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Thermal and energy Management for INcreased Driving range of an Electric minibus including improved user-centric Design and thermal comfort

Acronym: MINDED

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Publishable Executive Summary

In the recent years, there is a strong incentive from the European Commission (EC) towards the implementation of open access to scientific publications and research data derived from the European Union (EU) funded research projects. This is reflected in efforts to standardise procedures to achieve Findable, Accessible, Interoperable ad Reusable (FAIR) research data. The goal behind this incentive is to maximise the impact of EU-funded research projects and accelerate discovery through the interaction of the data produced in several research projects.

This initial Data Management Plan (DMP) aims at proposing a general approach to handle the research data during and after the end of the MINDED project, providing guidelines to specify which data will be collected, processed and/or generated, to what extent this data will be publicly available, and how data will be curated and preserved (including after the end of the project). The document also addresses several aspects on how to make the data produced in the MINDED project as FAIR as possible, following the indications provided by the EC. This deliverable does not include any deviation from the objectives and timings planned in the Grant Agreement of the project.

This initial data management plan will be revised throughout the entire project duration and updated in the upcoming Deliverables.





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Abbreviations and Nomenclature

Table 1: List of Abbreviations and Nomenclature

Symbol or Shortname	Description
GDPR	General Data Protection Regulation
NPI	New Product Introduction Process
GA	Grant Agreement
СА	Consortium Agreement
HVAC	Heating, Ventilation, and Air Conditioning
ECU	Electronic Control Unit
HMI	Human Machine Interface
CAD	Computer Aided Design





1 Introduction

1.1 The MINDED project

The objective of MINDED is to deliver a battery-electric, zero-emission IVECO eDaily minibus with a 20 % improved range at 0 °C. This objective is reached through the highly efficient heating system for the driver and passengers based on infrared (IR) heating panels, controlled by optimal thermal and energy management strategy, and supported by an innovative human-machine interface (HMI), and an optimised air conditioning system in heat pump mode, using innovative oil-free centrifugal e-compressor with gas bearing technology. The performance of the implemented heating system will be demonstrated on a chassis dynamometer at 0 °C ambient temperature at TRL 7, while the air conditioning system performance in heat pump mode will be demonstrated on the ThermoLab testbed under various operating conditions at TRL 6. The targeted TRLs in MINDED are fully consistent with the call's requirement to achieve at least TRL 6 by the end of the project.

To further improve the performance of the IVECO eDaily minibus, an overall predictive thermal and energy management strategy will be demonstrated in the Digital Twin Model of the entire vehicle. The model considers the vehicle's powertrain, the implemented infrared heating and air conditioning systems, and a prediction of the driving behaviour based on artificial intelligence (AI) and Advanced Driver Assistance Systems (ADAS) sensors.

The ambition of MINDED involves the development, implementation, and demonstration of technologies at TRL 6-7, with 20 % improved real-world range at 0 °C compared to the baseline battery-electric IVECO eDaily minibus. MINDED developments will yield a cost reduction of at least 5 % at the vehicle level, while increasing the performance and reliability, and the development time reduction by 30 % through digital twin and AI deployment.

1.2 Scope of the Data Management Plan

The present document is the first version of the MINDED data management plan (DMP) which will be revised throughout the entire project duration and updated in the upcoming two Deliverables D7.3 (First revision of data management plan - M18) and D7.4 (Final version of data management plan - M36). The present DMP is an indicative plan as to what kind of data the project beneficiaries expect to generate during the project, and how these data will be managed. This DMP follows the provided standard DMP template [1].

Section 2 provides some information about the data used, gathered, and shared in MINDED whereas section 3 provides an overview about the use of FAIR data. Section 4 highlights all other aspects of data handling.

During the project, data will be generated for developing an optimised HVAC system, improving the thermal and energy management strategy, and enhancing the driving range of the electric minibus. Furthermore, data will be generated for sharing information and for assessing and evaluating the success of the overall project objectives. The purpose of the data collection/generation can be subdivided into the following points:

- Modelling the vehicles: The creation of a digital twin model of the electric minibus is one main pillar in the MINDED project and will help to assess the impact of the developed solutions.
- Development of components and systems: In MINDED efficient solutions for 10 technology bricks will be elaborated covering the entire HVAC system, the thermal and energy management strategy, the prediction of the drier behaviour and a user centric Human-Machine-Interface for controlling the HVAC system of the bus.
- Measurements: Measurements will be done for setting the baseline KPIs for all improvements in MINDED and for evaluating the implemented technologies.

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1.3 Limitations

The MINDED partners will use and contribute to publicly available information. This includes open datasets, open-source coding, scientific publications and/or white papers and more that are accessed via Open Access (OA) channels. Therefore, it is very important to point out that each member of the MINDED consortium must actively decide whether to publish information and results related to the project or whether to protect sensitive data. This also includes understanding that any mistreatment could potentially have legal consequences. Since the developments in MINDED are based on a prototype vehicle owned by the OEM IVECO, many vehicle data, specifications, measurement results, etc. are subject to the intellectual property of IVECO and are therefore not intended to be shared openly. Nevertheless, the consortium will share that part of the data that has been jointly decided to make publicly available.

Reference to D9.2 of EMPOWER 1.4

As the project MINDED is closely related to the project EMPOWER and the coordination for both projects is in the hands of the same persons at the AIT, also similarities in the project and data management exist and synergies should be exploited, to reduce the project management efforts. Therefore, the project handbook of MINDED will equal for general paragraphs the Data Management Plan of EMPOWER and whole text passages will be reused from D9.2 Data Management Plan of EMPOWER to D7.2 Data Management Plan of MINDED.

2 **Data Summary**

Data types and formats 2.1

A wide range of data types and formats are expected to be generated in the project. While these cannot be listed in advance, some general remarks can be made. The data types will vary according to the source application in which they are generated. Generally, the consortium will endeavour to utilise common data formats. In some cases, particular laboratory equipment or software may output data in proprietary formats, but where sharing of these data with other partners is necessary, a conversion to or a summary in common formats may be possible. Table 2 gives an overview about the project work packages. Table 3 gives a summary of the expected types of research data expected to be generated in the project whereas Table 4 summarises the non-research data.

WP	Name
1	Vehicle platform data acquisition
2	Heating system and thermal user comfort
3	HVAC unit, ECU, and HMI
4	Digital twin model and operating strategy
5	Implementation, demonstration, and assessment on vehicle level
6	Dissemination, communication, and exploitation
7	Project management

Table 2: List of work packages in MINDED.





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WP	Type of Data	Data Format
1 - 5	CAD Data, system specifications, technical specifications, simulation models and results	CAD Data (e.g., *.stl, *.stp, *.jt), system specifications (e.g., *.pdf, *.xlsx, *.docx), technical specifications (e.g., *.xlsx, .docx), simulation models (e.g., *.mo, .m), results (e.g., *.mat, .xlsx), reports (*.pdf)

Table 4: Types and formats of non-research data to be generated and used in MINDED.

WP	Type of Data	Data Format
6	Website traffic; audience engagement statistics from social media; photos and/or videos of project participants, publications	Exports from LinkedIn analytics (probably *.xlsx and/or *.pdf), publications (*.docx, *.pdf, *.pptx)
7	Project management data (e.g. financial, resources)	Financial tables (*.xlsx), reports and deliverables (*.docx, *.pdf)

2.2 Reuse of existing data

Existing resources already available will be used for research in MINDED enlarging and diversifying the underlying database for developments made in this project. This means that the data was either obtained by a partner outside of the MINDED project or by external sources/parties and introduced into the MINDED during the project implementation. This data includes for example:

- Vehicle data will be gathered from different IVECO departments. IVECO will share internal data • related to vehicle systems and performances (overall vehicle performances and systems' performances). Some IVECO sensible data will not be shared and used/reused for this project for intellectual knowledge protection.
- Existing software source code which will be used during the ECU development. The code is already • available in C-code files (.c and .h formats) and Matlab/Simulink files (.m and .slx). The data is a basis for the ECU software development. It is required for the project and it represents the base for the software that will be developed throughout the project activities.
- Open-source driving datasets (containing videos, point clouds, radar information, velocity, position, etc. of vehicles). The data will be used for training and evaluation of the vehicle velocity prediction functions. The velocity prediction will be used to optimize the energy management of the electric minibus.
- Existing measurement data and parameterized models of. These will be used to set up a workflow . before the actual measurement data of this project will be available. In this way, the development of the energy and thermal management strategies can be sped up. The measurement data is necessary to parametrize the simulation models, which will then be used to generate data e.g. develop and validate the energy and thermal management strategies.

2.3 **Origin of data**

Most of the data in the project will be generated in-project. The re-used data will come from external and open sources databases as well as from internal databases from the project partners. Databases provided will be

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assessed beforehand for their suitability by the respective partner. Only technically and legally suitable data from external databases is used in the project.

2.4 **Expected Size of Data**

At this state of the project, the expected size of the data is unknown, as the vehicles, systems and testing scenarios are not fully defined. Nevertheless, a first estimation based on previous projects and the experience of the project partners can be given.

Table 5: Expected type and size of generated data in MINDED.

Type of Data	Size of Data
Controller Parameters	1 MB
Data Sheets and Components Specification Data	1 MB up to 1 GB
Simulation Models, Results Data	Up to 1 GB
Software Code	Up to 1 GB
CAD Data of Minibus	1 GB up to 10 GB
GT-Suite Models	1 GB up to 50 GB
Measurement Results (depending on final measurement setup and use cases)	10 GB up to 100 GB
Open-source driving datasets	100 GB up to 5 TB

2.5 **Standards and Regulations**

A lot of different data is used, generated, stored and shared in this project. Different standards and regulations exist dealing with the quality of these data and the handling during sharing between project partners and with external parties. The data itself and the handling is compliant to the following standards and regulations:

- Company specific internal policies •
- Grant Agreement (GA) •
- Consortium Agreement (CA) •
- General Data Protection Regulation (GDPR) •
- New Product Introduction (NPI) process •
- IATF 16949, a technical specification aimed at the development of a quality management system •
- **ISO 9001** •

2.6 Data utility

The data generated in MINDED will be useful for the project (consortium), for other research projects in a similar field and for companies that want to develop products or systems of a similar nature. Nevertheless, many data generated in this project are subject to intellectual property rights or are part of confidential deliverables and therefore cannot be published. However, data published in public deliverables are made freely available if there is consent of all project partners.





3 **FAIR** data

The research data generated by the MINDED project should be 'FAIR'; findable, accessible, interoperable, and re-usable. The acronym and principles were defined in March 2016 in a paper published in the journal Scientific Data by a consortium of scientists and organizations [2].

Table 6: Overview over the FAIR principle

F	The first step in (re)using data is to find them. Metadata and data should be easy to find		
r Findabla	for both humans and computers. Machine-readable metadata are essential for automatic		
Filluable	discovery of datasets and services.		
Α	Once the user finds the required data, she/he/they need to know how they can be		
Accessible	accessed, possibly including authentication and authorisation.		
Ι	The data usually need to be integrated with other data. In addition, the data need to		
Interoperable	interoperate with applications or workflows for analysis, storage, and processing.		
P	The ultimate goal of FAIR is to optimise the reuse of data. To achieve this, metadata and		
N Doucoblo	data should be well-described so that they can be replicated and/or combined in different		
Keusable	settings.		

3.1 Making data findable, including provisions for metadata

3.1.1 **Persistent identifiers**

Unless any project beneficiary applies persistent identifiers for their own use, no persistent data identifiers are envisaged for the purposes of information sharing between partners in the project. However, any datasets made available as open data will use the possibilities for persistent identifiers as provided by the host platform (e.g., Zenodo). As MINDED is part of the E-VOLVE cluster, also the E-VOLVE Cluster Zenodo community can be used.

3.1.2 Naming conventions

To manage the created number of documents, common rules for file names need to be followed. File names need to comply with the following rule which is also described in D7.1 Project handbook:

MINDED_Index_DocName_Date_Version_Partner.ext

with the following meanings:

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3.1.3 Metadata

Metadata for describing the data that is collected and generated by the MINDED project is needed for facilitating open access to the data, e.g. when searching or accessing data. There are many different meta-data standards for many different types of data, and it may not be possible to find one that fits all purposes. Therefore, a pragmatic and feasible approach is to agree on a common and minimal catalogue metadata schema

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for those datasets that are published in public catalogues and data repositories and to use data-type specific schema extensions, if necessary. Following initial metadata and classifiers have been identified currently:

- Scope: For what purpose was data created / collected?
- Date of dataset generation: When was the data generated? •
- (Laboratory) conditions: What where the relevant conditions like temperature, humidity, etc.? •
- Parameter settings: Which settings were set while generating the data? •
- Name and version of the software used: Which software and version were used? •
- Data type: Does the dataset contain raw data or processed data or both? •
- Variable names: Variable names / parameters are explained or self-explanatory (i. e. defined in the • vocabulary of the research field).
- Data version: The version of the archived and / or re-used data is clearly specified and documented. •

Once data will be generated, the list of metadata will possibly be adapted in further versions of the Data Management Plan.

Making data accessible 3.2

3.2.1 Availability of data

Since the developments in MINDED are based on a prototype vehicle owned by the OEM IVECO, many vehicle data, specifications, measurement results, etc. are subject to the intellectual property of IVECO and are therefore not intended to be shared openly. Nevertheless, data are subject to a case-per-case evaluation to determine whether they should be made openly available to protect industrially/commercially sensitive information. Only selected data will be shared after internal consultation and approval in the consortium.

3.2.2 Accessibility of data

The MS SharePoint repository set up by AIT enables partners to share and access the relevant data for the different project activities and tasks. Public deliverables as well as open access publications will be uploaded on the MINDED website (https://www.minded-project.eu/). Publications and public data will be available on open access data repositories such as OpenAIRE (https://www.openaire.eu/) and/or Zenodo (https://zenodo.org/).

3.2.3 Access management

For open data, no tracking of people accessing the data is planned from the MINDED consortium side.

Access to the MINDED project SharePoint is provided individually for each user of the project team secured by username (email) and password. The repository applies a strict policy in granting and revoking access to data and logging the user identity while accessing, downloading, and uploading, including version control. This enables to restore the availability and access to the data in timely manner if an incident were to occur.

3.2.4 Personal or sensitive data

No personal or sensitive research data is planned to be generated or shared in MINDED. For non-research personal data, project partners are requested to fill out a consent form regarding the use of photo or video material featuring still or animated images of individuals – in conformity with GDPR.

3.2.5 Expiry date for open data

Once approved for publication as open data, the consortium does not envisage an expiry date.





3.2.6 Additional tools

Any data generated in MINDED is expected to be readable with generally available tools (word processors, pdf and image viewers, spreadsheet software) or open-source tools available.

3.3 Making data interoperable

Community-based standards like ISO standards, established software, hardware and computer code will be used. Documents will be written in English and will be using established standard terminologies/ontologies. Nevertheless, variables and value names will be constructed following general data processing conventions common to the research subject. List of value names and their properties will be provided in a separate list. Examples of these information to be managed within the project will be e.g. units of variables, list of variables with the name and label of each variable as well as its values and value labels, frequency distribution of each variable, information on the classifications used and meanings of abbreviations used.

While knowing that not all the research datasets that is being collected and that will be generated during the project's duration are public, many datasets will be kept confidential and therefore will not be available for access or inter-operability. Moreover, files such as simulation models cannot be used by other partners that do not have the software license.

Nevertheless, some of the data that will be publicly available and put in open access repositories like Zenodo can be interoperable. JSON (JavaScript Object Notation) scheme is used by Zenodo for metadata. Research data can be exported into different file types which will be defined once it is known, which data will be available.

3.4 Increase data re-use

Ownership of datasets will belong to project consortium after the project completion. Creative Commons licence CC BY-SA or CC BY will be used for any open datasets unless there are compelling reasons to select a more restricted type of CC-licence. Creative commons licences will by default also include a disclaimer of liability for the re-use of opened data. The availability of data is summarised in Table 7.

Data	Туре	Availability	
Underlying data published in scientific journals	Public	Available after publication	
Underlying data published in scientific journals	Confidential	Not available for publication because of privacy concerns	
Data from public deliverables	Public	Available after approval of EC	
Other data	Public	Available after consent of all project partners at the end of the project at latest	
Other data	Confidential	Not available for publication.	

Table 7: Data availability

No definite period or time limit is planned for access or re-use of the data. However, the opened data will be deposited in a repository that guarantees data integrity on the bit level. At this point no continuous data curation policy to guarantee full long-term digital preservation of datasets is planned.

Justification for possible case-specific embargo for published data will be decided by project consortium. Embargo will be sought primarily in connection with any potential patent application based on project results.

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For all public open data, it will remain reusable via Zenodo for at least 20 years. As stated by the Zenodo Repository "Items will be retained for the lifetime of the repository. This is currently the lifetime of the host laboratory CERN, which currently has an experimental programme defined for the next 20 years at least.".

4 Allocation of resources

The activities related to the data generation and collection are part of the person months (and therefore Direct personnel costs) quantified in the Grant Agreement for each partner.

The cost related to long-term preservation (and protection, if necessary) of the generated data is not quantified yet in this initial DMP, and depends e.g., on the data storage repositories used and length of time for which the data shall remain accessible. The costs corresponding to the open access provision of research publications and research data have been included as "Other goods and services" in the budget.

The Project Coordinator (AIT) will be responsible for developing and updating the DMP throughout the whole duration of the project, as well as for providing guidelines to the MINDED partners to comply with the DMP. Each partner will be responsible for quality assurance of their generated data and metadata.

5 **Data Security**

Data security follows the policies and procedures of each project beneficiary, particularly those who create or own the data. In principle, it is assumed that data security corresponding to the state of the art is given. For open data, the consortium relies on the host repository's data security safeguards.

Open data, if any, will be stored in a trusted repository (probably zenodo.org).

6 **Ethical Aspects**

An ethics screening was done at the project proposal stage and in the grant agreement preparation of the project. No noteworthy ethics issues were identified.

Informed consent for personal data where it regards photos or videos is handled through the consent form as part of WP6. For preservation of these data, where project beneficiaries are the data controllers, these are handled in conformity with the data protection statement (as referenced in the consent form).

7 Conclusions

This deliverable describes the DMP of the MINDED project and how it addresses data management issues. It provides an initial analysis of the data sources identified by the consortium members that will be used or generated during the project coming from internal and external sources. In addition, a preliminary guide for sharing the project results is provided. Project results in the context of this deliverable mean all types of data that are generated in MINDED, e.g. scientific publications, open source code, open data sets, measurement results or other results. The datasets collected in the current version of the report are research data linked to the project work packages and are managed according to their level of availability (public or sensitive/confidential). MINDED also follows the FAIR data management guidelines in Horizon Europe, i.e. data must be discoverable, accessible, interoperable and reusable.

While beneficiaries are encouraged to look for ways to share data with the research community, they are under no obligation to disclose data if this goes against their interests.

An update of this DMP will be published at project month M18 as D7.3 First revision of data management plan.





8 **Bibliography**

- [1] European Commission, "Data Management Plan Template," 01 April 2022. [Online]. Available: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/temp-form/report/datamanagement-plan_he_en.docx. [Accessed 07 May 2024].
- [2] Wilkinson, Mark D et al., "The FAIR Guiding Principles for scientific data management and stewardship.," Scientific data, vol. 3, 15 Mar. 2016, doi:10.1038/sdata.2016.18.





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5	UOZ	University of Zagreb	Croatia
6	TUW	Technical University of Vienna	Austria
7	IDIADA	IDIADA Automotive Technology S.A.	Spain
8	VIL	Villinger GmbH	Austria
9	GAR	Garrett Motion Czech Republic s.r.o.	Czechia
10	LT	Lead Tech SRL	Italy
11	ATC	TU Wien Automotive Test Center GmbH	Austria