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AD ASTRA Deliverable D6.5

"Final versions of the DIMP and PEDER"

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Lead Beneficiary: ENEA

Nature: Open Research Data Pilot

Revision	Submission date	Description
01	27/08/2022	Original "template" version
02	04/10/2022	First version
03	10/11/2022	Second version
04	15/11/2022	Final version

Dissemination level (mark with an x the relevant)		
PU	Public	**X**
CO	Confidential, only for members of the consortium (including the Commission Services)	

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Report title **Final versions of the DIMP and PEDER**	**Deliverable No** D6.5
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Summary In this deliverable the way AD ASTRA manages, exploits, and disseminates the data feeding into and generated by the project is described: data creation, use, analysis, storage, sharing and reuse. This document addresses the requirements of an Open Data Research Pilot and identifies and classifies all knowledge generated in AD ASTRA for maximum effectiveness and ease of use, also after project conclusion, for the benefit of European scientific and technological progress in the field. The deliverable deals with Data accessibility and security, which hinges around the AD ASTRA database. This database is deposited on a dedicated server of the organization coordinating the project (ENEA), located in the Research Centre of Casaccia. The project web site (https://www.ad-astra.eu) is hosted on a generic ENEA server, and has a link embedded to the so-called Private Area where the database server is located (https://www.db.ad-astra.eu/AdAstra, with all the security measures inherent to the ENEA server) which has been developed by partner IEES. It is accessed by partner-specific credentials that have been distributed confidentially within the project. The deliverable also includes the plan for exploitation and dissemination of project results representing the programmed outcome of AD ASTRA activities in terms of exploitable value. Exploitation is considered to be direct – leading to directly correlated benefits for partners and value chain alike – and indirect – leading to increase of know-how and expertise that can increase the potential for innovation all round. Pathways to exploitation are identified and strategy for the dissemination of the knowledge generated is schematically laid out.	

Finally, estimated required resources for FAIR Data management are given and detailed tables identify for each partner both existing data and knowledge feeding into the project as well as a preliminary set of data to be expected.

Key words
Data management, data accessibility, data safety, intellectual property

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1. INTRODUCTION

1.1. Description of the deliverable content and purpose

The purpose of this deliverable is to describe the way AD ASTRA manages the data feeding into and generated by the project: data creation, use, analysis, storage, sharing and reuse. This document addresses the requirements of an Open Data Research Pilot and identifies and classifies all knowledge generated in AD ASTRA for maximum effectiveness and ease of use, also after project conclusion, for the benefit of European scientific and technological progress in the field.

The deliverable deals with Data accessibility and security, estimates required resources for FAIR Data management, and identifies for each partner both existing data and knowledge feeding into the project as well as a preliminary set of data to be expected.

1.2. Deviation from objectives

None.

2. THE AD ASTRA DATA REPOSITORY

2.1. Server, users and accessibility

The AD ASTRA database is deposited on a dedicated server of the organization coordinating the project (ENEA), located in the Research Centre of Casaccia. The project web site (https://www.ad-astra.eu) is hosted on a generic ENEA server, and has a link embedded to the so-called Private Area where the database server is located (https://www.db.ad-astra.eu/AdAstra, with all the security measures inherent to the ENEA server) and accessed by partner-specific credentials that have been distributed confidentially within the project.

The Data Base is structured as an internal communication tool with 6 database levels ("Book of Samples", "Data Bank", "Handbook of Protocols", "Knowledge Pool", "Modeling Data", "Project Resources Pool"). Partner 1 (ENEA) is responsible for hosting the server, the IP monitoring, and data management. Partner 6 (IEES) is responsible for the generation and maintenance of a structured database (registration of users, access, changes, updating etc.). To this effect, IEES has been granted administrator access to the ENEA server location. A Web server SSL certificate has been installed for the domain name to allow secure access by partners using the database.

2.1.1 Conditions, methods and software tools needed to access data

Since the AD ASTRA database is developed as internal communication tool, it acts as accumulation and storage of information and data connected with the implementation of the project. Thus, all data from project activities (experiments, presentations, participation in events, organization of internal and external meetings, collection of important external information, exchange of samples and internal information for preparation of reports, milestones, deliverables etc.) are collected and stored.

Every Partner organization has the right to access database information. The selection of the persons who have free access to the Data Base is done by every Partner's coordinator. A list with the names and e-mail address is given to the Data Base Administrator (authorized member of IEES team) who creates every access account (based on username and initial password). The user may change only the password.

For every operation in the Data Base (entering, downloading, uploading etc.) a Notification is sent to the Data Base Administrator. The users receive Notification from some Sections of the Data Base (important for the project implementation). There is an option to stop receiving Notifications.

There are no restrictions for the users to upload or download data in the 6 levels of the Data Base. The software used to programme the Data Base is open source, but no specific programmes need to be installed by the Data Base users (project partners).

2.1.2 Nomenclature, naming conventions and interoperability of data

For easier operation in the Data Base, Internal Nomenclature and Conventions are accepted. These have been agreed within the project consortium and are mainly for internal communication and operation.

The 6 levels of the Data Base are structured for user-friendly internal communication during the implementation of the project and thus they use standards and formats of available (open) software applications, most often used by the producers of the experimental equipment. The users (members of the Consortium) are from different Institutions and countries. For internal interoperability some project-specific conventions are introduced, but they do not go out of the standard data sets (for Instance SEM images have selected obligatory magnifications which ensure comparison of images from different internal sources, i.e. SEM experiments performed in different laboratories). Proposed changes of the initial (equipment) data formats, for facilitation of the data exchange, can be communicated by the partners via internal communication (with email notification to all users). This is also stored in the Data Base.

The introduction of generalized formatting of electrochemical testing experimental data coming from large numbers of single experiments can be beneficial both for the project and the scientific community. An attempt made to introduce Data storage in single “large structured files (LSF)” created directly during the measurements, or transferred after measurements, instead of operation with big number of single files and re-formatting. The initial formatting (ASCII, or similar) which is usually used by the equipment producers, will nevertheless be kept. Some of the data already double the equipment raw data with LSF format (for instance the testing data of sample 0027_IEES_NEW_002), which demonstrates the advantages for this approach for friendly operation with the data from different users. A friendly software is under development for restructuring of the data formats. The problem comes from the different software products for data collection which the companies producing the testing equipment are developing and using. That brings to the application of “case to case “approach.

Every Data Base level has a Glossary, List of abbreviations and Help for clarification of nomenclature.

2.2 Data re-use and accessibility after the project

The Data Base is currently for internal usage only, but part of it will be collected and developed for use by third parties via the external web site after clearance by all partners. The level of open access will follow the Data and Intellectual property Management Plan (DIMP) and the Plan for the effective dissemination and exploitation of the results (PEDER), which will permit the widest possible re-use. The open access data can be available after the termination of the project via the external web site which should continue its operation for at least 3 years more (pre-paid from the project). Taking into account the innovative character of some of the Data Base levels, the open access Data, which should be a common decision introduced in the present DIMP and realized following the PEDER, will have long term impact. For the same reason the re-use of data generated in AD ASTRA will be governed by a preliminary consultation within the project Consortium where the class of data for public re-use will be agreed on and the specific datasets identified.

The main form of data re-usage will be via publication activities and especially via the selected public deliverables (Workshop and partnering event for dissemination to stakeholders; Review of SOC degradation mechanisms & modelling approaches; Review Paper on SOC degradation submitted to a high-impact Journal).

Alongside with the open access publications, datasets comprised in already published works (via high-impact journals, conference proceedings or workshops) have been gathered and uploaded into the public repository ZENODO (https://zenodo.org/) and can be easily accessed by searching for the project's name or Grant Agreement number. In addition, part of the data from the project Data base which were prepared for Deliverable D.2.3 "Harmonized project inventory of cell/stack data and metadata" are going to be with open access due to internal agreement between the partners. Thus, from the testing and characterization data for 66 project samples included in the Deliverable, 24 samples (36%) will be with open access to the experimental data.

2.3 Data security

The entire ICT infrastructure of ENEA, that hosts – among many other platforms – the AD ASTRA servers, is hosted in a centre for data elaboration with controlled access by authorized personnel only. The entire system is based on the virtual infrastructure VmWare, that all ENEA research centres use according to similar principles. The main server services are replicated (automatically and constantly) in remote centres: when a centre for data elaboration has problems the service/server can be accessed at such a remote centre. All servers are backed up, maintaining daily copies of all data for up to a month. The storage of data, servers, back-ups and replications and all other features of the data infrastructure are SAN/iCSI type and are not certified for long term conservation. Servers that contain personal data are accessed only by authorized personnel, and all accesses (also by administrators) are logged.

3. AD ASTRA PLAN FOR EXPLOITATION AND DISSEMINATION OF RESULTS (PEDER)

This plan for exploitation and dissemination of project results represents the programmed outcome of AD ASTRA activities in terms of exploitable value. Exploitation is considered to be direct – leading to directly correlated benefits for partners and value chain alike – and indirect – leading to increase of know-how and expertise that can increases the potential for innovation all round. Pathways to exploitation are identified and strategy for the management and dissemination of the knowledge generated is schematically laid out.

3.1 Key innovations and their pathway to market

AD ASTRA aims to generate impactful results in terms of both exploitable, industrial tools and fundamental know-how. To foster commercial take-up, these need to be actively promoted towards SOC developers, also via Standards-developing organizations (SDOs). A fixed pathway has been established to process project outcomes (see Table below), covering subsequently:

1. Identification of the result – which are the key innovating aspects?

2. Protection and ownership – who owns results and is formal IP protection called for?

3. Assessment of innovation – identification of the domain (and market) of application

4. Adoption and pathway to market – identification of stakeholders and means for up-take

Result	Ownership	Assessment	Adoption
Generalized methodology for the definition of ASTs and predictive models	All partners	Fault tree analysis diagram specifying data, tools and equations required (WP2)	SOC development & manuf. community, JRC, SDOs
Database correlating failure mechanisms, degradation, manufacturing and operation	IEES, All partners	Knowledge hub (WP2) collecting data generated outside and inside the project	CLEAN HYDROGEN PARTNERSHIP, entire SOCdevelopment community
Protocol for in-situ accel. testing of SOC stacks replicating CHP profile	All partners except UNISA	Comparison with field-tested stacks and validation of repeatability	SOL, SUN, SOC&test bench manufacturers, JRC, SDOs
Protocol for the in-situ accel. testing of SOC stacks replicating P2X profile	All partners except UNISA	Comparison with field-tested stacks and validation of repeatability	SUN, SOL, SOC&test bench manufacturers, JRC, SDOs
Protocol for the accelerated ageing of critical cell parts and assemblies	DTU, ENEA, EPFL, SUN, SOL, UNIGE	Comparison with field-tested components and validation of repeatability	SUN, SOL, SOC&test bench manufacturers, JRC, SDOs
Procedure and protocols for Design of Experiments of cell/stack ASTs	UNISA	Evaluation of number of samples and set of experiments vs. conventional approaches	SUN, SOL, SOC stack manufacturers, JRC, SDOs
Transfer functions from accelerated stress domain to real-world operations	UNISA	Comparison with field-tested components and validation of repeatability	SUN, SOL, SOC stack manufacturers
Fast models for degradation phenomena to be embedded into performance models	UNISA	Comparison with field-tested stacks and validation of repeatability	SUN, SOL, SOC stack manufacturers
Statistical methodologies to enhance significance of experimental data	UNISA, IEES	Validation with field-tested systems and designated experiments	SUN, SOL, SOC and test bench manufacturers
Diagnostic tools for rapid estimation of RUL	UNISA, EIFER	Validation with field-tested systems and designated experiments	SUN, SOL, SOC manufacturers and integrators
Multiscale performance models incorporating degradation processes	CEA, UNIGE	Validation with field-tested systems and designated experiments	SUN, SOL, SOC manufacturers

3.2 Direct exploitation: AD ASTRA technology transfer to industry

The protocols and predictive tools will firstly be tailored to Sunfire and SOLIDpower products, granting them immediate advantage in terms of cost reductions and manufacturing optimization. The predictive tools developed in AD ASTRA will aid at preparing a stack development protocol used by SOLIDpower in the design of prototypes and validation of new materials, thereby serving as an effective bridge between applied research and large-scale manufacturing. In view of SOLIDpower's enlarged manufacturing annual capacity to scale-up volume and start serial production, the timing of AD ASTRA has been perfect, giving the opportunity

to employ AST protocols to attempt reducing time consumption and costs related to the development of new cell/stack prototypes.

As soon as the AST protocols adequately represent real-world stack operation, Sunfire will implement them in their own test benches, with numerous positive impacts. The drastic reduction of cost- intensive testing time required by developing stack components, particularly the electrodes and interconnect, will immediately be a measurable benefit. A stack test for 1000 h has approximately 10 k€ operational costs. At Sunfire, typical testing times to finally evaluate critical stack components are 15 kh for several stacks. By using AST protocols this testing time can be reduced to 3kh and 120k€ can be saved per test. Moreover, it will boost the significance of said tests as they would predict 40kh instead of 15kh of stack operation. Considering current test benches and material evaluations, Sunfire can save millions of euros per year while significantly speeding up the time-to- product cycles, allowing to drive the European SOFC industry ahead of competition.

3.3 Indirect exploitation: fostering EU scientific excellence and technology leadership

The methodological nature of the output of AD ASTRA will generate most impact by being adopted as standard, becoming a common benchmark for evaluation and certification of SOC stacks and components. To this effect, a close collaboration is envisaged with the Joint Research Centre (JRC) as highlighted in the Deliverable 6.6. AD ASTRA know-how will feed the JRC Working group on Harmonization of testing protocols for stationary applications within CLEAN HYDROGEN PARTNERSHIP projects and the International Electrotechnical Commission (IEC). The test procedure models of the CLEAN HYDROGEN PARTNERSHIP Project SOCTESQA will be followed, which were already successfully transformed into a Draft International Standard (IEC 62282-8-101, see www.iec.ch).

The highly advanced test methods, test facilities, characterization tools and modelling approaches that pooled together with the input from the External Advisors, allowed AD ASTRA to generate a global achievement. Thanks to the two SOC manufacturing technologies covered (anode- and electrolyte-supported), the outcomes of AD ASTRA will be implementable for all variants of SOC technology, including segmented-in-series structures as used in Japan. To transfer and leverage the specialized skills developed in AD ASTRA and raise awareness of the approach and protocols being developed, exchange of PhD students and young researchers has been encouraged but covid restrictions played a major role in limiting dramatically the visiting. Furthermore, maximum effectiveness of AD ASTRA meetings and knowledge sharing will be ensured by liaising with key CLEAN HYDROGEN PARTNERSHIP projects such as ID-FAST, GrInHy, ECO, qSOFC, PACE, INSIGHT and RUBY.

3.4 Dissemination of AD ASTRA results

The goal of this document is also to outline the plan followed for the most effective dissemination of the key results obtained in the project to the most fertile audiences. Given the scientific challenge of the project, creating links and exchanges with scientific experts across the world is deemed the first priority, after which spill over to industrial players will follow. To this effect, a team of highly qualified External Advisors has been appointed and engaged to foster real advancement in the understanding and harnessing of the complex degradation effects limiting SOFC lifetime towards AST protocols:

- Prof. Hiroyuki Uchida, Yamanashi University, Japan, project leader of “High-Performance and Durable Electrodes for Reversible Solid Oxide Cells (HPDE-RSOC)”

- Prof. Jong-Ho Lee, Principal Research Scientist at KIST, South Korea, running an important activity on Diagnosis and Suppression of SOC Air Electrode Degradation

- Prof. Xiao-Dong Zhou, University Louisiana, USA, running the DOE project "Employing Accelerated Test Protocols to Improve Robustness, Reliability, and Endurance of SOFC"

A joint review with the Advisors on SOC degradation has been prepared and submitted (i.e. D2.1) to a high-impact scientific journal. The JRC has been also invited as External Advisor to transfer the developed AST protocols to the entire European community of SOC testers.

High-visibility dissemination platforms have been engaged with for the leverage of impact:

- European Energy Research Alliance (EERA), Joint Programme on Fuel Cells and Hydrogen (JP FCH): gathers all important European players in fundamental research on FCH technology, links to the EU SET Plan and can leverage results through their IP repository, annual conference and other knowledge sharing initiatives. EERA also bridges to other energy technology areas, particularly Energy Storage and Advanced Materials

- International Energy Agency (IEA) Technology Collaboration Platform on Advanced Fuel Cells (TCP AFC), Annexes 30, 32, 37: gather important SOC players world-wide representing 13 countries, and provide specialized exchange as well as an informative website and a far- reaching Newsletter where AD ASTRA results can be showcased

- CLEAN HYDROGEN PARTNERSHIP and Hydrogen Europe: gathering all major stakeholders concerned with FCH technology in Europe, this network provides unparalleled opportunity for exchange and transfer of acquired knowhow

Participation to sector events, scientific conferences and exhibitions enriched the dissemination activities towards the scientific community working on energy- related technologies and the business and industrial community as well. Closing the circle of the dissemination activities a workshop and partnering event for dissemination to all stakeholders has been organized together with the consortium of RUBY project, more details on the event can be found in the deliverable D6.4.

A list of the dissemination events in which AD ASTRA has participated is reported hereafter.

Date	Event	Location	Presentation type	Title	Presented by (partner)	Audience (#people)	Comments
17.1.2020	DTU Energy Annual PhD symposium	Denmark	poster	Lifetime prediction of solid oxide cells using machine learning	DTU	scientific, industry (250 people)	
16-19.10.2019	Sofia Electrochemical Days 2019 - SED19	Sofia	oral presentation	Effect of pressure on the oxidation of steels for Solid Oxide Fuel Cell stacks	UNIGE	scientific, industry (100 people)	Authors: P. Piccardo et al.
9-11.12.2019	European fuel cell conference EFC19	Naples	poster, flyers	Developing Accelerated Stress Test Protocols for Solid Oxide Fuel Cells and Electrolysers: the European project AD ASTRA	ENEA	scientific, policy, industry (250 people)	Authors: S. McPhail et al.
9-11.12.2019	European fuel cell conference EFC19	Naples	poster, flyers	Characterization of interconnects operated in stacks up to 20k hours	UNIGE	scientific, policy, industry (250 people)	Authors: R. Spotorno et al.
9-11.12.2019	European fuel cell conference EFC18	Naples	oral presentation	Impedance Studies of Ex-Situ Artificially Aged Ni-YSZ Anode for Accelerated Stress Tests	IEES	scientific, policy, industry (250 people)	Authors: Daria Vladikova, Blagoy Burdin, Dario Montinaro, Paolo Piccardo, Mélanie Rolland, Roberto Spotorno
9-11.12.2019	European fuel cell conference EFC19	Naples	oral presentation	DEVELOPMENT OF A MODEL-BASED ALGORITHM FOR ONLINE DEGRADATION ESTIMATION OF SOLID OXIDE FUEL CELLS	UNISA	scientific, policy, industry (250 people)	Authors: P. Polverino et al.
10-14.5.2020	237th Meeting of the Electrochemical	Montreal	invited presentation	Exchanging Degradation for Durability: Accelerated Stress Test Protocols for Solid Oxide Fuel Cells and Electrolysers	ENEA	scientific, policy, industry (500 people)	submitted and accepted. Conference cancelled due to COVID-19
20-23.10.2020	14th European Fuel Cell Forum	Virtual	oral presentation	Modelling of the oxygen electrode for Solid Oxide Cells: study of the reaction mechanism and of the impact of the LSCF demixing	CEA	scientific, policy, industry (250 people)	Authors: E. Effori, E. Siebert, M. Petitjean, L. Dessemond, J. Laurencin
20-23.10.2020	14th European Fuel Cell Forum	Virtual	Oral presentation	Characterization of Interconnects Operated in Real Stacks up to 8500 hours in a reversible mode	UNIGE	scientific, policy, industry (250 people)	Authors: Paolo Piccardo, Roberto Spotorno, Giorgia Ghiara, Valeria Bongiorno
20-23.10.2020	14th European Fuel Cell Forum	Virtual	poster	Anode and electrolyte supported Solid Oxide Fuel Cells: experimentation and modelling	DTU/UNIGE	scientific, policy, industry (250 people)	Authors: A. K. Padinjarethil, F. R. Bianchi, B. Bosio, A. Hagen
20-23.10.2020	14th European Fuel Cell Forum	Virtual	Oral presentation	Characterization of Interconnects Operated in Real Stacks up to 8500 hours in a reversible mode	UNIGE	scientific, policy, industry (250 people)	Authors: Paolo Piccardo, Roberto Spotorno, Giorgia Ghiara, Valeria Bongiorno
2-3.12.2020	Scientific Session: Scientific achievements of ESHER	Bulgaria	oral presentation	Artificial Aging of Solid Oxide Cells via Redox Cycling	IEES	scientific (50 people)	Authors: Asrar Ahmad Sheikh, Blagoy Burdin, Milena Krapschanska, Daria Vladikova
18-26.01.2021	38°Convegno Nazionale AIM	Virtual	Oral presentation	Metodo innovativo per la quantificazione dell'evaporazione del cromo dagli interconnettori per le pile a combustibile ad ossidi solidi (Solid Oxide Fuel Cells-SOFCs)	UNIGE	scientific, policy, industry (250 people)	Authors: D. Paravidino, R. Spotorno, P. Piccardo
18-26.01.2021	38°Convegno Nazionale AIM	Virtual	Oral presentation	Ossidazione a caldo di acciai inossidabili ferritici per pile a combustibile ad ossidi solidi	UNIGE	scientific, policy, industry (250 people)	Authors: R. Spotorno, D. Paravidino, G. Ghiara, V. Bongiorno, P. Piccardo
5.2-.2021	DTU Energy Annual PhD symposium	Virtual	poster	Deconvolution of Ni-CGO based electrolyte supported solid oxide cells	DTU	scientific, policy, industry (250 people)	Authors: A. K. Padinjarethil, A. Hagen
1-5.06.2021	Processing & Manufacturing of Advanced Materials Processing, Fabrication, Properties, Applications - THERMEC'2021	Virtual	Oral presentation	High-Temperature Oxidation of AISI441 Ferritic Stainless Steel for Solid Oxide Fuel Cells	UNIGE	scientific, policy, industry (500 people)	Authors: R. Spotorno
1-5.06.2021	Processing & Manufacturing of Advanced Materials Processing, Fabrication, Properties, Applications - THERMEC'2021	Virtual	Oral presentation	A Novel Method for Evaluation of Chromium Evaporation from Solid Oxide Fuel Cells Interconnects: A Feasibility Study	UNIGE	scientific, policy, industry (500 people)	Authors: D. Paravidino, P. Piccardo, R. Spotorno
18.-23.07.2021	SOFC - 17th International Symposium on Solid Oxide Fuel Cells (SOFC-XVII)	Virtual	oral presentation	The Identification of degradation parameters in SOC using in-situ and ex-situ approaches	DTU	scientific, policy, industry (~200 attendants)	Authors: A. Krishnakumar Padinjarethil, A.Hagen
18-23.07.2021	SOFC - 17th International Symposium on Solid Oxide Fuel Cells (SOFC-XVII)	Virtual	oral presentation	Redox - cycling – a Tool for Artificial Electrochemical Aging of Solid Oxide Cells.	IEES	scientific, policy, industry (~ 200 attendants)	Authors: B. Burdin, A. Sheikh, M. Krapchanska, D. Montinaro, R. Spotorno, P. Piccardo, D. Vladikova
18.-23.07.2021	SOFC - 17th International Symposium on Solid Oxide Fuel Cells (SOFC-XVII)	Virtual	oral presentation	Fracture of Porous Ceramics: Application to the Mechanical Degradation of Solid Oxide Cell during Redox Cycling	CEA	scientific, policy, industry (~200 attendants)	Abaza, S. Meille, A. Nakajo, D. Leguillon, M. Hubert, C. Lenser, J. Laurencin
29.11.2021-30.11-2021	12th International Symposium on Electrochemical Impedance Analysis – EIA 12	Virtual	Poster	Experimental deconvolution of polarization contributions on Ni-CGO based SOC using different cathode materials	DTU	scientific, policy, industry (250 people)	Authors: A. K. Padinjarethil, J.Heijne, A. Hagen
29-30.11.2021	12th International Symposium on Electrochemical Impedance Analysis (EIA)	Virtual	oral presentation	Monitoring Redox behavior of Ni/YSZ electrode to estimate the accelerated degradation via EIA	IEES	scientific (~ 50 attendants)	Authors: D. Vladikova, B. Burdin, A. Sheikh, P.Piccardo, M. Krapchanska, D. Montinaro
09-10.12.2021	Fourth work Meeting of the ESHER General Assembly	Virtual	oral presentation	Accelerated Stress Tests for SOC via Artificial Aging of the Fuel Electrode	IEES	scientific (~ 30 attendants)	Authors: M. Krapchanska, B. Burdin, A. Sheikh, P. Piccardo, D. Montinaro, D. Vladikova
15-17.12.2021	European fuel cell conference EFC21	Virtual	oral presentation	Redox Cycling for SOFC Accelerated Degradation	IEES	scientific (~ 150 attendants)	Authors: D. Vladikova, B. Burdin, A. Sheikh, P. Piccardo, M. Krapchanska, D. Montinaro
15-17.12.2021	European fuel cell conference EFC21	Virtual	poster	Degradation of Ni-YSZ and Ni-CGO fuel cells after 1000 h operation: Analysis of different overpotential contributions according to electrochemical and microstructural characterization	DTU/UNIGE	scientific, policy, industry	Authors: A. K. Padinjarethil, F. R. Bianchi, B. Bosio, A. Hagen
15-17.12.2021	European fuel cell conference EFC21	Virtual	Oral presentation	Characterization of a metallic interconnect operated in stack during 40,000 hours in SOFC mode	UNIGE	scientific, policy, industry (250 people)	Authors: Paolo Piccardo, Roberto Spotorno, Valeria Bongiorno, Daniele Paravidino, Christian Geipel, Greta Patrone and Francesca Valente
26-30.06.2022	23rd World Hydrogen Energy Conference (WHEC-2022)	Istanbul	Oral Presentation	Accelerated Stress Testing of Solid Oxide Fuel Cells via ex-situ chemical redox cycling of Ni-CGO fuel electrodes	ENEA	scientific, policy, industry (~ 200 attendants)	M. Della Pietra, A. Monforti Ferrario, D. Pumiglia, L. Della Seta, S. J. McPhail
26.10.2022	ICACC2022	Virtual	invited talk	Fracture in Porous Ceramics: Application to the Mechanical Degradation of Solid Oxide Cell Electrodes during Redox Cycling	CEA		Authors: A. Abaza, S. Meille, A. Nakajo, M. Hubert, D. Leguillon, J. Laurencin

3.5 Strategy for knowledge management and IP protection

A reasonable but careful strategy for knowledge management has been pursued for all the duration of the project in order to safeguard exploitation by AD ASTRA's partners while expressing fully the European know-how and public funding, aiming to ensure that research results were suitably protected until their quality is verified. As highlighted in the section 2 of this document data generated and accrued in AD ASTRA has been organized in a comprehensive, manageable, and user-friendly project database for collection, storage and

exchange of datasets necessary for project implementation. Data will be shared in accordance with the FAIR principles to maximize the opportunities for data linkage and interoperability.

Section 5 of this document will provide a detailed overview of datasets associated with the project, indicating: identifier, origin and description; nature and scale of data; reference standards and/or metadata; repository where the dataset is available (e.g. AD ASTRA Database on ENEA server 3TB total space and/or ZENODO depending on the confidentiality of the datasets); access and sharing policy also restrictions due to IP protection or other commercial or security reasons. To ensure data that are machine-readable and data-formats are interoperable to effectively allow re-use and verification, the project will refer to OpenAIRE Guidelines as a reference standard.

The strategy and conditions for the access, use, publication or sharing of these data are formulated as already mentioned in section 2 of this document.

As regards publications, in line with Horizon2020 and Horizon Europe requirements, the Consortium ensured open access to peer-reviewed scientific publications relating to the project's results. Up to 20 scientific publications have been made accessible on the basis of "green" open access, where "gold" open access is inappropriate. Besides the journals specific repositories, open access versions of AD ASTRA publications have been uploaded into ZENODO (https://zenodo.org/) and HAL archives (https://hal.archives-ouvertes.fr/) public repositories. Moreover, bibliographic metadata will favour the access to knowledge produced and verification of results. Here below a list of publication produced during the project.

	Title/DOI	Authors	Journal	Edition/Issue/Frequency	Internet address	Open Access	Date
WP2 Database, DoE and Protocol Development							
1	Addressing Solid Oxide Cell degradation mechanisms – a critical review of selected components **DOI: 10.1002/elsa.202100024**	S. J. McPhail, S. Frangini, J. Laurencin, E. Effori, A. Abaza, A. Padinjarethil, A. Hagen, A. Leon, A. Brisse, D.Vladikova, B. Burdin, F.Bianchi, Barbara Bosio, P.Piccardo, R.Spotorno, H. Uchida, P. Polverino, E. Adinolfi, F.Postiglione, J. Lee, A. Nakajo, M. Bianco, H. Moussaoui, J. Van Herle	Electrochemical Science Advances	vol. 2(5), e2100024 (2021)	https://chemistry-europe.onlinelibrary.wiley.com/doi/full/10.1002/elsa.202100024	yes	October 2021
WP3 Experimentation							
2	Electrode Kinetics of Porous Ni-3YSZ Cermet Operated in Fuel Cell andElectrolysis Modes for Solid Oxide Cell Application **DOI: 10.1016/j.electacta.2021.138765**	F. Monaco, E, Effori, M. Hubert, E. Siebert, G. Geneste, B. Morel, E. Djurado, D. Montinaro, J. Laurencin	Electrochimica Acta	vol. 389, pp. 138765 (2021)	https://hal.archives-ouvertes.fr/hal-03267352	yes	September 2021
3	Degradation of Ni YSZ Electrodes in Solid Oxide Cells: Impact of Polarization and Initial Microstructure on the Ni Evolution	F. Monaco, M. Hubert, J. Vulliet, J. P. Ouweltjes, D. Montinaro, P. Cloetens, P. Piccardo, F. Lefebvre-Joud, J. Laurencin	Journal of Electrochemical Society	vol. 166, F1229-F1242	https://hal.archives-ouvertes.fr/hal-02572214	yes	2019
4	Electrochemical characterization and modelling of anode andelectrolyte supported solid oxide fuel cells **DOI: 10.3389/fenrg.2021.668964**	A. K. Padinjarethil, F. R. Bianchi, B. Bosio, A. Hagen	Frontiers Energy Research	vol. 9, article 668964	https://doi.org/10.3389/fenrg.2021.668964	yes	September 2021
5	The Identification of degradation parameters in SOC using *in-situ* and *ex-situ* approaches	A. Krishnakumar Padinjarethil, A.Hagen	ECS Transactions (SOFC - 17th International Symposium on Solid Oxide Fuel Cells (SOFC-XVII))	ECS Meeting Abstracts, vol. MA2021-03, pp. 67	https://iopscience.iop.org/article/10.1149/MA2021-03167mtgabs	no	July 2021
6	High-temperature oxidation of AISI441 ferritic stainless steel for solid oxide fuel cells **DOI:10.4028/www.scientific.net/MSF.1016.1381**	R. Spotorno	Materials Science Forum	vol. 1016, pp.1381-1385 (2021)	https://www.scientific.net/MSF.1016.1381	no	January 2021
7	A novel method for evaluation of chromium evaporation from solid oxide fuel cells interconnects: A feasibility study **DOI: 10.4028/www.scientific.net/MSF.1016.1109**	D. Paravidino, P. Piccardo, R. Spotorno	Materials Science Forum	vol. 1016, pp. 1109-1113 (2021)	https://www.scientific.net/MSF.1016.1109	no	January 2021
8	Volatilization of chromium from AISI 441 stainless steel: Time and temperature dependence **DOI: 10.1016/j.surfcoat.2022.128125**	R. Spotorno, D. Paravidino, S. Delsante, P. Piccardo	Surface and Coatings Technology	vol. 433, article 128185 (2021)	https://www.sciencedirect.com/science/article/abs/pii/S0257897222000469	no	March 2022
9	Redox - cycling – a Tool for Artificial Electrochemical Aging of Solid Oxide Cells	B. Burdin, A. Sheikh, M. Krapchanska, D. Montinaro, R. Spotorno, P. Piccardo, D. Vladikova	ECS Transaction, 17th International Symposium on Solid Oxide Fuel Cells (SOFC-XVII))	vol. 103(1), pp. 1137 (2021)	https://iopscience.iop.org/article/10.1149/10301.1137ecst	no	2021
10	Redox Cycling for SOFC Accelerated Degradation **DOI: 10.1051/e3sconf/202233404015**	D. Vladikova, B. Burdin, A. Sheikh, P. Piccardo, M. Krapchanska, D. Montinaro	ECS Web of Conferences , European Fuel Cells and Hydrogen Piero Lunghi Conference (EFC21)	vol. 334, article 04015 (2022)	https://www.e3s-conferences.org/articles/e3sconf/abs/2022/01/e3sconf_efc2022_04015/e3sconf_efc2022_04015.html	yes	2022
11	Fracture properties of porous yttria-stabilized zirconia under micro-compression testing **DOI: 10.1016/j.jeurceramsoc.2021.11.051**	A. Abaza , J. Laurencin, A. Nakajo, M. Hubert, T. David, F. Monaco, C. Lenser, S. Meille	Journal of the European Ceramic Society	vol. 42, pp. 1656–1669 (2022)	https://hal.archives-ouvertes.fr/hal-03525050	yes	2022
12	Degradation of Ni-YSZ and Ni-CGO fuel cells after 1000 h operation: Analysis of different overpotential contributions according to electrochemical and microstructural characterization **DOI: 10.1051/e3sconf/202233404011**	A. K. Padinjarethil, F. R. Bianchi, B. Bosio, A. Hagen	ECS Web of Conferences , European Fuel Cells and Hydrogen Piero Lunghi Conference (EFC21)	vol. 334, article 04011 (2022)	https://www.e3s-conferences.org/articles/e3sconf/abs/2022/01/e3sconf_efc2022_04011/e3sconf_efc2022_04011.html	yes	2022
13	Local Characterization of a Solid Oxide Cell Operated in Fuel Cell and Electrolysis Mode Using Lock-in Thermography **DOI: 10.1149/10301.1227ecst**	G. Jeanmonod, J. Van Herle	ECS Transactions	vol. 103 (1), pp. 1227-1237 (2021)	https://iopscience.iop.org/article/10.1149/10301.1227ecst/pdf	yes	2021
14	Accelerated Stress Tests for Solid Oxide Cells via Artificial Aging of the Fuel Electrode	D. Vladikova, B. Burdin, A. Sheikh, P. Piccardo, M. Krapchanska, D. Montinaro, R. Spotorno	Energies	vol.15(9), article 3287 (2022)	https://www.mdpi.com/1996-1073/15/9/3287	yes	apr-22
WP4 Post-test analysis							
15	CHARACTERIZATION OF INTERCONNECTS FROM SOFC STACKS OPERATED UP TO 20K HOURS: the air side **DOI: 10.3390/en13246487**	P. Piccardo, R. Spotorno, V. Bongiorno, G. Ghiara, C. Geipel	Energies	vol. 1324, article 6487 (2020)	https://www.mdpi.com/1996-1073/13/24/6487/htm	yes	2020
16	Characterization of metallic interconnects extracted from Solid Oxide Fuel Cell stacks operated up to 20,000 h in real life conditions: The fuel side **DOI: 10.1016/j.ijhydene.2021.04.156**	G. Ghiara, P. Piccardo, V. Bongiorno, L. Repetto, C. Geipel, R. Spotorno	International Journal of Hydrogen Energy	vol. 46(46), pp. 23815-23827 (2021)	https://www.sciencedirect.com/science/article/abs/pii/S0360319921015767	no	2021
17	Oxygen Electrode Degradation in Solid Oxide Cells Operating in Electrolysis and Fuel Cell Modes: LSCF Destabilization and Inter-Diffusion at the Electrode/Electrolyte Interface **DOI: 10.1016/j.ijhydene.2021.07.054**	F. Monaco D. Ferreira-Sanchez, M. Hubert, B. Morel, D. Montinaro, D. Grolimund, J. Laurencin	International Journal of Hydrogen Energy	vol. 46(62), pp. 31533-31549 (2021)	https://hal.archives-ouvertes.fr/hal-03543584	yes	2021
18	TEM Characterization of Long Term Aged Interconnect Oxide Layers from Real Stack **DOI: 10.1149/10301.1283ecst**	Stéphane Poitel, Samaneh Daviran, Manuel Bianco, Christian Walter, Kai Herbrig, Jan Van Herle	ECS Transactions	vol. 103(1), pp. 1283-1300 (2021)	https://iopscience.iop.org/article/10.1149/10301.1283ecst/pdf	yes	2021
19	Investigation of a Metallic Interconnect Extracted from an SOFC Stack after 40,000 h of Operation **DOI: 10.3390/en15103548**	Paolo Piccardo, Roberto Spotorno, Christian Geipel	Energies	vol. 15(10), 3548 (2022)	https://www.mdpi.com/1996-1073/15/10/3548	yes	2022
WP5 Modelling							
20	Evolution of the morphology near triple-phase boundaries in Ni-YSZ electrodes upon cathodic polarization **DOI: 10.1115/1.4046478**	H. Moussaoui, A. Nakajo, G. Rinaldi, P. Caliandro, G. Jeanmonod, L. Navratilova, M. Cantoni, J. Van herle	Journal of Electrochemical Energy Conversion and Storage	vol. 17(4), article 041102 (2020)	https://asmedigitalcollection.asme.org/electrochemical/article/17/4/041102/1074944/Evolution-of-the-Morphology-Near-Triple-Phase	yes	November 2020
21	Linear sweep and cyclic voltammetry of porous mixed conducting oxygen electrode: Formal study of intercalation, diffusion and chemical reaction model **DOI: ff10.1016/j.ssi.2020.115485**	C. Montella, V. Tezyk, E. Effori, J. Laurencin, E. Siebert	Solid State Ionics	vol. 359, pp. 115485 (2021)	https://hal.archives-ouvertes.fr/hal-03054078	yes	2021
22	Development of mathematical transfer functions correlating Solid Oxide Fuel Cell degradation to operating conditions for Accelerated Stress Test protocols design **DOI: 10.1016/j.jpowsour.2021.229521**	P. Polverino, M. Gallo, C. Pianese	Journal of Power Sources	vol. 491, article 229521 (2021)	https://www.sciencedirect.com/science/article/abs/pii/S0378775321000707	no	Apri 2021
23	A Physically-based Modelling to Predict the Cyclic Voltammetry Response of LSCF-type Electrodes: Impact of the Ohmic Losses and Microstructure **DOI: 10.1016/j.ssi.2021.115765**	E. Effori, J. Laurencin, V. Tezyk, C. Montella, L. Dessemond, E. Siebert	Solid State Ionics	vol. 371, pp. 115765 (2021)	https://hal.archives-ouvertes.fr/hal-03473098	yes	2021
24	Modelling Nickel Microstructural Evolution in Ni-YSZ Electrodes Using a Mathematical Morphology Approach **DOI: 10.1149/10301.0997ecst**	H. Moussaoui, A. Nakajo, G. Rinaldi, M. Hubert, J. Laurencin, J. Van herle	ECS Transactions	vol. 103(1), pp. 997-1009 (2021)	https://iopscience.iop.org/article/10.1149/10301.0997ecst/pdf	yes	2021
25	Fracture of Porous Ceramics: Application to the Mechanical Degradation of Solid Oxide Cell during Redox Cycling **DOI: 10.1149/10301.1151ecst**	A. Abaza, S. Meille, A. Nakajo, D. Leguillon, M. Hubert, C. Lenser, J. Laurencin	ECS Transaction	vol. 103(1), pp. 1151-1163 (2021) DOI: 10.1149/10301.1151ecst	https://hal.archives-ouvertes.fr/hal-03622485	yes	2021
26	Test and Modelling of Solid Oxide Fuel Cell Durability: A Focus on Interconnect Role on Global Degradation	R. Spotorno, F.R. Bianchi, D. Paravidino, B. Bosio, P. Piccardo	Energies	vol. 15(8), 2762 (2022)	https://doi.org/10.3390/en15082762	yes	2022
27	Prediction of crack nucleation and propagation in porous ceramics using the phase-field approach	A. Abaza, J. Laurencin, A. Nakajo, S. Meille, J. Debayle, D. Leguillon	Theoretical and applied fracture mechanics	vol. 119, 103349 (2022)	https://hal.archives-ouvertes.fr/hal-03681038	yes	2022

4. RESPONSIBILITY AND ALLOCATION OF RESOURCES

The coordinator (ENEA) is responsible for the data management, and €3000 plus the required person-months have been reserved for the management and safeguard of the server that will host the AD ASTRA Data Base.

In general, the resources for long term preservation of the project data will follow the Consortium Agreement. For more precise and up-to-date formulation in accordance with the project implementation, the DIMP and PEDER, which are structured as living documents for efficient and effective direct and indirect exploitation of the results, have been periodically updated.

5. PARTNER-SPECIFIC DATASETS

ENEA

Knowledge & Data owned by Partner re-used for the project		
Data sets	***Origin/Patents/References***	***How existing data will be used***
SOC Interconnect behaviour in dual atmosphere	BALANCE project (H2020, Grant 731224), NELLHI project (CLEAN HYDROGEN PARTNERSHIP, Grant 621227)	All information on sample preparation, test conditions and characterization and post-test analysis will serve as reference for samples tested in AD ASTRA
SOC single cell behaviour over fuel electrode surface	NELLHI project (CLEAN HYDROGEN PARTNERSHIP, Grant 621227)	All information on sample preparation, test conditions and characterization and post-test analysis will serve as reference in case single cells will be tested for local gas composition and temperature distribution in AD ASTRA (TBD)
Cell process deconvolution and ECM	qSOFC project (CLEAN HYDROGEN PARTNERSHIP, Grant 735160)	All information on sample preparation, test conditions and characterization and post-test analysis will serve as reference for button cell samples tested in AD ASTRA for the identification of the Distribution of Relaxation Times (DRT) peaks and equivalent circuit modelling (ECM)

Knowledge produced and shared by partner during the project						**Tools for access to knowledge created by the project**			
Data set identifier	*Type (literature, experiments, analysis, modelling, etc.), format and expected size*	*Purpose and relation to project objectives*	*Metadata (Standards, references, Digital Object Identifiers)*	*Restrictions (Specify: patents, IP, voluntary reasons – else open!)*	*Key words*	*Data storage and accessibility means*	*Data publication channels (specify gold/green open access)*	*Other tools (reports, website)*	*Events (seminars, workshops, Conferences, fairs)*

SEM images	Commented images in pdf report, 100MB	Comparison of tested samples in accelerated conditions with field-operated samples	According to AD ASTRA Protocols (Deliverable 4.1) [DATABASE NOMENCLATURE]	Confidential within the Consortium, selected data published during the project, all cleared data published after the project	Interconnects, cells, active layers	AD ASTRA Database on ENEA server (3TB total space)	Green open access for published data	Deliverables in WP3 and WP4, References to publications on AD ASTRA website	Conferences, workshops
IV Curves	Commented curves in Excel, 1 MB	Comparison of cell performance and ASR in various conditions	According to AD ASTRA Protocols (Deliverable 2.2) [DATABASE NOMENCLATURE]	Confidential within the Consortium, selected data published during the project, all cleared data published after the project	Button and Single Cells	AD ASTRA Database on ENEA server (3TB total space)	Green open access for published data	Deliverables in WP3 and WP4, References to publications on AD ASTRA website	Conferences, workshops
EIS + DRT curves	Commented curves in ZPlot, Excel and pdf, 10 MB	Comparison of cell processes and polarization resistance in various conditions	According to AD ASTRA Protocols (Deliverable 2.2) [DATABASE NOMENCLATURE]	Confidential within the Consortium, selected data published during, all cleared data published	Button cells, half-cells and symmetrical cells	AD ASTRA Database on ENEA server (3TB total space)	Green open access for published data	Deliverables in WP3 and WP4, References to publications on AD ASTRA website	Conferences, workshops

				after the project					

CEA

Knowledge & Data owned by Partner re-used for the project		
Data sets	***Origin/Patents/References***	***How existing data will be used***
Aged samples and 3D Ni-YSZ reconstructions	ENDURANCE project: European Union's Seventh Framework Programme (FP7/2007-2013) Fuel Cells and Hydrogen Joint Undertaking (FCH-JU-2013-1) under grant agreement n° 621173	The 3D reconstructions will be analysed to investigate the impact of Ni agglomeration and volatilisation on performances
Algorithms for µstructural computations	INSIGHT project: European Horizon 2020 – Research and Innovation Framework program (H2020-JTI-FCH-2015-1) under grant agreement n°735918.	The protocols and algorithms for µstructural computation will be used in AD ASTRA project.
SOC tested under high pressure	SOPHIA project: European Union's Seventh Framework Programme (FP7/2007-2013) Fuel Cells and Hydrogen Joint Undertaking (FCH-JU-2013-1) under grant agreement n° 621173	All information and expertise on cell preparation, experimental conditions and pressure management will serve as reference for cell testing in AD ASTRA.
Oxygen electrode modelling	ECO project: European Horizon 2020 – Research and Innovation Framework program (H2020-JTI-FCH-2015-1) under grant agreement n°699892	The O2 electrode model will be used as a reference to build the full elementary model in AS ASTRA.

Knowledge produced and shared by partner during the project						**Tools for access to knowledge created by the project**			
Data set identifier	*Type (literature, experiments, analysis,*	*Purpose and relation to*	*Metadata (Standards,*	*Restrictions (Specify: patents, IP,*	*Key words*	*Data storage and*	*Data publication channels*	*Other tools (reports, website)*	*Events (seminars, workshops,*

	modelling, etc.), format and expected size	*project objectives*	*references, Digital Object Identifiers)*	*voluntary reasons – else open!)*		*accessibility means*	*(specify gold/green open access)*		*Conferences, fairs)*
SEM image	Commented images	Comparison of tested samples in aggravated conditions compared to the standard conditions	According to AD ASTRA Protocols (Deliverable 4.1) [DATABASE NOMENCLATURE]	Confidential within the Consortium, selected data published during the project, all cleared data published after the project	Electrodes	AD ASTRA Database	Green open access for published data	Deliverables in WP4, References to publications on AD ASTRA website	Conferences, workshops
Modelled and experimental EIS	Commented diagrams	Comparison of modelled and experimental EIS before/after ageing	According to AD ASTRA Protocols (Deliverable 2.2) [DATABASE NOMENCLATURE]	Confidential within the Consortium, selected data published during the project, all cleared data published after the project	Electrodes	AD ASTRA Database	Green open access for published data	Deliverables in WP3 and WP5, References to publications on AD ASTRA website	Conferences, workshops
Modelled and experimental i-V curve	Commented polarisation curves	Comparison of modelled and experimental EIS before/after ageing	According to AD ASTRA Protocols (Deliverable 2.2) [DATABASE NOMENCLATURE]	Confidential within the Consortium, selected data published during the project, all	Electrodes, cell	AD ASTRA Database	Green open access for published data (as much as possible)	Deliverables in WP3 and WP5, References to publications on AD	Conferences, workshops

				cleared data published after the project				ASTRA website	
Predictive model for density of micro cracks	Analysis and modelling report	Electrode mechanical damaging after mechanical loading (e.g. redox cycling)	According to AD ASTRA proposal in WP5	Confidential within the Consortium, selected data published during the project, all cleared data published after the project	Electrodes	AD ASTRA Database	Green open access for published data (as much as possible)	Deliverables in WP3 and WP5, References to publications on AD ASTRA website	Conferences, workshops

DTU

Knowledge & Data owned by Partner re-used for the project		
Data sets	***Origin/Patents/References***	***How existing data will be used***
Deconvolution of EIS on cell and stack level	A series of publications and project results (EU and national)	Application to cells/stack testing in this project to explain and understand short and long term behavior
Degradation phenomena evaluated using electrochemical and micro structural tools on cell/stack level, including potential	A series of publications and project results (EU and national)	Application to cells/stack testing in this project to explain and understand short and long term behavior

means of accelerating them		

Knowledge produced and shared by partner during the project						**Tools for access to knowledge created by the project**			
Data set identifier	*Type (literature, experiments, analysis, modelling, etc.), format and expected size*	*Purpose and relation to project objectives*	*Metadata (Standards, references, Digital Object Identifiers)*	*Restrictions (Specify: patents, IP, voluntary reasons – else open!)*	*Key words*	*Data storage and accessibility means*	*Data publication channels (specify gold/green open access)*	*Other tools (reports, website)*	*Events (seminars, workshops, Conferences, fairs)*
SEM images	Commented images in pdf report, 100MB	Comparison of tested samples in accelerated conditions with field-operated samples and/or lab tested samples	According to AD ASTRA Protocols (Deliverable 4.1) [DATABASE NOMENCLATURE]	Confidential within the Consortium, selected data published during the project, all cleared data published after the project	Cells, active layers	AD ASTRA Database on ENEA server (3TB total space)	Green open access for published data	Deliverables in WP3 and WP4, References to publications on AD ASTRA website	Conferences, workshops
IV Curves	Commented curves in Excel, 1 MB	Comparison of cell performance and ASR in various conditions	According to AD ASTRA Protocols (Deliverable 2.2) [DATABASE NOMENCLATURE]	Confidential within the Consortium, selected data published during the	Cells and stacks	AD ASTRA Database on ENEA server (3TB total space)	Green open access for published data	Deliverables in WP3 and WP4, References to publications	Conferences, workshops

				project, all cleared data published after the project				on AD ASTRA website	
EIS + DRT curves	Commented curves in ZPlot, Excel and pdf, 10 MB	Comparison of cell processes and polarization resistance in various conditions	According to AD ASTRA Protocols (Deliverable 2.2) [DATABASE NOMENCLATURE]	Confidential within the Consortium, selected data published during the project, all cleared data published after the project	Cells, stacks	AD ASTRA Database on ENEA server (3TB total space)	Green open access for published data	Deliverables in WP3 and WP4, References to publications on AD ASTRA website	Conferences, workshops

EIFER

Knowledge & Data owned by Partner re-used for the project		
Data sets	***Origin/Patents/References***	***How existing data will be used***
Algorithms for advanced control systems	SAPPHIRE project (CLEAN HYDROGEN PARTNERSHIP, Grant 325275)	The protocols and algorithms developed will be used in the AD ASTRA project
Prognostics methods	PROPICE project (ANR-12-PRGE-0001)	Prognostics and health management methods develop to assess the health state of a fuel cell system will be used in the AD ASTRA project

Long-term degradation phenomena	Project results and publications	The data will be used within AD ASTRA as reference for accelerated degradation and the development of the prognostics methods for SOFC/SOEC

Knowledge produced and shared by partner during the project						**Tools for access to knowledge created by the project**			
Data set identifier	*Type (literature, experiments, analysis, modelling, etc.), format and expected size*	*Purpose and relation to project objectives*	*Metadata (Standards, references, Digital Object Identifiers)*	*Restrictions (Specify: patents, IP, voluntary reasons – else open!)*	*Key words*	*Data storage and accessibility means*	*Data publication channels (specify gold/green open access)*	*Other tools (reports, website)*	*Events (seminars, workshops, Conferences, fairs)*
V =f (t) I = f(t)	Commented diagrams	Comparison of model and experimental data	According to AD ASTRA protocols [DATABASE NOMENCLATURE]	Confidential within the Consortium, selected data published during the project, all cleared data published after the project	Cells and stack	AD ASTRA Database on ENEA server (3TB total space)	Green open access for published data	Deliverables in WP5 and WP3, References to publications on AD ASTRA website	Conferences, workshops

EPFL

Knowledge & Data owned by Partner re-used for the project		
Data sets	***Origin/Patents/References***	***How existing data will be used***
SOFC interconnect behaviour in oxidizing atmosphere and in stacks	SCoReD 2:0 project (H2020, Grant 325331)	All information on sample preparation, test conditions and characterization and post-test analysis will serve as reference for samples tested in AD ASTRA.

Knowledge produced and shared by partner during the project						**Tools for access to knowledge created by the project**			
Data set identifier	*Type (literature, experiments, analysis, modelling, etc.), format and expected size*	*Purpose and relation to project objectives*	*Metadata (Standards, references, Digital Object Identifiers)*	*Restrictions (Specify: patents, IP, voluntary reasons – else open!)*	*Key words*	*Data storage and accessibility means*	*Data publication channels (specify gold/green open access)*	*Other tools (reports, website)*	*Events (seminars, workshops, Conferences, fairs)*
SEM+FIB images	Commented images in pdf report, 100MB	Comparison of tested samples in accelerated conditions with field-operated samples. Understanding of degradation phenomena at	According to AD ASTRA Protocols (Deliverable 4.1) [DATABASE NOMENCLATURE]	Confidential within the Consortium, selected data published during the project, all cleared data published after the project	Interconnects, cells, active layers	AD ASTRA Database on ENEA server (3TB total space)	Gold open access for published data	Deliverables in WP3 and WP4, References to publications on AD ASTRA website	Conferences, workshops

		nanolevel (FIB). Modelling of cell microstructure evolution.							
IV curves	Commented curves in Excel, 1 MB	Comparison of cell performance and ASR in various conditions. Validation of the modelling of cell microstructure evolution	According to AD ASTRA Protocols (Deliverable 2.2 Deliverable 3.2) [DATABASE NOMENCLATURE]	Confidential within the Consortium, selected data published during the project, all cleared data published after the project	Single Cells and Stacks	AD ASTRA Database on ENEA server (3TB total space)	Gold open access for published data	Deliverables in WP3 and WP4, References to publications on AD ASTRA website	Conferences, workshops
EIS + DRT curves	Commented curves in Excel, 1 MB	Comparison of cell performance and ASR in various conditions. Validation of the modelling of cell microstructure evolution	According to AD ASTRA Protocols (Deliverable 2.2 Deliverable 3.2) [DATABASE NOMENCLATURE]	Confidential within the Consortium, selected data published during the project, all cleared data published after the project	Single Cells and Stacks	AD ASTRA Database on ENEA server (3TB total space)	Gold open access for published data	Deliverables in WP3 and WP4, References to publications on AD ASTRA website	Conferences, workshops
ASR curves	Commented curves and	Comparison of interconnects tested in	According to AD ASTRA Protocols (Deliverable 2.2	Confidential within the Consortium,	Interconnects	AD ASTRA Database on ENEA	Gold open access for	Deliverables in WP3 and WP4,	Conferences, workshops

	images in pdf report, 100 MB	accelerated conditions with samples operated in nominal conditions	Deliverable 3.2) [DATABASE NOMENCLATURE]	selected data published during the project, all cleared data published after the project		server (3TB total space)	published data	References to publications on AD ASTRA website	

IEES

Knowledge & Data owned by Partner re-used for the project		
Data sets	***Origin/Patents/References***	***How existing data will be used***
I/V curves and DRA on SOFC	ENDURANCE: CLEAN HYDROGEN PARTNERSHIP2 Project (GA 621207) / Recommendation for Measurements of Volt-Ampere Characteristics of Fuel Cells for Diagnostic Purposes/ http://www.durablepower.eu/images/downloads/hoe/03_01_09.pdf	All information on test procedures and conditions and DRA will serve as reference for button cells (SOC) tested in AD ASTRA (pristine and with preliminary aged components)
EIS + gas permeability of anode sample	ENDURANCE: CLEAN HYDROGEN PARTNERSHIP2 Project (GA 621207)	All information on test conditions, characterization and post-test analysis will serve as reference for testing of anode micro-samples sintered at different temperatures (artificial aging) in AD ASTRA

Knowledge produced and shared by partner during the project						**Tools for access to knowledge created by the project**			
Data set identifier	*Type (literature, experiments, analysis, modelling,*	*Purpose and relation to project objectives*	*Metadata (Standards, references,*	*Restrictions (Specify: patents, IP, voluntary*	*Key words*	*Data storage and accessibility means*	*Data publication channels (specify*	*Other tools (reports, website)*	*Events (seminars, workshops,*

	etc.), format and expected size		*Digital Object Identifiers)*	*reasons – else open!)*			*gold/green open access)*		*Conferences, fairs)*
I/V Curves	Experimental data in ASCII code and Origin graphics, 1 MB	Comparison of cell performance in various conditions and data base for DRA performance	According to AD ASTRA Protocols (Deliverables 2.2 and 2.3)	Confidential within the Consortium, selected data published during the project's implementation and after its termination; selected data in D.2.3 with open access	Button cells; I/V curves	AD ASTRA Database on ENEA server (3TB total space)	Green open access for published data	Deliverables in WP2 and WP3, References to publications on AD ASTRA website	Conferences, workshops
DRA	Analyzed data from I/V curves; calculated data in ASCII code and Origin graphics of the DRA dependencies (Differential Resistance (R_d)/current (I) and the corresponding spectral presentation), 5 MB	Calculation of $R_{d,min}$ as performance indicator; introduction of criterion for state of health evaluation	According to AD ASTRA Protocols (Deliverable 2.2 and 2.3) and planned experiments (Deliverable 3.3).	Confidential within the Consortium, selected data published during the project's implementation and after its termination .	Differential Resistance, Button cells, cells, stacks	AD ASTRA Database on ENEA server (3TB total space)	Gold open access for published data	Deliverables in WP3 and WP4, References to publications on AD ASTRA website	Conferences, workshops

EIS	Experimental data in ASCII code (some of them in LSC format) and Origin graphics, 1 MB	Testing of single anodes sintered at different temperatures and loads for evaluation of this approach for artificial aging. Comparison of cells behaviour in various conditions	According to AD ASTRA Protocols (Deliverables 2.2 and 2.3, 3.3)	Confidential within the Consortium, selected data published during the project's implementation and after its termination	EIS, anodes, button cells	AD ASTRA Database on ENEA server (3TB total space)	Green open access for published data	Deliverables in WP2 and WP3, References to publications on AD ASTRA website	Conferences, workshops

SolidPower

Knowledge & Data owned by Partner re-used for the project		
Data sets	***Origin/Patents/References***	***How existing data will be used***
Implementation of a new coating on short stacks	SCoReD 2:0 project (H2020, Grant 325331)	Internal protocols for single cells and stack testing will be used. Published information on stack materials will be used.
New material integration on stacks	ENDURANCE project: European Union's Seventh Framework Programme (FP7/2007-2013) Fuel Cells and	Internal protocols for single cells and stack testing will be used. Published information on stack materials will be used.

	Hydrogen Joint Undertaking (FCH-JU-2013-1) under grant agreement n° 621173	
Improved stack materials for SOE and Co-SOE operation	SOPHIA project: European Union's Seventh Framework Programme (FP7/2007-2013) Fuel Cells and Hydrogen Joint Undertaking (FCH-JU-2013-1) under grant agreement n° 621173	Internal protocols for single cells and stack testing will be used. Published information on stack materials will be used.

Knowledge produced and shared by partner during the project						**Tools for access to knowledge created by the project**			
Data set identifier	*Type (literature, experiments, analysis, modelling, etc.), format and expected size*	*Purpose and relation to project objectives*	*Metadata (Standards, references, Digital Object Identifiers)*	*Restrictions (Specify: patents, IP, voluntary reasons – else open!)*	*Key words*	*Data storage and accessibility means*	*Data publication channels (specify gold/green open access)*	*Other tools (reports, website)*	*Events (seminars, workshops, Conferences, fairs)*
Samples from cells, interconnectors and stacks	Text (200kB)	Aged and new samples delivered to the project partner	According to AD ASTRA protocols (deliverable D2.1)	Confidential within the Consortium, selected data published during the project, all cleared data published after the project	Interconnects, cells and stack	AD ASTRA Database on ENEA server (3TB total space)	Gold open access for published data	Deliverables in WP3 and WP4, References to publications on AD ASTRA website	Conferences, workshops

IV Curves	Commented curves in Excel, 20 MB	Comparison of cell performance and ASR in various conditions.	According to AD ASTRA protocols (deliverable D2.1-D6.2)	Confidential within the Consortium, selected data published during the project, all cleared data published after the project	Interconnects, cells and stack	AD ASTRA Database on ENEA server (3TB total space)	Gold open access for published data	Deliverables in WP3 and WP4, References to publications on AD ASTRA website	Conferences, workshops
EIS curves	Commented curves in Excel, 20 MB	Comparison of cell performance in various conditions.	According to AD ASTRA protocols (deliverable D2.1-D6.2)	Confidential within the Consortium, selected data published during the project, all cleared data published after the project	Interconnects, cells and stack	AD ASTRA Database on ENEA server (3TB total space)	Gold open access for published data	Deliverables in WP3 and WP4, References to publications on AD ASTRA website	Conferences, workshops

University of Genoa

Knowledge & Data owned by Partner re-used for the project		
Data sets	***Origin/Patents/References***	***How existing data will be used***

Knowledge produced and shared by partner during the project						Tools for access to knowledge created by the project			
Data set identifier	*Type (literature, experiments, analysis, modelling, etc.), format and expected size*	*Purpose and relation to project objectives*	*Metadata (Standards, references, Digital Object Identifiers)*	*Restrictions (Specify: patents, IP, voluntary reasons – else open!)*	*Key words*	*Data storage and accessibility means*	*Data publication channels (specify gold/green open access)*	*Other tools (reports, website)*	*Events (seminars, workshops, Conferences, fairs)*
Theoretical and empirical correlations	Modelling commented equations in pdf report, 1 MB	Interpretation of phenomena occurring in SOFC and SOEC	According to AD ASTRA Protocols (Deliverables 5.3) [DATABASE NOMENCLATURE]	Confidential within the Consortium, selected data published during the project	Cells	AD ASTRA Database on ENEA server (3TB total space)	Green open access for published data	Deliverables in WP5, References to publications on AD ASTRA website	Conferences, workshops
Simulated IV curves	Modelling, commented results in Excel, 1 MB	Comparison with SOFC and SOEC experimental data under different working conditions	According to AD ASTRA Protocols (Deliverable 5.3) [DATABASE NOMENCLATURE]	Confidential within the Consortium, selected data published during the project	Cells	AD ASTRA Database on ENEA server (3TB total space)	Green open access for published data	Deliverables in WP5, References to publications on AD ASTRA website	Conferences, workshops
Lifetime performance	Modelling commented results in Excel, 1 MB	Analysis of SOFC and SOEC operation and	According to AD ASTRA Protocols (Deliverable 5.3) [DATABASE NOMENCLATURE]	Confidential within the Consortium, selected data published	Cells	AD ASTRA Database on ENEA server (3TB total space)	Green open access for published data	Deliverables in WP5, References to publications	Conferences, workshops

		performance prediction		during the project				on AD ASTRA website	

University of Salerno

Knowledge & Data owned by Partner re-used for the project		
Data sets	***Origin/Patents/References***	***How existing data will be used***
SOFC stack and system model	DIAMOND project: Diagnosis-aided control for SOFC power systems, FCHJU FP7 G.A. 621208	The model will be used to develop SOC stack lumped model within WP5.
Multiscale approach and degradation modelling	PUMA MIND project: Physical bottom Up Multiscale Modelling for Automotive PEMFC Innovative performance and Durability optimisation, FCHJU FP7 G.A. 303419	The approach will be used to develop degradation models and implement a simplified version within the SOC lumped model in WP5.

Knowledge produced and shared by partner during the project						**Tools for access to knowledge created by the project**			
Data set identifier	*Type (literature, experiments, analysis, modelling, etc.), format and expected size*	*Purpose and relation to project objectives*	*Metadata (Standards, references, Digital Object Identifiers)*	*Restrictions (Specify: patents, IP, voluntary reasons – else open!)*	*Key words*	*Data storage and accessibility means*	*Data publication channels (specify gold/green open access)*	*Other tools (reports, website)*	*Events (seminars, workshops, Conferences, fairs)*

Stochastic and statistical models	Modelling, mathematical relationships and/or commented curves in pdf report, 1 MB	Development of degradation stochastic models from measured data for lifetime and reliability estimation of SOFC/SOEC units	According to AD ASTRA Protocols (Deliverable 5.4) [DATABASE NOMENCLATURE]	Confidential within the Consortium, selected data published during the project, all cleared data published after the project	Cell and stack	AD ASTRA Database on ENEA server (3TB total space)	Green open access for published data	Deliverables in WP5, References to publications on AD ASTRA website	Conferences, workshops
DoE for accelerated tests	Modelling, mathematical relationships and/or commented curves in pdf report, 1 MB	Support of the definition of DoE for accelerated tests	According to AD ASTRA Protocols (Deliverables 2.2, 2.3 and 2.4) [DATABASE NOMENCLATURE]	Confidential within the Consortium, selected data published during the project, all cleared data published after the project	Cell and stack	AD ASTRA Database on ENEA server (3TB total space)	Green open access for published data	Deliverables in WP2, References to publications on AD ASTRA website	Conferences, workshops
Generation of regression transfer functions	Modelling, mathematical relationships and/or commented curves in pdf report, 1 MB	Support to the selection of suitable life-stress relationships for measured data	According to AD ASTRA Protocols (Deliverable 5.6) [DATABASE NOMENCLATURE]	Confidential within the Consortium, selected data published during the project, all cleared data	Cell and stack	AD ASTRA Database on ENEA server (3TB total space)	Green open access for published data	Deliverables in WP5, References to publications on AD ASTRA website	Conferences, workshops

				published after the project					
Stack Lumped Model	Modelling (MATLAB/Simulink), <1 MB	Support to design of performance model for durability estimation and AST transfer function definitions	According to AD ASTRA Protocols (Deliverables in WP5) [DATABASE NOMENCLATURE]	Confidential within the Consortium, selected data published during the project, all cleared data published after the project	Cell and Stack	AD ASTRA Database on ENEA server (3TB total space)	Green open access for published data	Deliverables in WP5, References to publications on AD ASTRA website.	Conferences, workshops
Degradation grey-box models	Modelling (MATLAB/Simulink), <1 MB	Support to mathematical reduction of complex degradation models and implementation in stack lumped model	According to AD ASTRA Protocols (Deliverables in WP5) [DATABASE NOMENCLATURE]	Confidential within the Consortium, selected data published during the project, all cleared data published after the project	Cell, Stack and System	AD ASTRA Database on ENEA server (3TB total space)	Green open access for published data	Deliverables in WP5, References to publications on AD ASTRA website.	Conferences, workshops

Sunfire

Knowledge & Data owned by Partner re-used for the project

Data sets	*Origin/Patents/References*	*How existing data will be used*

Knowledge produced and shared by partner during the project						**Tools for access to knowledge created by the project**			
Data set identifier	*Type (literature, experiments, analysis, modelling, etc.), format and expected size*	*Purpose and relation to project objectives*	*Metadata (Standards, references, Digital Object Identifiers)*	*Restrictions (Specify: patents, IP, voluntary reasons – else open!)*	*Key words*	*Data storage and accessibility means*	*Data publication channels (specify gold/green open access)*	*Other tools (reports, website)*	*Events (seminars, workshops, Conferences, fairs)*
IV Curves	Commented curves in Excel, 1 MB	Comparison of cell performance and ASR in various conditions	According to AD ASTRA Protocols (Deliverable 2.2)	Confidential within the Consortium, selected data published during the project, all cleared data published after the project	Stack test	AD ASTRA Database on ENEA server (3TB total space)	Green open access for published data	Deliverables in WP3 and WP4, References to publications on AD ASTRA website	Conferences, workshops
Vt Curves	Commented curves in Excel, 10 MB	Comparison of cell performance and ASR in	According to AD ASTRA Protocols (Deliverable 2.2)	Confidential within the Consortium, selected data published	Stack test	AD ASTRA Database on ENEA server (3TB total space)	Green open access for published data	Deliverables in WP3 and WP4, References to	Conferences, workshops

		various conditions		during the project, all cleared data published after the project				publications on AD ASTRA website	
selected details of samples (cells, interconnect, stack)	Plain text (100kB)	Delivery of virgin and “old” cells, interconnect, stacks to AdAstra partners	According to AD ASTRA Protocols (Deliverable 2.2)	Confidential within the Consortium, selected data published during the project, all cleared data published after the project	Cells, Interconnects, Stacks	AD ASTRA Database on ENEA server (3TB total space)	Green open access for published data	Deliverables in WP3 and WP4, References to publications on AD ASTRA website	Conferences, workshops