Data management plan – midterm update

PROJECT INFORMATION

GRANT AGREEMENT NUMBER	826323
PROJECT FULL TITLE	Low Cost Interconnects with highly improved Contact Strength for SOC Applications
PROJECT ACRONYM	LOWCOST-IC
FUNDING SCHEME	FCH-JU2
START DATE OF THE PROJECT	1/1-2019
DURATION	36 months
CALL IDENTIFIER	H2020-JTI-FCH-2018-1
PROJECT WEBSITE	www.lowcost-ic.eu

DELIVERABLE INFORMATION

WP NO.	1
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CONTRIBUTING PARTNERS	All
NATURE	ORDP: Open Research Data Pilot
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CONTRACTUAL DEADLINE	Midterm update
DELIVERY DATE TO EC	29-08-2019

VERSION HISTORY

30-03-2019	Version 1, accepted by all partners
29-08-2020	Version 2, updated at midterm, accepted by all partners

DISSEMINATION LEVEL

PU	Public	X
PP	Restricted to other programme participants (incl. Commission Services)	
RE	Restricted to a group specified by the consortium (incl. Commission Services)	
CO	Confidential, only for the members of the consortium (incl. Commission Services)	

1 Introduction

This document introduces the second version of the LOWCOST-IC data management plan and is prepared for the midterm reporting. It describes how data collected or generated by the project will be organised, stored and shared.
It specifies which data will be open access and which will be confidential within the consortium, as far as it is possible to do so at this stage.
LOWCOST-IC has 10 partners who each contribute with a number of datasets. The data summary section is divided into 10 subsections, each representing a partner's data summary. LOWCOST-IC's partners are a mixture of universities/research institutions and companies which is also reflected in the openness of the data created in the project.

2 Project summary

Lower costs and a better long-term stability are needed to accelerate commercialization of Solid Oxide Cell (SOC) technology. Among the enduring challenges is degradation related to the steel interconnect (IC) material and insufficient robustness of the contact between the IC and the cell. LOWCOST-IC will tackle these issues by developing, fabricating and demonstrating low-cost ICs and exceptionally tough contact layers for use in SOC stacks.
Novel robust contact layers, utilizing the concept of reactive oxidative bonding, will substantially improve the mechanical contact between the cell and the interconnect, while ensuring a low and stable area specific resistance. The cost of SOC ICs will be reduced by combining cost-effective high volume steel grades with highly protective coatings. Large-scale mass manufacturing methods will be demonstrated for application of the coating by physical vapour deposition (PVD), for subsequent shaping of the ICs by hydroforming and finally for fast printing of contact layers by a drop-on-demand process. Novel computationally efficient stack models will together with hydroforming be customized to decrease the prototyping costs and thereby accelerate IC development.
The new interconnect steels, coatings and contact layers will be implemented in the SOC stacks of two commercial manufacturers and undergo extensive testing in an industrially relevant environment. Finally, the cost-effectiveness of the proposed production route will be assessed and compared with existing production routes to facilitate a fast market entry of the project innovations.
The overall effort will bring the technological solutions from their current TRL 3 to TRL 5. To achieve the optimum output, the LOWCOST-IC consortium comprises the entire interconnect and contact layer supply chain.

Project objectives and sub-objectives:

1. **Increasing the robustness and thus lifetime of the stacks by:**

    a) Introducing contact layers based on a novel reactive oxidative bonding concept, which will increase the mechanical fracture energy of the cell-interconnect contact by > 200 % compared to state-of-the-art contact materials.

    b) Applying highly protective coatings on both the air and the fuel side of the interconnect, thereby reducing the Ohmic resistance across the interconnect to < 15 mΩcm2 at 750°C and < 20 mΩcm2 at 850°C (evaluated after 3,000 h). The combination of the protective coating and a robust contact layer will reduce ASR-degradation to < 5 mΩcm^2 per 10 thermal cycles.

c) Developing novel interconnect designs that reduce the maximum stress by > 30 % in the cell interconnect interface, while maintaining a low pressure drop (< 30 mbar), by use of computationally highly efficient SOC stack models.

d) Demonstrating stable operation for > 3000 hours and 50 cycles with the new contact layers and coated interconnects in multiple 1 kW stacks.

2. Minimizing the interconnect development and production costs by:

a) Introducing cheaper high-volume steel grades that reduce the interconnect raw material cost by > 80 %. The interconnect performance and lifetime will be retained by applying cost-effective protective coatings.

b) Demonstrating the feasibility of combining state-of-the-art large-scale roll-to-roll manufacturing methods for *both* interconnect coating and shaping, and a fast drop-on-demand (DoD) printing (40 m/min) technology for application of the contact layer. This will reduce the fabrication costs to < 5 € per unit of interconnect including coatings and contact materials for processing at 50 MW/year capacity.

c) Demonstrating a flexible and cost-effective interconnect development route with design iteration cost < 10 % of SoA, by using computationally highly efficient SOC stack models (> x10 faster than conventional models) for designing and hydroforming for shaping the interconnect.

3 Data Summary

The objective of the LOWCOST-IC project is to contribute to the successful upscaling and widespread commercialization of solid oxide fuel cells (SOFC) by addressing the SOFC's interconnects and their interface with the electrode.

The research data will be collected in order to lower the cost and minimize the degradation of the interconnects as well as increase robustness of the contact layer in the interface between the interconnect and the air electrodes in SOFC stacks. This requires collection of data in several areas:

i) Experimental data in order to produce, test and optimize the interconnect coating, the shaping of it and the contact layer.
ii) Data from computer-based methods in order to support the experimental work, primarily the shaping.
iii) Data generated and collected in order to optimize and scale the production of interconnects, shaping and contact layer.
iv) Data generated and collected in order to assess the competitiveness of the technology against alternative production methods.

The contribution from each partner is described in the sections below.

Table 3.1. Overview of the data generation for all partners.

Partner	Data will be generated/collected in order to	The generated/collected data supports to the project objective by
DTU (Technical University of Denmark)	investigate and optimize the novel reactive bonded contact layers, to optimize interconnect geometry of fuel cell stack and to investigate mechanical properties of coating and interconnect	providing a more robust contact solution for the fuel cell stacks and by increasing robustness of the stack by minimizing thermal stresses
APE (Aperam)	No data collection	No data collection
AVL (AVL)	reduce the SOC interconnect cost	reducing raw materials cost by > 80 % by exchanging interconnect steels, reducing fabrication costs to < 5 € per unit at 50 MW/year capacity and by reducing costs of design iterations to < 10 % by a more efficient interconnect development route
BOR (Borit)	investigate and quantify the difference between the reality and the drawing (depth of the channels, radii, draft angle,….). This will be used to help guide the design of the new interconnect.	providing input on manufacturing capabilities to be included in the interconnect design
CU (Chalmers)	investigate degradations mechanism in interconnect materials, and test and improve coatings to mitigate degradation.	facilitating a low cost interconnect
FZJ (FZ Jülich)	optimize interconnect geometry and material of fuel cell stack and test the stack performances with optimized interconnects and contact material	increasing robustness of the stack by minimizing thermal stresses as well as reducing manufacturing costs of the interconnect and by generating electrochemical results and a comparison with respect to SoA materials
SMT (Sandvik)	optimize coated stainless steel strip for SOFC interconnects	evaluating the coating and stainless steel grade variations
SOL (SolidPower)	test stack performances and degradation with new interconnects materials	generating electrochemical results and a comparison with respect to SoA materials.

SUN (Sunfire)	test stack degradation with new coatings and cathode ribs	generating degradation data.
TI (Tecno Italia)	the deposition of conductive paste on SOFCs interconnects	providing a method of deposition of the developed paste able to selected the application points

3.1 Data Summary - DTU

Table 3.2. Data Summary I – Data categories

Data will be generated/collected in order to investigate and optimize the novel reactive bonded contact layers, to optimize interconnect geometry of fuel cell stack and to investigate mechanical properties of coating and interconnect	
The generated/collected data supports to the project objective by providing a more robust contact solution for the fuel cell stacks and by increasing robustness of the stack by minimizing thermal stresses	
Data category number	**Data categories**
1	Processing data for making contact layers
2	Area specific resistance test data of novel contact layers
3	Mechanical test data of novel contact layers
4	Simulation data from multiphysics stack model to optimize interconnect geometry
5	Microscopy data for broken specimens and stack components
6	Dilatometry and gravitometry data of oxidizing contact layer

Table 3.3. Data Summary II – Information on data categories

Data category number	Data category	What does the data describe	How is the data generated	Data type	Data format

1	Processing data for making contact layers	Physical properties of the ink for printing the contact layers. Quality of screen-printed layers.	Rheometer, laser profilometer,	Report	Ascii text file
2	Mechanical test data of novel contact layers	The fracture energy between the contact layer and the interconnect	4 point bending of notched sandwich	Table	Ascii text file
3	Area specific resistance test data of novel contact layers	Area specific resistance of novel contact layer and adjacent layers through ageing	Voltage measurements over stacked repeating units	Table	Ascii text file
4	Simulation data from multiphysics stack model to optimize interconnect geometry	Simulated variation of various interacting physical phenomena in the fuel cell stacks	Comsol Multiphysics	Model file	*.mph
5	Microscopy data for specimens and stack components	Microstructure and composition of fracture interfaces	Scanning electron microscrope with energy-dispersive X-ray spectroscopy	Images	Jpeg
6	Dilatometry and gravitometry data of oxidizing contact layer	The expansion and change of phase of contact layers during oxidation with increasing temperature	Dilatometer, X-ray diffractometer	Table	Ascii text file

Table 3.4. Data Summary III – Datasets generated outside the project that will be used in the project (data not in Table 1 and 2)

Datasets that will be reused	Origin of the reused data	Any restriction on the openness and use of the reused data

Reference measurements of conventional perovskite contact layers	Internal DTU project on stack development, DTU Stack Platform	Data has been published in *ACS Appl. Energy Mater.* 2020, 3, 3, 2372–2385

Table 3.5. Data Summary IV – Dataset generated within the project (data listed in Table 1 and 2)

Datasets generated within the project	**Origin of the data**	**Possible reasoned restriction on the openness and use of the generated data**
Processing data for making contact layers	DTU Energy processing laboratory	The measurements themselves will be open. The composition of binder system is DTU IPR (background), which will not be open.
Mechanical test data of novel contact layers	DTU Energy mechanical test laboratory	**Open**: published as stand-alone data or in connection with the journal paper analysing the data
Area specific resistance test data of novel contact layers	DTU Energy electrochemical characterization laboratory	**Open**: published as stand-alone data or in connection with the journal paper analysing the data
Simulation data from multiphysics stack model to optimize interconnect geometry	Using Comsol Multiphysics software on own workstations	Base line data used is from Sunfire, and these data are not open. New results (foreground) will be open after having been investigated for possible IP.
Microscopy data for specimens and stack components	On DTU Energy microscropes	**Open**: published as stand-alone data or in connection with the journal paper analysing the data Publications have been submitted / is in preparation.
Dilatometry and gravitometry data of oxidizing contact layer	DTU Energy processing laboratory	**Open**: published as stand-alone data or in connection with the journal paper analysing the data

Table 3.6. Size of data

Size of data	MB-GB

Table 3.7. Data utility

Outline the data utility, i.e, for whom will it be useful	Academia and industry working with solid oxide cells and stacks

3.2 Data Summary – APE

Aperam will be supplying samples only and will not generate other data. Data attached to certificates of the samples are public.

3.3 Data summary – AVL

Data Summary I – Data categories

Table 3.8

Data will be generated/collected in order to reduce the SOC interconnect cost	
The generated/collected data supports to the project objective by reducing raw materials cost by > 80 % by exchanging interconnect steels, reducing fabrication costs to < 5 € per unit at 50 MW/year capacity and by reducing costs of design iterations to < 10 % by a more efficient interconnect development route	
Data category number	**Data category**
1	Raw materials and manufacturing costs

Table 3.9. Data Summary II – Information on data categories

Data category	**What does the data describe**	**How is the data generated**	**Data type**	**Data format**
Raw materials and manufacturing costs	Mapping og the cost of the interconnect by breaking down the cost of raw materials and the different processing steps. Economy of scale for two different processing routes	Collecting relevant numbers from partners Simulating economic scenarios	Report	Word

	Cost of the SOC technology			

Table 3.10. Data Summary III – Datasets generated outside the project that will be used in the project (data not in Table 1 and 2)

Datasets that will be reused	Origin of the reused data	Any restriction on the openness and use of the reused data
None		

Table 3.11. Data Summary IV – Dataset generated within the project (data listed in Table 1 and 2)

Datasets generated within the project	Origin of the data	Possible reasoned restriction on the openness and use of the generated data
Raw materials and manufacturing costs	Partners know how	Confidential data – data will be harmonized for public reports

Table 3.12. Size of data

Size of data	MB-range

Table 3.13. Data utility

Outline the data utility, i.e, for whom will it be useful	Industry to reduce production and IC costs

3.4 Data Summary – BOR

Table 3.14. Data Summary I – Data categories

Data will be generated/collected in order to investigate and quantify the difference between the reality and the drawing (depth of the channels, radii, draft angle etc). This will be used to help guide the design of the new interconnect.	
The generated/collected data supports to the project objective by providing input on manufacturing capabilities to be included in the interconnect design	
Data category number	**Data category**
1	Dimensional characterization of the formed samples

Table 3.15. Data Summary II – Information on data categories

Data category number	Data category	What does the data describe	How is the data generated	Data type	Data format
1	Geometrical dimensions of the formed parts	Dimensions of the formed shape on both sides to the interconnect: channel depth and pitch, draft angle, top and bottom radii.	Stylus measurement	Table, images	Xps file

Table 3.16. Data Summary III – Datasets generated outside the project that will be used in the project (data not in Table 1 and 2)

Datasets that will be reused	Origin of the reused data	Any restriction on the openness and use of the reused data
None		

Table 3.17. Data Summary IV – Dataset generated within the project (data listed in Table 1 and 2)

Datasets generated within the project	Origin of the data	Possible reasoned restriction on the openness and use of the generated data
Geometrical dimensions of the formed parts	Borit measurement room	Design of interconnect/sample is proprietary to Sunfire

Table 3.18. Size of data

Size of data	10 Mb

Table 3.19. Data utility

Outline the data utility, i.e, for whom will it be useful	Only relevant within the project, as the data is very design specific

3.5 Data Summary – CU

Table 3.20, Data Summary I – Data categories

Data will be generated/collected in order to investigate degradations mechanism in interconnect materials. Test and improve coatings to mitigate degradation.	
The generated/collected data supports to the project objective by facilitating a low cost interconnect	
Data category number	**Data categories**
1	Mass gain data: Mass gains of samples during high temperature exposure.
2	Cr evaporation data
3	Area specific resistance data
4	Microstructure characterization data

Table 3.21. Data Summary II – Information on data categories

Data category number	**Data category**	***What does the data describe***	***How is the data generated***	***Data type***	***Data format***
1	Mass gain data	Mass gains of samples during high temperature exposure which is a measure of oxide scale thickness	High temperature exposure in furnace	Table	XLSX
2	Cr evaporation data	Cr volatilization data measured during high temperature exposure	High temperature exposure in furnace	Table	XLSX
3	Area specific resistance data	Electrical resistance of the oxide scale	High temperature exposure in furnace with Pt electrodes attached	Table	XLSX
4	Microstructure characterization data	SEM and TEM analysis		images	TIFF

Table 3.22. Data Summary III – Datasets generated outside the project that will be used in the project (data not in Table 1 and 2)

Datasets that will be reused	**Origin of the reused data**	**Any restriction on the openness and use of the reused data**
None		

Table 3.23. Data Summary IV – Dataset generated within the project (data listed in Table 1 and 2)

Datasets generated within the project	**Origin of the data**	**Possible reasoned restriction on the openness and use of the generated data**

Mass gain data	Chalmers – Dept. of Chemistry and Chem. Engineering	**Open**: published as stand-alone data or in connection with the journal paper analysing the data
Cr evaporation data	Chalmers – Dept. of Chemistry and Chem. Engineering	**Open**: published as stand-alone data or in connection with the journal paper analysing the data
Area specific resistance data	Chalmers – Dept. of Chemistry and Chem. Engineering	**Restricted openness – business secret**: data that might relate to business secrets will be kept confidential until the relevant partners have reviewed the data and possibly accepted that the data can be realised for publication.
Microstructure characterization data	Chalmers – Dept. of Chemistry and Chem. Engineering	**Restricted openness – business secret**: data that might relate to business secrets will be kept confidential until the relevant partners have reviewed the data and possibly accepted that the data can be realised for publication.

Table 3.24. Size of data

Size of data	~5 GB

Table 3.25. Data utility

Outline the data utility, i.e, for whom will it be useful	Academia working in the same field

3.6 Data Summary – FZJ

Table 3.26 Data Summary I – Data categories

Data will be generated/collected in order to optimize interconnect geometry and material of fuel cell stack and test the stack performances with optimized interconnects and contact material	
The generated/collected data supports to the project objective by increasing robustness of the stack by minimizing thermal stresses as well as reducing manufacturing costs of the interconnect and by generating electrochemical results and a comparison with respect to SoA materials	
Data category number	**Data category**

1	Simulation data from flow model to optimize interconnect geometry
2	Drawings and CAD Models of interconnect
3	Stack characterization data (I/V, ASR, fuel/air flow, Temperatures)
4	Microscopy data for broken specimens and stack components
5	Visual inspection data of post-test stack components

Table 3.27. Data Summary II – Information on data categories

Data category number	**Data category**	**What does the data describe**	**How is the data generated**	**Data type**	**Data format**
1	Simulation data from flow model to optimize interconnect geometry	Flow distribution in interconnect and pressure drop	Navier Stokes approach	Model file, diagrams	
2	Drawings and CAD Models of interconnect	Interconnect	CAD modelling	3D-model, CAD Drawing	CAT CAD files, stp files, pdf files
3	Stack characterization data (I/V, ASR, fuel/air flow, Temperatures)	Stack performance, temperatures, gas flows	Stack test measurements	Table, plots	Asci text file, xlsx
4	Microscopy data for specimens and stack components	Interconnect geometry, stack set-up, components interfaces, microstructures and compositions	Microscopy, Scanning electron microscrope	images	jpeg
5	Visual inspection data of post-test stack components	Interconnect geometry, stack set-up, components interfaces,	photography	images	jpeg

		microstructures and compositions			

Table 3.28. Data Summary III – Datasets generated outside the project that will be used in the project (data not in Table 1 and 2)

Datasets that will be reused	**Origin of the reused data**	**Any restriction on the openness and use of the reused data**
Drawings and 3D-Model of Sunfire interconnect	Sunfire	Data is confidential/restricted

Table 3.29. Data Summary IV – Dataset generated within the project (data listed in Table 1 and 2)

Datasets generated within the project	**Origin of the data**	**Possible reasoned restriction on the openness and use of the generated data**
1. Simulation data from flow model to optimize interconnect geometry	Own workstations	Modelling constraints data is confidential/restricted to Sunfire
2. Drawings and CAD Models of interconnect	Own workstation and computer	Drawings and CAD Models of interconnect are confidential/restricted to Sunfire.
3. Stack characterization data (I/V, ASR, fuel/air flow, Temperatures)	Own test benches	Data will be published after having been investigated for possible IP with Partner.
4. Microscopy data for specimens and stack components	On own microscropes	Data will be published after having been investigated for possible IP.
5. Visual inspection data of post-test stack components	On own photography lab	Data will be published after having been investigated for possible IP.

Table 3.30. Size of data

Size of data	MB-GB

Table 3.31. Data utility

Outline the data utility, i.e, for whom will it be useful	Research and industry working with solid oxide cells and stacks

3.7 Data Summary – SMT

Table 3.32. Data Summary I – Data categories

Data will be generated/collected in order to optimize coated stainless steel strip for SOFC interconnects	
The generated/collected data supports to the project objective by evaluating the coating and stainless steel grade variations	
Data category number	**Data category**
1	Chemistry and microstructure of materials and components

Table 3.33. Data Summary II – Information on data categories

Data category number	Data category	What does the data describe	How is the data generated	Data type	Data format
1	Chemistry and microstructure of materials and components	Stability and performance of investigated components, devices and systems, microstructural evolution, critical degradation reactions	SEM and EDS	Images, graphs	Aztex-files, jpeg

Table 3.34. Data Summary III – Datasets generated outside the project that will be used in the project (data not in Table 1 and 2)

Datasets that will be reused	Origin of the reused data	Any restriction on the openness and use of the reused data
None		

Table 3.35. Data Summary IV – Dataset generated within the project (data listed in Table 1 and 2)

Datasets generated within the project	Origin of the data	Possible reasoned restriction on the openness and use of the generated data
Chemistry and microstructure of materials and components	Characterization laboratory at Sandvik Materials Technology, Sandviken, Sweden	**Restricted openness – IPR**: data that might form the basis for IPR will be kept confidential until the data can be released without jeopardising a possible IPR process.

Table 3.36. Size of data

Size of data	Gb range

Table 3.37. Data utility

Outline the data utility, i.e, for whom will it be useful	Academia and Industry

3.8 Data Summary – SOL

Table 3.38. Data Summary I – Data categories

Data will be generated/collected in order to test stack performances and degradation with new interconnects materials	
The generated/collected data supports to the project objective by generating electrochemical results and a comparison with respect to SoA materials.	
Data category number	**Data categories**
1	Stack test performance data
2	Data for LCA analysis

Table 3.39. Data Summary II – Information on data categories

Data category number	**Data category**	**What does the data describe**	**How is the data generated**	**Data type**	**Data format**
1	Stack test performance data	Performance and durability of investigated stack interconnects materials Failure mechanisms at components Cost structure and targets for the developed technology	During stack testing post operation analyses Own data	Table, plots, reports	*docx, *.xlsx
2	Data for LCA analysis	Environmental and climate impact of the units investigated Market opportunities for the developed technology	Own data	table	xlsx

Table 3.40. Data Summary III – Datasets generated outside the project that will be used in the project (data not in Table 1 and 2)

Datasets that will be reused	Origin of the reused data	Any restriction on the openness and use of the reused data
Performances of SoA materials	Own laboratory	SOLIDpower reserves the right to refuse public use of collected data. Data marked confidential must be kept by the partner only, data marked as project internal has to be kept to the project partners only, data marked as open can be openly used. Unmarked data should be treated as project internal.

Table 3.41. Data Summary IV – Dataset generated within the project (data listed in Table 1 and 2)

Datasets generated within the project	Origin of the data	Possible reasoned restriction on the openness and use of the generated data
Stack test performance data	Internal test benches	SOLIDpower reserves the right to refuse public use of collected data. Data marked confidential must be kept by the partner only, data marked as project internal has to be kept to the project partners only, data marked as open can be openly used. Unmarked data should be treated as project internal.
Data for LCA analysis	Own data	SOLIDpower reserves the right to refuse public use of collected data. Data marked confidential must be kept by the partner only, data marked as project internal has to be kept to the project partners only, data marked as open can be openly used. Unmarked data should be treated as project internal.

Table 3.42. Size of data

Size of data	500MB

Table 3.43. Data utility

Outline the data utility, i.e, for whom will it be useful	Industry, research institutes.

3.9 Data Summary – SUN

Table 3.44. Data Summary I – Data categories

Data will be generated/collected in order to test stack degradation with new coatings and cathode ribs	
The generated/collected data supports to the project objective by generating degradation data	
Data category number	**Data category**
1	Stability and performance of components, devices and systems

Table 3.45. Data Summary II – Information on data categories

Data category number	Data category	What does the data describe	How is the data generated	Data type	Data format
1	Stability and performance of components, devices and systems	Stack performance data	Stack test	Table, diagrams	xlsx

Table 3.46. Data Summary III – Datasets generated outside the project that will be used in the project (data not in Table 1 and 2)

Datasets that will be reused	Origin of the reused data	Any restriction on the openness and use of the reused data
None		

Table 3.47. Data Summary IV – Dataset generated within the project (data listed in Table 1 and 2)

Datasets generated within the project	Origin of the data	Possible reasoned restriction on the openness and use of the generated data
Stack performance data	Internal test benches	Restricted data

Table 3.48. Size of data

Size of data	~200 MB

Table 3.49. Data utility

Outline the data utility, i.e, for whom will it be useful	Industry

3.10 Data Summary – TI

Table 3.50. Data Summary I – Data categories

Data will be generated/collected in order to optimize the deposition of conductive paste on SOFCs interconnects	
The generated/collected data supports to the project objective by providing a method of deposition of the developed paste able to selected the application points	
Data category number	**Data category**

1	Materials stability and performance

Table 3.51. Data Summary II – Information on data categories

Data category number	Data category	What does the data describe	How is the data generated	Data type	Data format
1	Materials stability and performance	Stability of the inks to be applied by ink-jet printing, and performance of printer with the new inks Quality control	SEM	Images, table, report	Tiff, docx

Table 3.52. Data Summary III – Datasets generated outside the project that will be used in the project (data not in Table 1 and 2)

Datasets that will be reused (i.e. generated outside the project)	**Origin of the reused data** (e.g. sourced reports/studies, open research literature, internet)	**Any restriction on the openness and use of the reused data**
No datasets outside the project will be used		

Table 3.53. Data Summary IV – Dataset generated within the project (data listed in Table 1 and 2)

Datasets generated within the project	**Origin of the data** (e.g. partners' laboratory, partner's production facility, generated by subcontractors)	**Possible reasoned restriction on the openness and use of the generated data*** (referring to the specific data sets)
Stability of the inks to be applied by ink-jet printing,	Partner's laboratories	Not applicable

and performance of printer with the new inks		

* Include only data sets that you positively know that will have restricted openness and use. The Data Management Plan will include the following statement: "If the project generates data that might form the basis for IP protection, these data will be kept confidential until the IPR situation has been settled." This will allow keeping data that intentionally was meant to be open confidential.

Table 3.54. Size of data

Size of data	1GB

Table 3.55. Data utility

Outline the data utility, i.e, for whom will it be useful	academia working in specific areas, industry within the specific business segment of SOFCs

4 Fair data and publication

All partners confirm that their organizations will strive to comply with the FAIR principles when sharing and publishing data stemming from this project, as described in table 4.1.

Table 4.1. The general agreement on keeping data Findable, Accessible, Interoperable and Re-usable.

F	Documentation of data/storing of metadata for use in the project and beyond	Each partner's responsibility (using the partner's own conventions)
	Documentation of published data	Each partner's responsibility (using publishers standard)
A	Openness of data	Is decided by each partner, however reason must be given if there are restrictions
I	Interoperability will be ensured by metadata vocabularies, standards or methodologies set by publisher/repository	Each partner's responsibility

R	Re-use of published data will be ensured by using FAIR compliant data repositories and licensing/open access with or without embargo	Each partner's responsibility

Data will be published in repositories that fulfill the following

- recognized in the actual research community
- has clear terms and conditions
- provides persistent and unique identifiers, e.g. DOI
- offer standard license agreements for datasets.

The specific repository will be selected by the partner who published the data.

5 Allocation of resources

All partners confirm that the resources needed for managing their organization's data in compliance with H2020 Open data policy is included in my partner budget or will be covered by my organization via other budgets.

6 Data security

Secure storage of the research data is the responsibility of the partner generating the actual data. All partners have agreed to store digital research data exclusively on infrastructure that is subjected to regular backup, that has admission control, and that complies with the responsible partner's IT security policy

7 Other

Table 7.1. Other procedures for data management

Refer to possible national/funder/sectorial/institutional/departmental procedures for data management that regulates your organization's handling of research data (if any).
This data management plan complies with DTU Energy's procedure for Data Management and With the DTU Policy of the Retention of Primary Materials and Data and the Danish Code of Conduct for Research Integrity.

8 Acknowledgment

"This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking under grant agreement No 826323. This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation programme, Hydrogen Europe and Hydrogen Europe research."