Conflict of Interest

Applicants shall not have any actual and/or potential conflict of interest with BD4NRG Open Call process, from the application to the development phase of the selected proposals. All cases of conflict of interest will be assessed case by case by the Support Team.

Conflict of interest may occur when there are conditions involving economic interest, political or national affinity, family or emotional ties or any other shared interest that might affect the objective evaluation of the proposal, as defined in the H2020 and EC regulations. Consortium partners, their affiliated entities, employees and permanent collaborators have not the right to participate.

3.8 Other

Each applicant when submitting the proposal agrees that:

- the proposal submitted is based on original work and in advance any expected developments are free from third party rights, otherwise they are clearly stated.
- the proposal is not excluded under the provisions of article 19 of Regulation (EU) No 1291/2013 of the European Parliament and of the Council of 11 December 2013 (ethical principles).
- he/she understands and will sign all statements embodied in the Declaration of Honor document in case the proposal is selected. The Declaration of Honor document is available here: <https://opencall-bd4nrg.cintechsolutions.eu/important-documents/>
- he/she is not “undertaking in difficulty” according to the COMMISSION REGULATION (EU) No 651/2014 (Article 2.18)
- he/she is not excluded from the possibility of obtaining EU funding under the provisions of EU rules and regulations and/or national law.
- he/she has received knowledge of the Terms of Service and Privacy Policy of the Open Call portal (<https://opencall-bd4nrg.cintechsolutions.eu/terms-of-service-and-privacy-policy/>).





4 Financial Support and Payment Conditions

4.1 Origin of Funds

In the H2020 Framework programme and according to the H2020 Rules for Participation Regulation No 1290/2013 (Article 23.7) “an action may involve financial support to third parties under the conditions defined in the Financial Regulation and the Rules for Application. The maximum amount of financial support is 60 000 EUR per third party.” (complete document is available on the following link: https://www.ffg.at/sites/default/files/downloads/page/h2020guidancenote_financialsupport2thirdparties.pdf)

Accordingly, BD4NRG launches BD4NRG Open Call to attract, select and provide financial support to SMEs/Start-ups in order to develop new innovative tools, services and activities by integrating and making use of the services and data offered through the BD4NRG platform. The selected Applications of BD4NRG Open Call will be published on BD4NRG website and channels.

Selected applicants for funding will sign a Contract Funding Agreement with BD4NRG Consortium. The funds provided in the framework of BD4NRG project are funds owned by the European Union, whose management has been led to BD4NRG partners via the Grant Agreement Number 872613. BD4NRG is a mere holder and manager of the funds.

The relationship between selected applicants (legal entities with projects selected for funding by BD4NRG Open Call) and the BD4NRG Consortium, as well as selected applicants’ obligations to both the BD4NRG Consortium and the European Commission, will be detailed in the Contract Funding Agreement. It is the responsibility of selected applicants to fulfil these obligations, and of BD4NRG Consortium to inform selected applicants about them.

4.2 Costs covered by Cascade Funding

The total funding provided by BD4NRG Open Call to each third party cannot exceed 60,000€. Up to 20% of the budget can be reserved for equipment and consumables needed to implement the proposal, according to European Commission rules.

Only costs generated during the lifetime of the development of the proposal can be eligible. Please note that costs must be actually incurred (actual costs) and used for the lone purpose of achieving the objectives of the proposal and its expected results, in line with the principles of economy, efficiency and effectiveness.

Beneficiaries shall keep records, supporting documents, statistical records and other records pertaining to a grant for three years following the project completion.

4.3 Financial Support Criteria and Rules

The financial support follows the EU funding scheme for “low value grants” and covers 100% of project’s costs. Selected applicants will receive a pre-financing of 40% of their respective awarded total cascade fund as lump sum. Further payments will be delivered after successful completion of predefined deliverables.

The Cascade funding partner (responsible for the funding payments) will be authorised by the Project Coordinator to proceed with the payments when all necessary justifications (deliverables, reports and





financial documents) - in fulfilment of the Contract Funding Agreement- are submitted by the selected applicants and approved.

The Cascade funding partner can proceed with a payment only if all the conditions described in the Contract Funding Agreement are satisfied or if a sufficient evidence document is provided by selected applicants and approved by the Mentoring team that is monitoring the action and subsequently by the Project Coordinator.



5 Proposal Submission

BD4NRG Open Call key dates:

- September 20, 2022– Submission opening
- December 15, 2022 at 17:00 CET – Submission deadline
- By end of February, 2023 - Results Announcement
- 5 business days after results notification – Objections
- March/April – Contracting Period
- April– Development phase begins

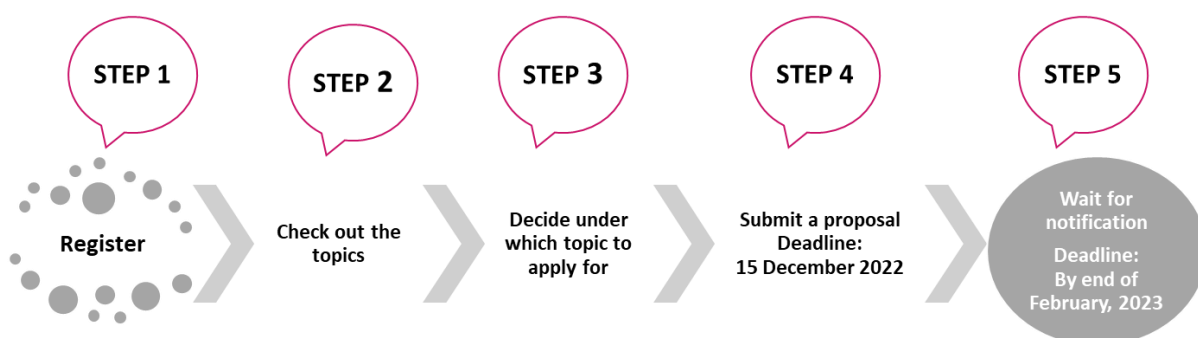


Figure 10: Application Steps

Proposals have to be submitted through BD4NRG Open Call portal. Applications submitted by any other means will not be considered for funding. All potential applicants should register beforehand to the portal to receive additional material, such as proposal template, declaration of honor, etc. and updates (if any) regarding the process.

The proposals – submitted only through the online tool – will include the following sections:

- Legal and Contact Information
- Proposal Description
 - (Scored) IMPACT
 - (Scored) TECHNICAL QUALITY
 - (Scored) QUALITY OF THE WORK PLAN
- Intellectual Property and Ethical Issues
- Company description

As noted above (Section 3.5), additional material/data, not specifically required in the *Proposal Template*, will not be assessed. The BD4NRG Consortium makes its best effort to keep all provided data confidential. However, for the avoidance of doubt, the applicant is the lone responsible to indicate its confidential information as such.

Applicant is the sole responsible for the verification of the *Proposal Template* completeness. Information not included in the *Proposal Template* will not be taken into account for assessment disregarding the reason for not being included.



Important notice: Applicants are strongly recommended not to wait for a last-minute proposal submission. Failure for the proposal to arrive in time whatever reason, including extenuating conditions, will result in the rejection of the proposal.

PROPOSAL CONTENT

Only proposals with a clearly identified partner can be submitted. Content and structure should be based on the Proposal Template and address the issues detailed in this Guide for Applicants.

PROPOSAL LENGTH

The cover page and administrative data, like proposal name and participant details, cannot exceed two pages. The maximum length of the main proposal is 10 pages. Please read carefully the instructions included in the *Proposal Template* document available on the following link: <https://opencall-bd4nrg.cintechsolutions.eu/important-documents/>

SUBMISSION FORMAT

Single PDF file with less than 50MB in size.



6 Summary of Evaluation Process

The call and the selection of the SMEs/Start-ups to be funded shall follow the same principles which govern European Commission calls as described in this *Guide for Applicants*:

Excellence. The proposal(s) selected for funding must demonstrate a high quality in the context of the topics and criteria set out in the call.

Transparency. Funding decisions must be based on clearly described rules and procedures, and all applicants should receive adequate feedback on the outcome of the evaluation of their proposals.

Fairness and impartiality. All proposals submitted to a call are treated equally. They are evaluated impartially on their merits, irrespective of their origin or the identity of the applicants.

Confidentiality. All proposals and related data, knowledge and documents are treated in confidence.

Efficiency and speed. Evaluation, award and grant preparation should be as rapid as possible, commensurate with maintaining the quality of the evaluation, and respecting the legal framework.

The evaluation workflow is described on the following figure:

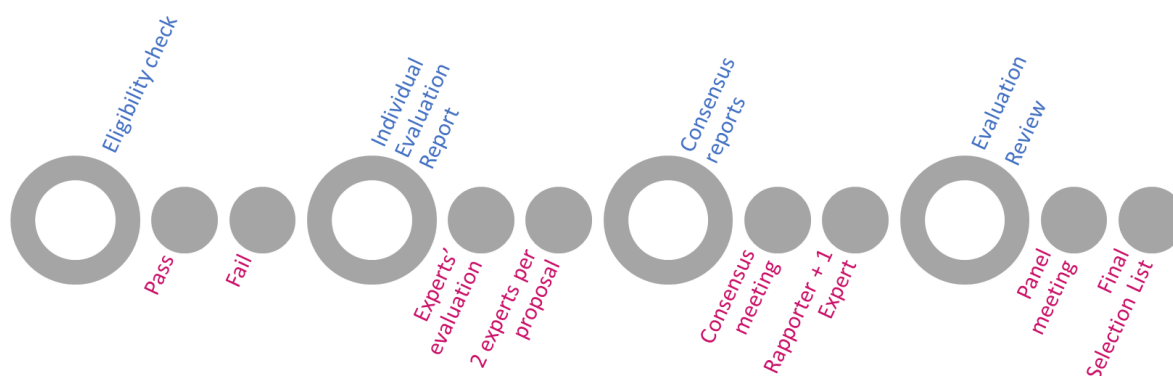


Figure 11: Evaluation Workflow

6.1 Eligibility Check

The Cascade funding partner performs a first check of admissibility and eligibility of submitted proposals according to the provisions and criteria set in Section 3 of the current document. However, a proposal can be declared ineligible at any phase of the evaluation procedure. As a result, the 'Eligible Proposals List' will be set out. The applicants will be informed by email whether they have passed the first Eligibility check or not.

6.2 Expert Evaluation

Each eligible proposal is allocated by the BD4NRG partner responsible for this Open Call (CINTECH) to two Experts Evaluators (either from BD4NRG Consortium or externals), according to their field of technical expertise. The two Experts Evaluators assess independently the eligible proposal and prepare an Individual Evaluation Report (IER).



Each evaluator will rank the proposal assigning a score¹ from 0 to 5 for each awarded criterion IMPACT, TECHNICAL QUALITY, QUALITY OF WORK PLAN and conduct an Individual Evaluation Report (IER). The default threshold for each criterion is 3 out of 5. The default overall threshold is 10 out of 15.

The proposals shall address the following awarded criteria:

EXPECTED IMPACT:

- Is there a measurable enhancement in the service provision to energy stakeholders when adapting the proposal into the BD4NRG framework?
- To what extent has the proposal the potential to address future / wider applications in the field?
- To what extent can the results be replicable and demonstrable (e.g., level of prototyping)?
- Are open-data and open-source initiative are considered?

TECHNICAL QUALITY:

- Are the use case and the technical approach for the adaptation/integration of the framework clearly described?
- To what extent is possible the exchange of information between assets, systems, data hubs and actors in a common manner?
- What is the level of innovation in the proposed solution and what is the degree of differentiation this project will bring?
- What is the potential and level of integration with the BD4NRG technologies?

QUALITY OF WORK PLAN:

- Is the work plan coherent and effective and appropriate regarding the allocation of tasks and resources, and the justification of resources?
- To what extent the crucial risks (technical, commercial and other) to project success appear to have been identified and how effectively will these be managed?

6.3 Consensus Meeting

Following the Individual Evaluations phase, a remote Consensus meeting will be realised between the two Evaluators to exchange views on the basis of the individual evaluations. The initiative is for the two Evaluators to come to an agreement on the comments provided for each criterion and reach to a consensus report (CR). The outcome of all CRs will be an 'Initial Ranking List' of the eligible proposals based on the individual scores assigned to each proposal.

¹ The scores range from 0 to 5.

0 - Fails The proposal fails to address the criterion under examination or cannot be judged due to missing or incomplete information.

1 - Poor The criterion is addressed in an inadequate manner, or there are serious inherent weaknesses.

2 - Fair While the proposal broadly addresses the criterion, there are significant weaknesses.

3 - Good The proposal addresses the criterion well, although improvements would be necessary.

4 - Very good The proposal addresses the criterion very well, although certain improvements are still possible.

5 - Excellent The proposal successfully addresses all relevant aspects of the criterion in question. Any shortcomings are minor.





6.4 Evaluation Panel Meeting

The Evaluation Panel (Support Team and Evaluators) will identify the most promising candidates through an Evaluation Panel Meeting. The scope of the Panel Meeting is to perform an additional quality check to the reports, to prioritise ex-aequo cases and to approve the 'Final Ranked List' of proposals.

The BD4NRG Consortium wishes to cover all the offered topics as these are indicated in Section 2.4 to ensure a balanced portfolio, therefore the following exception applies:

BD4NRG Open Call grants will be awarded to applications not only in order of ranking but at least also to those that are the highest ranked within set topics, provided that the applications attain all thresholds.

Following this exception and should two or more proposals are above threshold ranked with the same score, the prioritisation will be as follows:

- Proposals will be prioritised according to the scores for the criterion Impact.
- When these scores are equal, priority will be based on the scores for the criterion Technical Quality.
- When these scores are equal, any further prioritisation will be based on the criterion of the Gender Equality.

As an outcome of the Panel Meeting, one 'Final Ranked List' (up to 10 SMEs/Start-ups) will be produced. The exact number of proposals selected will be decided based on the overall quality of the proposals. A 'Reserve List' will also be produced with the next ranked proposals in case a selected applicant fails to sign the Contract Funding Agreement for any reason.

Evaluation Summary Reports (ESRs) with the results of the evaluation process will be communicated to the applicants by email within 60 business days from the submission closure.



7 Contract Funding Agreements Process

Selected applicants will be checked against the fulfilment of the legal requirements in order to proceed with the signature of the Contract Funding Agreement with BD4NRG Consortium. Third parties included in the 'Final Ranked List' will have to provide all necessary documentation required to prove their compliance with the Eligibility Criteria described in Section 3.

Specifically, third parties will have to provide the following documentation:

- **Legal existence.** An original of the Legal Entity Form together with copies of supporting documents such as Company Register, Official Gazette or other official document per country are required. These documents shall show the name of the organisation, the legal address and registration number and, if applicable, a copy of a document proving VAT registration (in case the VAT number does not show on the registration extract or its equivalent) needs to be provided.
- Recent certificates issued by the appropriate national competent authorities that **provides evidence covering all taxes and social security contributions** for which the third party is liable, including for example, VAT, income tax (natural persons only), company tax (legal persons only) and social security contributions are required.
- A recent **extract from the judicial record** is required or, failing that, an equivalent certificate recently issued by a judicial or administrative authority in the country of establishment of the person proving that the above requirements are satisfied.
- An **original of declaration of honor** signed by the (legal) representative.
- **Bank account details:** The account where the funds will be transferred will be indicated through a bank identification form signed by the third party. The form must be signed by the bank, otherwise a recent bank statement clearly showing the account holder, the bank name and the bank account (IBAN and BIC) is needed.
- **Signature of the Contract Funding Agreement.**

The above documentation will have to be provided within deadline communicated to selected applicants (during or after objections period). If the requested documentation is not provided in time, this will directly end the Contract Funding Agreement process and third parties enlisted in the 'Reserve List' will substitute the above ones in order of ranking.





8 Applicants Communication

8.1 General communication procedure

Applicants will receive communications after the first Eligibility Check evaluation phase indicating if they passed or failed the eligible criteria. Following the Evaluation Panel Meeting, applicants will receive by email the Evaluation Summary Reports with justifications for their proposals' success or exclusion within 60 business days from the submission closure.

8.2 Objections

If an applicant considers that a mistake has been made or that Evaluators have failed to comply with the rules and conditions of BD4NRG Open Call or acted unfairly and that her/his interests have been prejudiced as a result, can send his/her objections for review 5 business days after receiving the Evaluation Summary Report to the following email address: bd4nrg_opencall@cintechsolutions.eu

The objection shall be written in English and include the following information:

- Contact details (including postal and e-mail address).
- The subject of the objection.
- Information and evidence of the stated objections.

Anonymous emails will not be considered.

Please note that as a general rule, the BD4NRG Support Team will investigate the complaints with a view to arriving at a decision to issue a formal notice or to close the case within no more than five business days from the date of reception of the complaint, given that all the required information has been submitted by the complainant. Whenever this time limit is exceeded, the BD4NRG Support Team will inform the complainant by email of the reasons for the unforeseen delay and the subsequent steps.





9 Obligations of the Selected Applicants

The selected applicants for funding must ensure that they comply with specific obligations originally detailed under the Grant Agreement between the BD4NRG Project and the European Commission. These obligations are clearly stated in the Contract Funding Agreement signed between BD4NRG Cascade funding partner and selected applicants.

When signing the Contract Funding Agreement with BD4NRG Cascade funding partner and thus accepting to receive funding grants owned by the European Commission, third parties apply a relation between themselves and the European Commission through BD4NRG Project that carries a set of obligations to the third parties with the European Commission.

All selected applicants shall comply with the following obligations:

- Avoidance of conflicts of interest
- Confidentiality
- Dissemination of the action and visibility to the EU funding
- Liability for damages

Selected applicants must accept the right of control of the European Commission, OLAF and the Court of Auditors and the right for the European Commission to make an evaluation of the impact of the action. In order to be able to fulfil these obligations, the contractual arrangements on the third parties will be included in the Contract Funding Agreement (including control measures and/or reducing the financial support).



10 Service Development

Following the signing process of the Contract Funding Agreements, the selected applicants will develop the proposed services as described in their submitted proposals and in respect to the conditions detailed in their Contract Funding Agreement.

The Contract Funding Agreements enter into force on the date of the signature of the last signatory. The expected start date of the service's development phase is the date stated and agreed in the Contract Funding Agreement. The development phase will be a single-phase process, with predefined deliverables to be submitted.

10.1 Service Execution

Selected applicants need to expand upon and validate their service from a business and a technical perspective. All funding proposals will receive support from the BD4NRG Open Call Mentoring Team to help them understand the technical requirements of the topic they are addressing, including: online resources and documentation, focused calls and webinars where needed. Expectations from the tasks, deliverables and/or reports of its proposal will be discussed through individual meetings between the selected applicant and the Mentoring Team.

The following deliverables/reports are mandatory and are linked to the release of the funding.

- i. **Mid-term report (due at M3 of the workplan):** A description of the methodology (solution design, methodological approach, technical / business design, expected results, etc.)
- ii. **Final report (due at the end of the workplan) :** Final solution technical / business design, results, tests, assessment, conclusions)

All required documentation and services are expected to be submitted before the defined deadline. If a third party fails to have its project ready or to submit its documentation on schedule, they will not receive the cascade fund. The overall duration of the development phase is up to 6 months with the possibility to extend two weeks for the quality improvement of the deliverables.

10.2 Payment Breakdown

Selected applicants will receive a fixed lump sum of up to 60.000€ in 4 payment shares. The breakdown and the different percentages are explained in the table below.

Table 2: Lump Sum breakdown per payment stage

Lump sum payment share versus total awarded funding	Payment Stage
40%	Within 45 days of signing contracts for project work commencing Subject to agreed workplan
25%	Within 45 days of the successful assessment of the mid-term report by the project mentors and upon agreement of Coordinator





Lump sum payment share versus total awarded funding	Payment Stage
20%	Within 45 days of the successful assessment of the final report by the project mentors and upon agreement of Coordinator
15%	Subject to the EU having provided sufficient payments noting that this is to happen between 6-12 months after BD4NRG completion.





11 Other Considerations

11.1 Legal Framework

Applicants must acknowledge that all data and documents provided through the BD4NRG Open Call process will be used by the BD4NRG Consortium, European Commission and other entities involved in this call from submission to selection, funding and development procedures. According to H2020 rules and guidelines, BD4NRG partners have the right and will keep internal records including:

- A list of submitted proposals, identifying the name and address of applicants.
- Communications with applicants before proposals' submission deadline and during the evaluation process.
- Names and affiliations of the members of the Steering Committee.
- A copy of the submitted Proposal Templates assessed during the evaluation process.
- A record of all incidents occurred during the evaluation process and any deviation from the standard procedure.
- Copy of requests for payment and attached documentation.

Any data, knowledge and information communicated as confidential in the framework of an action shall be kept confidential, taking due account of European Union law regarding the protection and access to classified information. Selected applicant shall comply with national legislation, regulations and ethical rules in the countries where the service will be carried out.

11.2 Privacy

Personal data shall be collected, processed and published in accordance with Regulation (EU) 2016/679, also known as GDPR (General Data Protection Regulation). Regarding the processing of personal data, please refer to BD4NRG Open Call portal's Privacy Policy on the following link: <https://opencall-bd4nrg.cintechsolutions.eu/terms-of-service-and-privacy-policy/>

11.3 Ethical Issues

Research activities in Horizon 2020, and specifically BD4NRG, should respect fundamental ethical principles, particularly those outlined in "The European Code of Conduct for Research Integrity" that is available on the following link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/european-code-of-conduct-for-research-integrity_horizon_en.pdf





12 Available Documents

All BD4NRG Open Call documentation and templates can be downloaded from the BD4NRG Open Call portal on the following link: <https://opencall-bd4nrg.cintechsolutions.eu/important-documents/>

The supporting documentation of this Open Call includes:

- Open Call Announcement
- Open Call Guide for Applicants
- Open Call Proposal Template
- Open Call Declaration of Honor.





13 Applicants' Support

For more information and/or details about the BD4NRG Open Call, please visit the *Frequently Asked Questions (FAQs)* subpage available here: <https://opencall-bd4nrg.cintechsolutions.eu/frequently-asked-questions/>

For additional information on the Open Call, any queries concerning eligibility criteria, data to be provided in the *Proposal Template*, or for questions about the submission process or any portal issues, please contact the BD4NRG Open Call Helpdesk by email: bd4nrg_opencall@cintechsolutions.eu

Please include the following data in your email message:

- username, telephone number and email address.
- details of the specific problem (error messages, bugs descriptions, etc.).
- screenshots of the problem you encounter.





APPENDIX I – Data Governance and Management Components Description

Module_Id	Trusted data sharing and re-use
General Description	<p>The Trusted off-chain data sharing module is dedicated to use the DLT/Blockchain technology to ensure an integrity and trustworthiness of the data shared in the BD4NRG project. The primary purpose of the blockchain technologies used in this module is to remove the need for intermediaries and replace them with a distributed network of digital users who work in partnership to verify transactions and safeguard the integrity of the ledger. Use of blockchain in the data sharing model of BD4NRG has these main key advantages:</p> <p>Traceability and data storage: decentralised and distributed system that becomes a secure way to track changes in information and data over time.</p> <p>Trust of data: the creation of trust among untrusted participants and among the other the possibility to maintain data trustiness during time</p> <p>Peer-to-peer transactions: the absence of intermediaries promotes a more transparency data sharing.</p>
Functionality	<p>The proposed solution will combine the on-chain data storage together with distributed (or centralised) databases for off-chain data storage according to a hybrid approach. In order to minimise the amount of data to be stored on the blockchain, raw data from the data sources will be stored using a distributed database: the blockchain will then be used to periodically store a fixed-length hash of the data received in the last time interval. The hybrid approach combines the functionality scalability of a distributed NoSQL database with the blockchain, making tampering attempts evident, enabling provenance tracking, non-repudiability, and the use of self-enforcing smart contracts.</p> <p>Each data source will be connected to a gateway, an embedded device which takes care of pre-processing, calculating digital fingerprints (hash codes) to assure data immutability via notarisation, and storing the data off-chain. It is also included the possibility that handle data from the Data Storage. A private network based on Ethereum will be used as blockchain network. The Ethereum nodes provide the networking capabilities and the rules needed to determine consensus among them. The private network will be used as a platform for running smart contracts and register data with a timestamp.</p> <p>Thanks to dedicated APIs, every node in the network can be queried and it is possible to build dedicated applications on top of this stack for monitoring the process, validating the off-chain data against the data stored on-chain, provide limited access for auditing purposes, or provide even finer-grained access to specific users for specific purposes, interacting with smart contracts deployed in the network.</p>
Input data	Data sources
Output data	--
Interconnections (Interfaces)	Connection with IoT devices will be implemented via MQTT, a lightweight protocol suitable for unstable connections and low-power devices. Additionally, connection with NoSQL Data Storage will be supported for off-chain data handling.
Module_Id	Data Access Policy Brokerage





Module_Id	Trusted data sharing and re-use
General Description	<p>The central idea behind the Data Access Policy Brokerage is the development and enforcement of mechanisms for the application of Data Access Policies in the BD4NRG datasets. These mechanisms will be used by the upper layer's BD4NRG components specifying user access rights and rules based on:</p> <p>Volume of data access</p> <p>Frequency of data access</p> <p>Request Device (e.g., laptop, smartphone etc.)</p> <p>Person or Group Role (e.g., location, IP, role in the company etc.)</p> <p>Historic data regarding access patterns (e.g., frequency, usual dates or hours of access, usual duration of access, previously accessed data etc.)</p> <p>Access Control Type (MAC, DAC or RBAC/ABAC)</p>
Functionality	<p>In more detail the Data Access Policy Brokerage component will be responsible for:</p> <p>The development of appropriate context model for semantically describing associations between types of access depending on the data objects and circumstances under which this access should be allowed</p> <p>Based on the above-mentioned context model the creation, management and maintenance of BD4NRG Data Access Policies</p> <p>Enforcement of DAPs through specific User Access Rights</p> <p>Support of the User Access Rights administration through specific software components which will provide the following functionalities:</p> <p>Identity and Access Management (IAM) for users, groups and devices management.</p> <p>Policy Enforcement Point (PEP) Proxy which will carry out or enforce policy decisions.</p> <p>Policy Decision Point (PDP) which will evaluate and issue authorisation decisions.</p> <p>Policy Administration Point (PAP) which will manage access policies.</p> <p>Data Usage Control.</p> <p>DAP Annotation Management.</p> <p>Validity checking of DAP annotations (e.g. spotting inconsistent annotations).</p> <p>Tracking dependencies between DAP annotations.</p> <p>Ensuring compliance with pertinent organisational policies, especially with respect to the available encryption and data distribution strategies.</p>
Input data	Data sources
Output data	--
Interconnections (Interfaces)	--
Dependencies	--



Module_Id	Legal, Regulatory, Privacy and Cybersecurity Management & Compliance Tools
General Description	<p>The central idea behind the Legal, Regulatory, Privacy and Cybersecurity Management & Compliance Tools is the adherence of the BD4NRG Data Governance and Management layer to the legal, regulatory and cybersecurity guidelines and principles especially based on the T2.5 outcomes. The aim of this process is to guarantee the security of the individual subsystems, in order to satisfactorily address security concerns in relation to receiving and sending information and sensitive data.</p>
Functionality	<p>This will be achieved by specific functionalities provided:</p> <ul style="list-style-type: none"> Data collection from network infrastructure level and endpoint level. Transform and normalise above data (if needed). Network traffic data analysis. Application endpoints data analysis. Classification of data flows using anomaly detection and machine learning techniques. Development of automated rating and classification mechanisms. Evaluation of Security mechanisms based on data analysis results. Update Access control policies and identification of new ones. <p>Basic Audit</p> <p>The outcome, functionality-wise will be the provision of a proactive and exploratory network/application security tool via behavioural machine learning or other analytics techniques. Based on this, theBD4NRG platform will be able to identify events and at the same time prevent threats or at least decrease response times.</p> <p>The whole process should make use of data ingestion pipelines which through an analytics engine will provide data visualisations, alerts, or automated workflow triggers for threat remediation.</p>
Input data	Data Sources
Output data	--
Interconnections (Interfaces)	--
Dependencies	--

Module_Id	Data Quality
General Description	<p>This module allows to properly define the minimum requirements in terms of data quality (format, latency, continuity ...) to not compromise the results delivered by the tools available in the BD4NRG-MARKETPLACE.</p>
Functionality	<p>Data sources will be pre-processed to apply the defined profiling rules; evaluate profiling routines; define cleaning rules; auditing the cleaning rules; check data standards and formats</p>
Input data	Energy data assets





Output data	Data standardised to comply with the Marketplace requirements
Interconnections (Interfaces)	Data Sources Actors Energy Assets Data Access Layer
Dependencies	Interoperability and Homogenisation

Module_Id	Interoperability and Homogenisation
General Description	The Interoperability and Homogenisation module will be in charge of integrating and managing heterogeneous data from different sources and/or platforms in the energy ecosystem and beyond. Such data, historical or generated in real-time, will be provided by the BD4NRG data providers via different channels/technologies such as IoT devices, smart meters, SMX, sensors, etc.
Functionality	The Interoperability and Homogenisation module will be based on specific data connectors developed as micro-services to manage the different data available under different formats and communication protocols (Rest APIs, SFTP, IoT protocols, Sensor Network). It will also provide interfaces to other energy and non-energy datasets/platforms of third parties willing to federate/integrate with BD4NRG.
Input data	Data sources
Output data	Data sources homogenised
Interconnections (Interfaces)	The idea is to develop the Interoperability and Homogenisation module taking advantage from NGSI-LD API and the FIWARE curated framework.

Module_Id	Data Connectors
General Description	These assets establish the path that proceeds with the data ingestion and management (batch & streaming)
Functionality	<ul style="list-style-type: none"> Batch Ingestion: provides mechanisms for ingesting data within the platform as batch files. Streaming Ingestion: provides mechanisms for ingesting real time data from edge and IoT devices.
Input data	Data from Data Providers
Output data	Data ready to be processed by the platform
Interconnections (Interfaces)	Interoperability & Homogenisation Edge Integration HTAP OLAP
Dependencies	





Development status	Deployed
Code Base Project	S3, HTTP, Local disk Apache Kafka

Module_Id	HTAP OLAP
General Description	This module offers an analytics data store especially designed for supporting data science applications, business intelligence and real-time insights.
Functionality	<p>The component offers Online Analytical Processing capabilities and delivers fast query at high concurrency. Moreover, it provides easy integration with existing data pipelines while supporting different file format for structured and semi-structured data ingestion, processing, and storage.</p> <p>The component has been designed to provide fast access to structured and semi-structured data as well as to pre-process the data to improve the efficiency and effectiveness of the bigdata process and to create specific views for the consumer applications.</p>
Input data	Energy data assets
Output data	Use-case specific dataset
Interconnections (Interfaces)	Data Connectors Integrated Querying of Streaming Data Data Consumers Applications
Dependencies	
Development status	Deployed
Code Base Project	DRUID

Module_Id	Integrated Querying of Streaming data
General Description	This module enables the creation and efficient execution of queries to BD4NRG data sources, including combinations of different and heterogeneous data sources (e.g., joins). It also allows queries to near real time data. Moreover, it provides a useful interface to the users to enable them build queries without any prior knowledge of any programming language. In addition, it enables a user to save and retrieve queries in order to be used in the future.
Functionality	The querying module is responsible for querying different data sources that are built with different technologies, and the combination of them (e.g., real-time data with historical data or their metadata). It will be accessible not only through a user interface to the users, but also through connectors to other services and/or APIs.
Input data	Static and real-time data sources.
Output data	Query results.
Interconnections (Interfaces)	Data Sources Energy Assets Data Access Layer





Module_Id	Integrated Querying of Streaming data
	Users
	Other services
Dependencies	HTAP, Interoperability and Homogenisation

Module_Id	Dynamic local meta-data catalogue (DLMC)
General Description	<p>The Dynamic local metadata catalog consists of two layers: metadata extraction, and metadata storage and search layer. The metadata extraction layer provides active metadata discovery, KPI extractor and data provenance and traceability extractor:</p> <ul style="list-style-type: none"> • The active metadata discovery connects to many popular storage technologies and other data sources that are relevant to the full lifecycle of a data pipeline. • The KPI extractor tracks dataset stats that represent the shape, distribution, and the properties of data over time to build a comprehensive view on the varying properties of data sources and data pipelines. • The data provenance and traceability extractor gathers historical information about data lineage, its origin and all transformations applied to it in the data pipeline over time. <p>The metadata storage and search consist of metadata catalog, data and algorithm KPIs, data management and integration KPIs, and data provenance and traceability store:</p> <ul style="list-style-type: none"> • The metadata catalog module stores all data source metadata in a knowledge graph form allowing easy addition and search of various metadata. • The data and algorithm KPIs module keeps all metadata related to data and algorithm stats, for example the shape and distribution of data over time and the performance of the algorithm. • The data management and integration KPIs module stores information on data pipeline lifecycle including information that can be used for automated pipeline management and integration. • The data provenance and traceability store module keeps the information about all the data lineage and traceability of the full data pipeline.
Functionality	Metadata extraction, metadata storage and search
Input data	Metadata
Output data	Metadata, data lineage, data pipeline KPIs
Interconnections (Interfaces)	---
Dependencies	Data sources
Development status	Proof of concept developed
Code Base Project	Available upon request and clearance

Module_Id	Adaptation engine
General Description	<p>The adaptation engine is responsible for the maintenance and integration of the data pipeline. The adaptation engine observes both DLMC and live data pipelines to determine an adaptation strategy, next it executes a chosen adaptation strategy and triggers data pipeline optimiser. To close the adaptation loop, this module monitors the effects of adaptation and analyses the effect of a specific adaptation strategy.</p>
Functionality	Maintain and adapt the data pipeline to changing conditions
Input data	DLMC
Output data	Adaptation actions
Interconnections (Interfaces)	---
Dependencies	DLMC
Development status	This module is being designed, working towards a proof of concept
Code Base Project	Available upon request and clearance





Module_Id	Data Pipeline Optimiser
General Description	The module is a wrapper around the HTAP OLAP API allowing the modification of existing data pipelines, in order to optimise their executions. It retrieves the existing pipelines configuration from the Dynamic data provider component and provides API to modify existing HTAP OLAP ingestion specifications.
Functionality	Optimisation of data pipelines and parallelisation of data streams
Input data	Ingestion specifications stored in DLMC
Output data	Updated HTAP OLAP ingestion specification
Interconnections (Interfaces)	---
Dependencies	HTAP OLAP and HTAP Lake, DLMC
Development status	The component is under design and implementation and will be integrated in the WP3 demo
Code Base Project	Available upon request and clearance





APPENDIX II: Analytics Toolbox Component Description

Module_Id	Data Virtualisation and Delivery Platform
General Description	<p>This module offers <i>data consumers</i> a unified, abstracted, and encapsulated view for querying and manipulating data stored in a heterogeneous set of <i>data stores</i> that will be – thus – presented as one integrated data source. <i>Data Consumer</i>: refers to any application that retrieves, enters and/or manipulates data. <i>Data Store</i>: is any source of data that is relevant for the BD4NRG project.</p> <p>At this point the platform will be specified to provide a <i>virtual space</i> – during the run-time – that ensures that data will stay in place even if they appear as though they sit in a single place. This design choice can be changed if a physical data warehouse is needed. Therefore, the platform does not contain any actual data; it only contains the logic/intelligence for accessing the data sources.</p>
Functionality	<p>The Data Virtualisation and Delivery Platform is responsible to integrate data from heterogeneous and distributed data sources including data-at-rest, machine data, external services while delivering a single access point to data consumers for accessing data. The platform will provide both run-time and design-time intelligence. The latter allows to transform data from data sources into virtual tables while specifying a <i>mapping</i>. The former includes all the necessary mechanisms to implement <i>on-demand</i> data integration by using the <i>mapping</i>.</p>
Input data	Energy data assets
Output data	Use-case specific datasets
Interconnections (Interfaces)	<p>Data Sources</p> <p>Actors</p> <p>Data Querying for Business Intelligence Applications</p>
Dependencies	Seamless Elastic Distributed Data Management and HTAP (Heterogeneous Data Capture, Cleansing, Integration, Polyglot Persistence)





APPENDIX III: Marketplace Components Description

Module_Id	Orchestration Layer
General Description	This module allows to manage the service access to data and metadata resources.
Functionality	The module allows to configure services according to the resource configuration and the data providers and data consumers permissions.
Input data	Service Configuration Data. Resources Configuration Data User permission Data
Output data	Datasets Configuration
Interconnections	Service Configuration Interface Resources Configuration Interface User Permission Configuration Interface. Data Configuration Required Interface
Dependencies	Energy Assets Data Access Layer
Development status	Deployment phase
Code Base Project	Python

Module_Id	MLaaS
General Description	This module allows to provide Machine Learning as a Service in a cloud-based environment
Functionality	The module will provide a set of trained Machine Learning libraries that will be deployed on demand in the Marketplace cluster
Input data	Basic Service Configuration Training request to the service REST endpoint. Prediction request to the service REST endpoint.
Output data	ML models information. Prediction response.
Interconnections	Service Configuration Interface. Service Query Interface. Model Provisioning Interface.
Dependencies	Blockchain Based Asset Management Layer Orchestration Layer. DaaS Layer
Development status	Not yet deployed
Code Base Project	To be confirmed





Module_Id	Anomaly Detection Service
General Description	This module provides Anomaly Detection as a Service in a cloud-based environment
Functionality	The module will provide a set of unsupervised anomaly detection Machine Learning libraries that will be deployed on demand in the Marketplace cluster
Input data	Dockerised trained and trainable models. Basic Service Configuration Training and Prediction request to the service REST endpoint.
Output data	ML models information. Prediction response. Training response
Interconnections	Service Configuration Interface. Service Query Interface.
Dependencies	Blockchain Based Asset Management Layer Orchestration Layer.
Development status	Deployed
Code Base Project	--

Module_Id	Explainable AI Service
General Description	This module provides Explainable AI as a Service in a cloud-based environment
Functionality	The module will provide the ability to execute explainable AI analysis and optimisation methods on ML predictive models
Input data	Dockerised trained models. Basic Service Configuration Analysis request to the service REST endpoint.
Output data	ML models information. Prediction analysis response. Explainer model Visualisations based on analysis
Interconnections	Service Configuration Interface. Service Query Interface. Model Provisioning Interface.





Dependencies	Blockchain Based Asset Management Layer Orchestration Layer.
Development status	Deployed
Code Base Project	--

Module_Id	Augmentation service
General Description	This module provides satellite image augmentation as a Service in a cloud-based environment
Functionality	The module will provide the ability to execute augmentation operations on satellite imagery
Input data	Data set (upload or stream) Basic Service Configuration Operator sequence definition REST endpoint.
Output data	Augmented data
Interconnections	Service Configuration Interface. Service Query Interface.
Dependencies	Blockchain Based Asset Management Layer Orchestration Layer.
Development status	Deployed
Code Base Project	---

Module_Id	DaaS
General Description	This module allows to collect data from different sources to provide new services.
Functionality	The module allows to retrieve data from the sources configuring streaming or on-demand data consumption. The module will provide a discovery service to allow data consumer to identify new potential services from diverse data sources and types.
Input data	Data Configuration Resource Configuration Input Data
Output data	Metadata Output Data





Interconnections	Data Service Configuration Data Service Provision Discovery Service Resource Configuration Data Provisioning
Dependencies	Energy Assets Data Access Layer Resource Management Orchestration Layer.
Development status	Not deployed yet
Code Base Project	To be confirmed

Module_Id	3 rd Party Services
General Description	This module allows to provide 3 rd party services
Functionality	This module allows to configure and consume 3 rd party services
Input data	Configuration Data Input Data
Output data	Service Output Data
Interconnections	Data Provisioning
Dependencies	Dockerised model Resource Configuration Orchestration Layer
Development status	Not developed yet
Code Base Project	To be confirmed

Module_Id	Marketplace API
General Description	The Marketplace API is a public available REST API that provides applications with access to the marketplace services like MLaaS, DaaS, SIMaaS, third party services, user management services, and resource management services.
Functionality	This module exposes the BD4NRG functionalities in a REST API
Input data	REST calls to the server





Output data	Server responses
Interconnections	Orchestration layer
Dependencies	All other components
Development status	Development not started yet
Code Base Project	To be confirmed

Module_Id	Marketplace Dashboard
General Description	The Marketplace Dashboard is the GUI that Data Provider users and Service Provider/Data Consumer users can use to interact with the marketplace application. The dashboard serves as a metadata catalogue for the data provided by the data providers and a catalogue of data and services the service provider/data consumer can use to create new added value services. The dashboard is connected to the marketplace through the open API.
Functionality	This module exposes the BD4NRG functionalities in a GUI
Input data	User interaction
Output data	Visual feedback from the BD4NRG components
Interconnections	Marketplace API
Dependencies	Marketplace API
Development status	Not developed yet
Code Base Project	To be confirmed

