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powder2power

MW-scale fluidized particle-driven CSP prototype demonstration

Grant Agreement n° 101122347

Data Management Plan

Deliverable 1.3

WP3 – Project Management

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Summary	This Data Management Plan governs the creation, storage and sharing of data generated by research within the framework of the Powder2Power project. It foresees the storage of datasets in Zenodo and governs access to this data depending on whether it is generated through Public or Sensitive deliverables. It statutes the creation of a Data Management Committee that will oversee the implementation of this Plan and its periodic reviews throughout the project's lifetime.	
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POWDER2POWER Project Factsheet

Grant Agreement n°	101122347	Project Acronym	POWDER2POWER
Project Full Title	MW-scale fluidized particle-driven CSP prototype demonstration		
Call identifier	HORIZON-CL5-2022-D3-03 “Innovative components and/or sub-systems for CSP plants and/or concentrating solar thermal installations”		
Funding instrument	Innovation Action		
Project start date	01/10/2023	Duration	48 months
Website	www.powder2power-project.eu		

Partners Short Name					
	• PROMES-CNRS • EDF	• EPPT • JCR	• B2Z • POLIMI	• KTH • CSPB	• SEI • KUL

WP	Task
WP1 - Project Management (CNRS)	Task 1.1 – Administrative, legal, and financial management
	Task 1.2 – Quality Management
	Task 1.3 – Coordination of the activities
	Task 1.4 – Data Management Plan
WP2 - Particle Behavior, Transport and Handling (EPPT)	Task 2.1 – Particle flow properties as a function of temperature
	Task 2.2 – Erosion, attrition and dust emission
	Task 2.3 – Assessment of particle transport issues at pilot & commercial scale
	Task 2.4 – Design & construction of the particle conveyance system for the P2P pilot plant
	Task 2.5 – Design & construction of the particle electrical heater
WP3 - Solar Pilot Modification, Component testing and complete Pilot Demonstration (CNRS)	Task 3.1 – Pilot loop modification and implementation
	Task 3.2 – Commissioning of the particle loop
	Task 3.3 – Complete solar pilot testing
	Task 3.4 – Guideline for operation and maintenance
WP4 - P2P Technology Up-scale Towards Commercialization (B2Z)	Task 4.1 – Definition of up-scaled integrated P2P power plant layouts, including PV + heaters hybridization
	Task 4.2 – Design of a utility-scale heliostat field and solar receiver
	Task 4.3 – Design of a utility-scale particle-to-sCO_2 heat exchanger
	Task 4.4 – Design of utility-scale electrical heating system
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WP5 - Environmental, Social, Economic and Technical Performance Assessment (EDF)	Task 5.1 – Definition of optimal operational strategies and flexibility assessment of the utility scale P2P plant
	Task 5.2 – Techno-economic assessment of a utility-scale hybrid CSP-PV P2P power plant
	Task 5.3 – Techno-economic model development & verification
	Task 5.4 – Environmental and social impact assessment via LCA and sLCA modelling
	Task 5.5 – Social impact assessment of the best identified cases
WP6 - Communication, Exploitation, Dissemination (CSPB)	Task 6.1 – Identification and protection of exploitable results
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Executive summary

The Deliverable D1.3 “Data Management Plan” is implemented by the Powder2Power consortium under the umbrella of WP1 – Project Management. All members of the consortium are involved in its creation and periodic revisions throughout the project’s lifetime.

It includes provisions on the platform that will be used to store data, Zenodo, and the different functionalities it has, as well as specific rules regarding the generation and storage of data and metadata. It also creates the governance structure for data management within the project through the creation of a Data Management Committee made up of a Project Data Manager, WP Data Managers and a Dissemination Officer that will convene twice every reporting period to oversee the implementation and periodic reviews of this Plan.

This deliverable’s first version is only a foundation that will be built upon and expanded throughout the project’s lifecycle, in particular through the addition of datasets to the DMP according to the model table in Appendix I. The deliverable will be reviewed and updated periodically, every three months as the Grant Agreement foresees. However, the Consortium may choose to not update the document after three months are up from the previous review should there be no new elements to add.

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3.2. Beneficiaries should consider which of the questions pertaining to FAIR data above, can apply to the management of other research outputs, and should strive to provide sufficient detail on how their research outputs will be managed and shared, or made available for re-use, in line with the FAIR principles. 15

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List of Acronyms and Abbreviations

Acronym / Abbreviation	Meaning / Full text
CCBY	Creative Commons Attribution
CERN	European Organization for Nuclear Research
CINEA	European Climate, Infrastructure and Environment Executive Agency
CSP	Concentrated Solar Power
CST	Concentrated Solar Thermal
DMC	Data Management Committee
DMP	Data Management Plan
DOCX	Office Open XML, MS Word
DOI	Digital Object Identifier
EU	European Union
FAIR	Findability, accessibility, interoperability and reusability
GIF	Graphics Interchange Format
H2020	Horizon 2020
JPEG	Joint Photographic Experts Group
P2P	Powder2Power
PDB	Protein Data Bank
PDF	Portable Document Format
PMT	Project Management Team
PNG	Portable Network Graphics
PROMES-CNRS	PROcédés, Matériaux et Energie Solaire – Centre National de la Recherche Scientifique
RTF	Rich Text Format
WP	Work Package
XLSX	Office Open XML, MS Excel
ZIP	ZIP file format

1. Data Summary

1.1. Will you re-use any existing data and what will you re-use it for? State the reasons if re-use of any existing data has been considered but discarded.

Existing data from previous national and EU-funded projects carried out by some or all partners, especially CSP2 (FP7) and Next-CSP (H2020), will be used in the framework of Powder2Power, which aims at continuing the work carried out during said projects. This includes technical specifications, experimental results, databases, etc.

1.2. What types and formats of data will the project generate or re-use?

The project will generate a compilation of data stemming from prior sources and state-of-the-art data, data images like drawings, illustrations, posters, or presentations; texts, like publications, articles, reports, or datasheets; protocols for the data collection, analysis, use and storage, measurement technique and experiments; as well as numerical data like experimental and numerical simulation results, diagrams, etc.

This data will be stored in convenient formats: such as JPEG, PNG and GIF for the images, PDF, DOCX, RTF, XLSX, ZIP, PDB for the texts. All published datasets will be assigned a DOI.

1.3. What is the purpose of the data generation or re-use and its relation to the objectives of the project?

The Powder2Power project will engage in different modelisation and experimental activities across its technical work packages that will result in the generation of data. This data generation will serve to fulfil the main objectives of the project, namely validating the project's main hypothesis on the viability of the operation of an innovative particle-driven CSP technology that can be applied for both power and industrial heat production.

1.4. What is the expected size of the data that you intend to generate or re-use?

The project is expected to generate about 5 gigabytes of data.

1.5. What is the origin/provenance of the data, either generated or re-used?

Other than the earlier projects mentioned in question 1.1 and general data obtained by the partners in their general work outside of the scope of Powder2Power, data will be generated by the project's partners within the framework of the project's tasks, including experiments and modelisation.

1.6. To whom might your data be useful ("data utility"), outside your project?

We expect data to be useful to the wider CST (concentrated solar thermal) scientific community to carry out further research, industrial stakeholders to find practical applications for our research, policy-makers to make informed policy choices, as well as educators to bring our research results into the wider community's reach, starting by children.

2. FAIR data

2.1. Making data findable, including provisions for metadata

2.1.1. Will data be identified by a persistent identifier?

Yes, it will. All data will be stored in Zenodo, which allows to create a persistent Digital Object Identifier (DOI). Consequently, all datasets uploaded to Zenodo will have their own DOI.

2.1.2. Will rich metadata be provided to allow discovery? What metadata will be created? What disciplinary or general standards will be followed? In case metadata standards do not exist in your discipline, please outline what type of metadata will be created and how.

Rich metadata will be provided to allow discovery through one of two possible means: either through a general description of the data included in the dataset provided along with it, or through a text-only file attached to the dataset. Data uploaders will have a choice as there are no set standards within the CST discipline.

2.1.3. Will search keywords be provided in the metadata to optimize the possibility for discovery and then potential re-use?

Keywords will be chosen and provided for all metadata stored in Zenodo through the platform's search keyword function.

2.1.4. Will metadata be offered in such a way that it can be harvested and indexed?

Indeed it will, as part of Zenodo's search keyword function allows for metadata to be indexed and harvested by all platform users according to a streamlined and simplified procedures accessible even to basic users.

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2.2. Making data accessible

2.2.1. Repository

2.2.1.1. Will the data be deposited in a trusted repository?

Yes, the data will be deposited in a trusted repository. The Powder2Power consortium has chosen Zenodo due to its free access and ease of use.

2.2.1.2. Have you explored appropriate arrangements with the identified repository where your data will be deposited?

Appropriate arrangements are not necessary as the Zenodo platform is owned by the European Union and operated by CERN. As such, the platform is already compliant with the laws applicable to the Powder2Power consortium and its individual members.

2.2.1.3. Does the depository ensure that the data is assigned an identifier? Will the repository resolve the identifier to a digital object?

Yes, Zenodo allows users to assign a general DOI to each dataset as well as additional DOIs to each modification of the dataset (in case of a repeated experiment, for instance).

2.2.2. Data

2.2.2.1. Will all data be made openly available? If certain datasets cannot be shared (or need to be shared under restricted access conditions), explain why,

clearly separating legal and contractual reasons from intentional restrictions. Note that in multi-beneficiary projects it is also possible for specific beneficiires to keep their data closed if opening their data goes against their legitimate interests or other constraints as per the Grant Agreement.

Data generated as part of Public deliverables according to the provisions of our consortium's grant agreement will all be uploaded on Zenodo and freely available to the general public. On the other hand, data generated as part of the work carried out for Sensitive deliverables will still be uploaded to Zenodo but under restricted access, with the exception of parts of these datasets that might be used in upcoming Open Access publications, which will all be made freely available on Zenodo too.

2.2.2.2. If an embargo is applied to give time to publish or seek protection of the intellectual property (e.g. patents), specify why and how long this will apply, bearing in mind that research data should be made available as soon as possible.

A specific timeframe cannot be given for this potential scenario, given that the actual length of an embargo will largely depend on external factors to the Powder2Power consortium, namely potentially divergent national law provisions applicable to each of the partners for their proprietary data with regard to intellectual property law, national security, and others, as well as agreements made with publishers within the context of an upcoming publication containing the dataset under embargo.

2.2.2.3. Will the data be accessible through a free and standardized access protocol?

Yes, it will be accessible through Zenodo, a free and standardised platform accessible through a simple HTTP protocol.

2.2.2.4. If there are restrictions on use, how will access be provided to the data, both during and after the end of the project?

This question only applies for data delivered by the project under a Sensitive deliverable. During the project's lifetime, the Data Management Committee will statute on provision of access to project-generated sensitive data. After the project ends, it will be up to each consortium partner to statute on access to their proprietary data as generated within the project's framework.

2.2.2.5. How will the identity of the person accessing the data be ascertained?

The identity of the person accessing the data will be ascertained via Zenodo authentication protocols as well as, if and when applicable, specific access authorisation granted to a specific Zenodo user for a particular dataset.

2.2.2.6. Is there a need for a data access committee (e.g. to evaluate/approve access requests to personal/sensitive data)?

The Data Management Committee will act as a data access committee if and when required throughout the project's lifetime, but not beyond it.

2.2.3. Metadata

2.2.3.1. Will metadata be made openly available and licenced under a public domain dedication CC0, as per the Grant Agreement? If not, please clarify why. Will metadata contain information to enable the user to access the data?

Consortium partners will make metadate openly available and licenced under CCBY whenever this is possible and compatible with project obligations with regard to sensitive data, as well as the provisions of national law applicable to them.

2.2.3.2. How long will the data remain available and findable? Will metadata be guaranteed to remain available after data is no longer available?

Both data and metadata will remain available and findable on Zenodo for as long as the platform exists. Should Zenodo cease to operate, it will be up to each consortium partner to determine whether to keep providing access to metadata elsewhere or not, this scenario being highly unlikely in any case.

2.2.3.3. Will documentation or reference about any software be needed to access or read the data included? Will it be possible to include the relevant software (e.g. in open source code)?

Metadata generated under this project will be text-only.

2.3. Making data interoperable

2.3.1. What data and metadata vocabularies, standards, formats or methodologies will you follow to make your data interoperable to allow data exchange and re-use within and across disciplines? Will you follow community-endorsed interoperability best practices? Which ones?

Data and metadata vocabularies, while not adherent to any specific standard, will align and closely follow the best practices linked to the CST (concentrated solar thermal) and CSP (concentrated solar power) scientific communities, to whom the data and metadata will be the most useful and to whom most researchers involved in the project belong.

2.3.2. In case it is unavoidable that you use uncommon or generate project specific ontologies or vocabularies, will you provide mappings to more commonly used ontologies? Will you openly publish the generated ontologies or vocabularies to allow reusing, refining or extending them?

This question does not apply to the Powder2Power consortium.

2.3.3. Will your data include qualified references to other data (e.g. other data from your project, or datasets from previous research)?

Datasets from previous research, notably within the framework of the FP7 project CSP2 and the H2020 project Next-CSP, will be used within the context of Powder2Power.

2.4. Increase data re-use

2.4.1. How will you provide documentation needed to validate data analysis and facilitate data re-use (e.g. readme files with information on methodology, codebooks, data cleaning, analyses, variable definitions, units of measurement, etc.)?

All documentation needed to validate data analysis and facilitate data re-use will be given in the form of project deliverables and scientific publications associated to the project's research and technological advancements.

2.4.2. Will your data be made freely available in the public domain to permit the widest re-use possible? Will your data be licensed using standard re-use licences, in line with the obligations set out in the Grant Agreement?

Data will be made freely available in the public domain for public data. However, restricted licences will apply for sensitive data.

2.4.3. Will the data produced in the project be usable by third parties, in particular after the end of the project?

Yes, data produced in the project will be usable by third parties, both during the project and after it ends.

2.4.4. Will the provenance of the data be thoroughly documented using the appropriate standards?

Yes, data provenance will be thoroughly documented according to Zenodo's best practices whenever applicable.

2.4.5. Describe all relevant data quality assurance processes.

Data quality will be ensured by the Data Management Committee (DMC), which will be made up of a Project Data Manager (a PMT member), WP Data Managers for each WP (a correspondent appointed by each WP leader), and a Dissemination Officer (a correspondent appointed by the Project Data Manager). The Data Management Committee will convene six times, thus holding meetings every eight months, which corresponds to two meetings per reporting period throughout the project's lifetime, to statute on whether data is being generated and stored according to applicable quality and legal processes. The DMC votes under the same provisions contained in the Consortium Agreement and upon their voting results it will give feedback to WP leaders on their WP's generation and storage of data.

2.4.6. Further to the FAIR principles, DMPs should also address research outputs other than data, and should carefully consider aspects related to the allocation of resources, data security and ethical aspects.

Potential decisions on research outputs other than data will be made by the Data Management Committee after careful consideration of all dynamics and dimensions involved, including the allocation of resources, ethical aspects, and data security.

3. Other research outputs

3.1. In addition to the management of data, beneficiaries should also consider and plan for the management of other research outputs that may be generated or re-used throughout their projects. Such outputs can be either digital (e.g. software, workflows, protocols, models, etc.) or physical (e.g. new materials, antibodies, reagents, samples, etc.).

Digital and physical research outputs remain proprietary for the partners that developed or own them, in particular when it comes to software of physical research outputs.

3.2. Beneficiaries should consider which of the questions pertaining to FAIR data above, can apply to the management of other research outputs, and should strive to provide sufficient detail on how their research outputs will be managed and shared, or made available for re-use, in line with the FAIR principles.

The project's main research output is the pilot solar tower developed under WP3. As per the grant agreement, the depository or owner, in this case PROMES-CNRS, keeps decision-making rights. Other partners will be free to use the pilot tower for experiments and testing for two years after the end of the project at their operational expense.

4. Allocation of resources

4.1. What will the costs be for making data or other research outputs FAIR in your project (e.g. direct and indirect costs related to storage, archiving, re-use, security, etc.)?

Data upload and storage costs are covered by Zenodo, thus in principle there are no dedicated direct or indirect costs for consortium partners.

4.2. How will these be covered? Note that costs related to research data/output management are eligible as part of the Horizon Europe grant (if compliant with the Grant Agreement conditions).

This question does not apply to the Powder2Power consortium.

4.3. Who will be responsible for data management in your project?

The Project Data Manager (a PMT member) will be directly responsible for data management in the project in conjunction with the wider Data Management Committee, whose structure has been outlined in section 2.4.5 of this deliverable.

4.4. How will long-term preservation be ensured? Discuss the necessary resources to accomplish this (costs and potential value, who decides and how, what data will be kept and for how long)?

The long-term preservation of data generated by the project is ensured by the reliability of Zenodo's service to the European scientific community.

5. Data security

5.1. What provisions are or will be in place for data security (including data recovery as well as secure storage/archiving and transfer of sensitive data)?

Data security protocols within the project are a combination of Zenodo data security protocols and data security protocols in place at each of the consortium partners.

5.2. Will the data be safely stored in trusted repositories for long term preservation and curation?

Indeed, it will, once again in Zenodo as well as internal repositories used by each of the consortium partners.

6. Ethics

6.1. Are there, or could there be, any ethics or legal issues that can have an impact on data sharing? These can also be discussed in the context of the ethics review. If relevant, include references to ethics deliverables and ethics chapter in the Description of the Action (DoA).

We expect no ethics or legal issues arising from research carried out within the framework of the project, hence this question does not apply to the Powder2Power consortium.

6.2. Will informed consent for data sharing and long term preservation be included in questionnaires dealing with personal data?

This question does not apply to the Powder2Power consortium.

7. Other issues

7.1. Do you, or will you, make use of other national/funder/sectorial/departmental procedures for data management? If yes, which ones (please list and briefly describe them)?

Other than the procedures outlined in the DMP, consortium partners engage to manage data in a way that is compliant with their internal best practices and the national law provisions applicable to them.

Appendix A. Dataset table model

Table 1. Dataset name

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