

# E3 ENTRANCE

## Initial Data Management Plan



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## Executive Summary

This document describes the data management plan for all the data sets that will be collected, processed, or generated within the ENTRANCE project. This is an initial data management plan that will be updated two times within the project lifetime based on the project development and requirements. This document describes what data will be collected and generated and how this data will be shared and made open, and how it will be curated and preserved. The document gives also an overview of the data types and their relation to the ENTRANCE objectives. This document defines the data preparation, maintenance, and implementation of the data.



# 1. General about data management plan within ENTRANCE

ENTRANCE aims to enable smart-grid-ready, decarbonized buildings by integrating energy efficiency, flexibility, renewables, mobility, and user empowerment. The project develops and demonstrates solutions that ensure user comfort while enhancing buildings' role in the energy system and market. Guided by four principles — technology integration, digitalization, user engagement, and performance-driven economics — these solutions will be tested across six European countries to ensure wide applicability.

This document is explaining initial data management plan (DMP) in the ENTRANCE project. The DMP is written at M6 and will be updated at M36 and M48. The DMP will be updated to coincide with the periodic reporting of the project, and will also be updated as required, depending on the data management needs during project implementation. The DMP will follow the FAIR principles, making data findable, accessible, interoperable, and reusable.

## 1.1 Deliverable overview and objectives

This deliverable presents the initial DMP for the ENTRANCE project. Its purpose is to establish a tailored strategy to effectively manage data within ENTRANCE, make transparency among data, and support the broader uptake of the results, laying the groundwork for long-term impact beyond the project's duration. Developed at the start of the project, this DMP defines the data preparation, maintenance, and implementation of the data. The DMP includes a variety of activities supporting the ENTRANCE objectives.

This deliverable sets the foundation for all the data generated and collected in ENTRANCE and will be periodically reviewed and updated throughout the project to ensure relevance, effectiveness, and alignment with the project needs.

The structure of the document is as follows:

**Chapter 1** introduces the **general structure of the DMP** in the ENTRANCE project.

**Chapter 2** details the **data summary** of the ENTRANCE project and how the data will be collected and generated.

**Chapter 3** details the **FAIR principle** and how it will be maintained.

**Chapter 4** explains the **allocation of resources** in the case of additional cost for data storing.

**Chapter 5** provides how the **data security** will be handled in the project.

**Chapter 6** provides how the **DMP** will be updated.

**Chapter 7** details the **ethical aspects** within the project.



## 2. Data summary

The DMP describes how the beneficiaries will handle the data sets, ensuring reasonable effort to make the data open as possible, as stipulated by the FAIR principles. No previously generated data will be reused in this project.

Purpose of the data collection and generation is described in this section. The data collected and generated in the ENTRANCE project will be used for evaluation of building energy performance, energy efficiency, evaluation of indoor air quality (IAQ), building energy modelling, defining control strategies, operation optimization of smart grid-ready buildings, evaluation of sector integration, definition of performance-driven economic indicators, and definition of business models for the building performance improvement. Data frequency and detail of data will be defined based on specific problem need according to the project description. A brief overview of the data types in the ENTRANCE project are given in Table 1.

Table 1. Data types in the ENTRANCE project

<b>1. Building general information</b>
Building name
Location (address, GPS coordinates)
Building type (e.g. office, school, residential)
Rooms/spaces involved in the demonstration (e.g. two single-person offices)
<b>2. Building simulation model</b>
Simulation tool, description of the input and output data
Building geometry for the simulation tool
U-values for external walls, internal walls, windows, roof, ground floor
<b>3. Flexible assets, local power generation and storage systems</b>
Demand-side flexible assets involved in the demonstration (e.g. HVAC, EV)
Supply-side systems involved in the demonstration (e.g. PV, CHP)
Energy storage systems involved in the demonstration (e.g. thermal storage, batteries)
Type of all the systems involved in the demonstration (e.g. HVAC system: air-to-water heat pump with floor heating etc.)
<b>4. Control systems</b>
Building management system (BMS) or cloud-based control system
What systems are currently controlled?
What control/ strategies are applied?
What communication protocols or interfaces are used among the system components?
<b>5. Measured data</b>
Description of the measured data available from the building including the time resolution
Description of the measured data available from the technical systems including the time
Data access format/method (e.g. CSV, via API)



Historical data coverage (e.g. for past 6 months)
<b>6. Occupancy detection</b>
Occupancy data (e.g. hourly occupancy data in each room of the building)
Detection method, if it exists (e.g. based on PIR sensors, schedule-based)
Algorithm or logic used to estimate the occupancy level

The data collected and generated are related to the research objectives of the project, shown as follows:

- (a) For the objective “Develop flexibility enhancement and building-to-grid integration processes and products”, the collected and generated data from the ENTRANCE pilots based on measurement and simulation data will be used to facilitate building integration in the energy system with a view to support grid and network management.
- (b) For the objective “Develop services for building participation in the energy markets”, measurement data from the pilots together with the generated simulated data will be used for designing the new innovative and competitive solutions to facilitate building active participation in the energy market. The generated simulation data will be utilized through the IoT network, machine learning, and digital twin for smart energy management to improve building performance, increase flexibility, and enable smart-grid ready building will be proven to support building operation in coordination with external signals.
- (c) For the objective “Empower users and improve experience of energy service and contract management”, the generated models and simulated data will be used for development of user-friendly interfaces and data exchange for building users and other interested stakeholders (e.g., facility managers, portfolio managers, aggregators, etc.). For that purpose, ENTRANCE KPIs for four different macro-areas of impact: energy, environmental (at local and global scale), financial (according with a whole life cycle approach) and socio-economic will be developed to evaluate different measures.
- (d) For the objective “Contribute to operational energy performance, smart readiness, and flexibility”, the simulated data and measurement or operational data will be used to develop and verify the flexibility services based on high level use of digital technologies to enable easy energy grid interactions together with cost-effective implementation of energy efficiency, renewables, and storage technologies.
- (e) For the objective “Demonstrate the applicability and effectiveness of the project results in operational environments”, the measurement or operational data will be used to demonstrate and validate ENTRANCE innovations.
- (f) For the objective “Develop performance-based economic evaluation”, the simulated data and measurement or operational data will be used for developing performance-based economic evaluation.
- (g) For the objective “Foster the EU-wide uptake and replication of the project results”, the collected data and generated data in different format and frequency will be utilized to exploit and disseminate the ENTRANCE concept and solutions on a European scale.



Types and formats of data. The data will be classified into the following categories: measurements for real tests, historical and new performance data, codes for data pre- and post-processing by using big data analytics and other types of methods. The data will be recorded in the Microsoft Excel or as the .txt format, and the data will be presented in the publications in the formats of figures and tables. The data will be presented in the non-proprietary and open formats with documented standards as far as possible.

Origin of the data. The simulated data will be obtained from the developed simulation platform. The measurement and operational data will be obtained from the ENTRANCE pilots. BMS or cloud-based platforms will be used for the operational data collection. Depending on the project needs, additional measures will be used.

Size of the data. The expected database is made up of four sections: source files, reports, simulated, measurement, and operation data. The expected sizes of the simulated and experimental data are large. The expected size of the source files is middle. The expected size of the reports is small.

Data utility. The FAIR rules formulated by the European Commission will be used to guide the utilization of the data collected or generated in this project. The meaningful results obtained from the collected or generated data will be presented in the national or international scientific seminars or conferences. The meaningful results obtained from the collected or generated data will also be published in the conference and journal papers in the open-access format.

## 3. FAIR data

### 3.1. Making data findable, including provisions for metadata

**FAIR Data Principles** will be respected and implemented as guidelines for making data findable, accessible, interoperable, and reusable. The key components of the strategy for comprehensive data support and management will therefore be respected. It ensures identification, archiving, provisioning, processing, and management. Metadata will be used to identify data and understand its meaning regardless of structure, origin, or location. In particular, a three-level architectural scheme will be developed: 1) Internal (or physical) level for the representation of the logical scheme in which the physical structures of data storage will be defined, 2) Logical level for the description and representation of the database in terms of entities, entity attributes and relationships between the attributes of different entities, 3) External level for the visualization and use of partial views made available for data access queries only to authorized users who have permission to access the repository. All the data shared on the project teams folder are confidential, until the project partners reach the final report or publication that will be declared as public. The person/partner who is responsible for the report must ask the other partners for the permission for the public data presentation.



**Data sharing within the project** – NTNU has overall responsibility for all the deliverables and storing them. Each partner responsible for its deliverable will store the deliverable locally and share with other partners at the project teams folder. NTNU has an overall responsibility to organize and follow-up the deliverables. ENTRANCE data will be hosted by NTNU, while access to all the partners will be given to upload their data and for analysis and modeling purpose.

Each group of data in the teams folder will be named in a unified means. In the name, WP represents the work package; S represents the simulated study; E represents the experimental or measurement data; M represents models, O represents the operation data, and A represents the activity. A general format is shown as follows: WP (work package number) - S/M - A (description of the activity). A table will be used to introduce the information of the set of data, including Date, Authors, Descriptions, and Revisions. Date represents the date when this version is available; Authors represents the authors who completes this version; Descriptions represents the introduction of the file in the current version; and Revisions represent the number of the current version.

**Data dissemination** – ENTRANCE will have extensive activities on data and results dissemination out of the project and for wider audience. A detail plan for result dissemination publicly and scientifically will be defined in WP8. Dissemination for the ENTRANCE data to SMEs and other interested will be specifically developed based on the level of interests (SMEs to further use the platform or policy developers).

**Data storage and access during the project** - The project partners will take responsibility for the collection, management, and sharing of the research data in the project, and arrangements for data use within the consortium will be elaborated in the consortium agreement. The project coordinator will act as the data manager for the project's administrative data. All data sharing and publications will respect international, EU, and national privacy law as well as the commercial interests and IPR of project partners, which may lead to withdrawal from publication or embargo periods placed on some data produced by the project. Such decisions will be explained in the consortium agreement. GDPR rules will be adhered to. Regular back-ups will be made to ensure that data is not lost in the event of technical issues with the server. The project partners will create a database structure that is easy to navigate. This will also facilitate the curation of the data. Access by project partners to data during the project will be regulated in the Grant Agreement. The idea behind the development of the project data management strategy is to ensure that all resources are positioned in such a way that they can be used, shared, and moved easily and effectively by the project partners.

## 3.2. Making data openly accessible

The databases consisting of simulated and experimental data are classified into two categories: open and internal databases. The open databases will be fully access to the public, while the internal databases might be not access to the public. The access right of the internal databases to the public is determined case by case. If the external users need the access to the



restricted databases, a request will be needed to send to Professor Natasa Nord, who will judge the request case by case. As explained in Section 3.1, all the data shared on the project teams folder are confidential, until the project partners reach the final report or publication that will be declared as public. The person/partner who is responsible for the report must ask the other partners for the permission for the public data presentation.

### 3.3. Making data interoperable

The collected or generated data in this project will be interoperable as far as possible, which means that the data exchange and re-use between researchers, institutions, organizations, and countries will be maximized. The open data and metadata vocabularies and open file formats will be conducted for maximizing the interoperability. The standard vocabularies for all data types will be used as far as possible to allow the inter-disciplinary interoperability. In case it is unavoidable that you use uncommon or generate project specific ontologies or vocabularies, mappings will be provided to more commonly used ontologies.

### 3.4. Increase data re-use (through clarifying licences)

Based on the FAIR data directive, the collected or generated data in this project will be made available as soon as possible. If the collected or generated data in this project is required by third parties, licensing options will be evaluated case by case. The ENTRNACE project will collaborate with the BRIDGE initiative by sharing relevant data on smart grid-ready building. The ENTRNACE project partners will reach the final decision what data will be shared with the BRIDGE initiative. The license of the data will also refer to the information presented in the Attribution-NonCommercial 4.0 International (<https://creativecommons.org/licenses/by-nc/4.0/legalcode>). The scientific publications or reports supported by the collected or generated data in this project will be peer-reviewed by the internal experts of this project. If necessary, the external experts will also participate in the peer-reviewed process. These processes will make sure that the data quality is high.

## 4. Allocation of resources

Professor Natasa Nord will be responsible for the data management in the project. The costs for making data FAIR in this project will be discussed case by case. If necessary, the costs might be covered by the project. It should be noted that the precondition of this case is that the costs are not significant.



## 5. Data security

Several provisions are performed for enhancing the data security, shown as follows. The collected or generated data in this project will be stored in the online repositories. The access right of the repositories is protected by the password and other necessary identification approaches. The computers used by the people participated in this project are protected by the password. If necessary, the high-level data antivirus software will be used. The confidential information of this project will not be allowed to present in the email. To prevent the data loss, the periodic backup of the data will be conducted. If necessary, the cloud storage devices will be used.

**Cybersecurity Management** - The aim of this task is to provide cybersecurity of the data collected and organized within the project. As explained in Section 2, the ENTRANCE project will use building and digital technologies from different monitoring platforms. Collected information will be used to understand the building energy performance characteristics and to know the available digital and physical infrastructures (IoT hardware/data). Thus, within the ENTRANCE project, guidelines will be developed to secure communication between IoT devices and each platform using encryption protocols and VPN encapsulation. Zero trust, based on standards (e.g., NIST SP 800-207), will be used to overcome VPN capacity constraints. To secure the connection between field devices and the cloud platform, a VPN server such as OpenVPN or WireGuard will be used. Each partner will appoint a network administrator to configure the VPN server and to issue VPN certificates for the server and for the gateways that provide connectivity between the field devices and the cloud hosting the platform.

Guidelines to role-based access control (e.g., demo owner, tenants, construction manager, Facility Manager, etc.) will be developed to provide specific user access rights in accordance with their capabilities and role to visualize, query, manage and update data within the platform. This will ensure that data is accessed by authorized people using standard cybersecurity/data privacy protocols. Within WP3, WP4, and WP5, EURIX with the close help of NTNU will coordinate the ENTRANCE pilots' auditing regarding available data, models, and building performance analysis methods. Other partners will provide data regarding their respective pilots and their respective tools, stakeholders/roles involved, data access permits, etc.

## 6. Data Management Update Plan

The DMP of ENTRANCE will be reviewed and updated in M36-D1.7: **Updated Data Management Plan** and on M48-D1.8: **Final Data Management Plan**. Both deliverables will include updated data management plan for the data used, processed, and stored during the project duration and beyond. D1.7 and D1.8 will be an updated version based on the experience with the data and results sharing.



## 7. Ethical Aspects

Ethical aspects connected to the research data collected or generated in the project will be considered during this project. Currently there are no ethical issues that could have an impact on the sharing of research data in this project.



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