Upgraded High Temperature Heat in Energy Intensive Sectors Upheat-INES2

A Data Management Plan created using DMPonline.be

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Project abstract:
The project develops a **proof-of-concept very high temperature vapor compression heat pump that delivers heat sink temperatures between 160 °C-200 °C**. The performance of the system is evaluated based on the COP for given heat sink and source temperatures and output powers. Second law efficiencies between 40 % – 60 % are expected with a minimal COP of 2.4.

The proof-of-concept system operates with a **zeotropic water-ammonia working fluid mixture**. The addition of ammonia is key in achieving a high COP and increases the optimal integration potential.

In order to unlock the potential of water-ammonia vapor compression heat pumps, suitable construction and sealing materials have to be identified. These materials need to withstand the high pressures and temperatures, the contact with the water-ammonia mixture and have desirable mechanical properties required for the manufacturability. **Suitable materials for the construction and design of water-ammonia VHT-HPs are identified, tested and selected**.

The design, control and fault detection in heat pumps are often treated separately. The present project presents a **combined design, control and operation strategy** taking into account the variability of the heat source on multiple time scales. Based on validated dynamic heat pump models, a robust controller, optimized together with the design specifications is made. Both static and temporal performance metrics for fault detection and diagnosis are assessed.

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Upgraded High Temperature Heat in Energy Intensive Sectors Upheat-INES2 VLAIO DMP (Flemish Standard DMP)

1. Research Data Summary

List and describe all datasets or research materials that you plan to generate/collect or reuse during your research project. For each dataset or data type (observational, experimental etc.), provide a short name & description (sufficient for yourself to know what data it is about), indicate whether the data are newly generated/collected or reused, digital or physical, also indicate the type of the data (the kind of content), its technical format (file extension), and an estimate of the upper limit of the volume of the data.

Dataset Name	Description	New or reused	Digital or Physical	Only for digital data Digital Data Type	Only for digital data Digital Data format	Only for digital data Digital data volume (MB/GB/TB)	Only for physical data Physical volume
		Please choose from the following options: • Generate new data • Reuse existing data	*Please choose from the following options:* • Digital • Physical	*Please choose from the following options:* • Observational • Experimental • Compiled/aggregated data • Simulation data • Software • Other • NA	*Please choose from the following options:* • .por, .xml, .tab, .cvs,.pdf, .txt, .rtf, .dwg, .gml, ... • NA	*Please choose from the following options:* • <100MB • <1GB • <100GB • <1TB • <5TB • <10TB • <50TB • >50TB • NA	
Samples for materials compatibility testing	Samples for testing the materials compatibility with water ammonia in WP1	Generate new data	Physical	NA	*NA*	*NA*	<1 m3
Software codes	Software codes for the models developed in WP1 and WP2	Generate new data	Digital	Software	.py, .mo	*<1 GB*	NA
Simulation results	Results obtained by running the software codes	Generate new data	Digital	Simulation data	.cvs,.pdf, .txt, .rtf	*<100GB*	NA
Experimental setup specifications	Description and design specifications (P&ID) of the experimental setups used in WP3	Generate new data	Digital	Compiled/aggregated data	.cvs,.pdf, .txt, .rtf, .dwg,	*<1 GB*	NA
Experimental data and test matrix	Testing conditions and measured values (WP3)	Generate new data	Digital	Experimental	.cvs,.pdf, .txt, .rtf,	*<100GB*	NA

If you reuse existing data, please specify the source, preferably by using a persistent identifier (e.g. DOI, Handle, URL etc.) per dataset or data type:

Data reused are:

- Task1.1. Materials databases (https://www.matweb.com/)
- Task1.3 and Task2.1. Fluid properties: CoolProp database (http://www.coolprop.org/) and Refprop database (https://www.nist.gov/srd/refprop)

Are there any ethical issues concerning the creation and/or use of the data (e.g. experiments on humans or animals, dual use)? Describe these issues in the comment section. Please refer to specific datasets or data types when appropriate.

- No

Will you process personal data? If so, briefly describe the kind of personal data you will use in the comment section. Please refer to specific datasets or data types when appropriate.

- No

Does your work have potential for commercial valorization (e.g. tech transfer, for example spin-offs, commercial exploitation, ...)? If so, please comment per dataset or data type where appropriate.

- Yes

All the results/data generated by the project undergoes the Intellectual Property Agreement signed by the parties within the Moonshot framework.

Do existing 3rd party agreements restrict exploitation or dissemination of the data you (re)use (e.g. Material/Data transfer agreements/ research collaboration agreements)? If so, please explain in the comment section to what data they relate and what restrictions are in place.

- No

Are there any other legal issues, such as intellectual property rights and ownership, to be managed related to the data you (re)use? If so, please explain in the comment section to what data they relate and which restrictions will be asserted.

- Yes

As above mentioned all the project results should comply with "SAMENWERKINGSOVEREENKOMST - MOONSHOT 2022 Strategisch BasisOnderzoek"

2. Documentation and Metadata

Clearly describe what approach will be followed to capture the accompanying information necessary to keep data understandable and usable, for yourself and others, now and in the future (e.g., in terms of documentation levels and types required, procedures used, Electronic Lab Notebooks, README.txt files, Codebook.tsv etc. where this information is recorded).

In order to make data understandable and easy to use, naming conventions for files and folders will be introduced.
A hierarchical structure of the folders will be used and they will be divided per work packages/tasks, the latter will also be the basis reference to name the folders. The files name will refer to: file content (code/simulation/measurement/),date of data capturing, reference person who generated the file. In each folder a readme.txt file will be included to explain the content of the folder and dictionary used. Search key words will be listed also in the readme file.
All adaptations to and processing of the dataset will be documented. Major changes will lead to a new version of the dataset which will be indicated using a hierarchical numbering scheme (v1.0; v1.1, etc).
The data produced will be interoperable, they will adhere to standards for format (e.g. .csv, .txt, .pdf, .py, etc) and open software applications will be the first choice every time it is possible.
Regarding software codes, within each function or object, a brief description of the function or object will be provided.

Will a metadata standard be used to make it easier to find and reuse the data? If so, please specify (where appropriate per dataset or data type) which metadata standard will be used. If not, please specify (where appropriate per dataset or data type) which metadata will be created to make the data easier to find and reuse.

- Yes

The metadata model (DataCite) will be taken as reference. It is the reference metadata standard for RDR (pronounced "Radar"), the KU Leuven's institutional research data repository for the publication of research data.

3. Data storage & back-up during the research project

Where will the data be stored?

The data for the all project will be stored in OneDrive, the institutional repository of UGent.
The research group of KU Leuven will also use its institutional OneDrive repository for intermediate data of its own research tasks.
The software codes will be uploaded also on a GitHub repository, owned by UGent.
The physical samples will be stored in the Thermotechnical lab of UGent

How will the data be backed up?

Standard back-up provided by Ughent and KU Leuven ICTS for OneDrive repository.
In particular the most important back-up is on the UGent ATHT-share, which is on the DICTservers. These shares are managed by DICT, who take regular snapshots of the shares. These can be used in the extreme case that the back-ups mentioned above would be lost.
Papers will be backed up on the biblio.ugent.be environment and Lirias of KUL.

Is there currently sufficient storage & backup capacity during the project? If yes, specify concisely.
If no or insufficient storage or backup capacities are available, then explain how this will be taken care of.

- Yes

Currently the Share (managed by DICT UGhent) has 1PB of free space left

How will you ensure that the data are securely stored and not accessed or modified by unauthorized persons?

All the above mentioned repositories require an authentication to access the data, this allow the access only to people participating in the project and authorized by the storage owner.

What are the expected costs for data storage and backup during the research project? How will these costs be covered?

No costs are expected for the foreseen size of the data to be stored (OneDrive, H-disk and DICT-servers can be used free of charge by researchers of Ugent University. The same at KUL below a storage size of 5TB)

4. Data preservation after the end of the research project

Which data will be retained for at least five years (or longer, in agreement with other retention policies that are applicable) after the end of the project? In case some data cannot be preserved, clearly state the reasons for this (e.g. legal or contractual restrictions, storage/budget issues, institutional policies...).

All data will be preserved for 10 years (according to KU Leuven RDM policy)
Data will be selected and redundant and temporary data generated while running the project will be discarded.

Where will these data be archived (stored and curated for the long-term)?

The long term storage will be on the ATHT Share, which is managed centrally at UGent by DICT.
KU Leuven RDR.

What are the expected costs for data preservation during the expected retention period? How will these costs be covered?

For the expected volume of the archived data, no costs are expected.

5. Data sharing and reuse

Will the data (or part of the data) be made available for reuse after/during the project? In the comment section please explain per dataset or data type which data will be made available.

- Yes, in a restricted access repository (after approval, institutional access only, ...)

All data

If access is restricted, please specify who will be able to access the data and under what conditions.

Members of the research groups of the project will be able to access all the data.

Are there any factors that restrict or prevent the sharing of (some of) the data (e.g. as defined in an agreement with a 3rd party, legal restrictions)? Please explain in the comment section per dataset or data type where appropriate.

- Yes, Other

The sharing of data and results have to be compliant with the collaboration agreement within the Moonshot framework.

Where will the data be made available? If already known, please provide a repository per dataset or data type.

The data will remain on the previously mentioned repositories and made available with restricted access upon request.

When will the data be made available?

An embargo applies to data to be used in publications or to software codes in development phase. The data will be made available when ready for dissemination activities.

Which data usage licenses are you going to provide? If none, please explain why.

The following licenses will be considered:
GNU GPL-3.0 (code)
CC-BY 4.0 (data)

Do you intend to add a PID/DOI/accession number to your dataset(s)? If already available, you have the option to provide it in the comment section.

- Yes

Yes, a PID will be added upon deposit in a data repository

What are the expected costs for data sharing? How will these costs be covered?

NA

6. Responsibilities

Who will manage data documentation and metadata during the research project?

Each researd group will be in charge to manage the data that they will generate with their own activities

Who will manage data storage and backup during the research project?

The coordinator of the project (Steven Lecompte, UGhent), will be in charge to manager the storage and back up during the project

Who will manage data preservation and sharing?

The coordinator of the project (Steven Lecompte, UGhent), will be in charge to manager data preservation and sharing

Who will update and implement this DMP?

The coordinator of the project (Steven Lecompte, UGhent), will be in charge to update and implement the DMP

Upgraded High Temperature Heat in Energy Intensive Sectors Upheat-INES2 GDPR

GDPR

Have you registered personal data processing activities for this project?

- No

DPIA

Have you performed a DPIA for the personal data processing activities for this project?

- Not applicable

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