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ARENHA

ADVANCED MATERIALS AND **R**EACTORS FOR **EN**ERGY STORAGE T**H**ROUGH **A**MMONIA

H2020 GRANT AGREEMENT NUMBER: 862482

Start date of project: 01/04/2020 **Duration: 4 years**

WP7 – Dissemination and communication

D7.22
ARENHA Dissemination activities M36

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v0.1	12/06/2023	First Release	CNH2	E. Monge
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Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	
CON	Confidential, only for members of the Consortium	

(*) for generating such code please refer to the Quality Management Plan, also to be included in the header of the following pages

(**) indicate the acronym of the partner that prepared the document

Content

1. EXECUTIVE SUMMARY

1.1. Description of the deliverable content and purpose

Among the task foreseen in the ARENHA project, dissemination and communication activities play a crucial role to spread the scientific knowledge and technological developments to the largest audience. This package of activities will increase visibility of both project and partners, and will guarantee its optimal acknowledgement and future exploitation, as they will address the main European and worldwide forums and platforms on the project's topic.

The aim of this deliverable is to describe the group of actions that have been carried put during this period (M36) in order to ensure the achievements of the goals and results fixed in the ARENHA project. This document aims to shed light on the detailed activities carried out as well as the progress made in the main communication strategy and measurable objectives of the ARENHA project.

1.2. Deviation from objectives

No relevant deviation were experienced during this period.

2. DISSEMINATION AND COMMUNICATION PLAN

In general terms, the first initial 12 month were mainly focused on the elementary internal dissemination and external communication and also the implementation of the dissemination strategy and communication tools (i.e., public and private website, project communication material). The second stage covers the activities in the second year of the project. The main targets in this stage are the internal and external disseminations with special focus on communicating with the external audience:

i) internal dissemination between the WPs
ii) creating an effective network between all participants
iii) the update of the website

During this period, which is referred to the activities carried out in the period M18-M36, and is defined as Advances Stage, main focused was put in the participation of Congress and Events as well as publications of scientific. papers and articles.

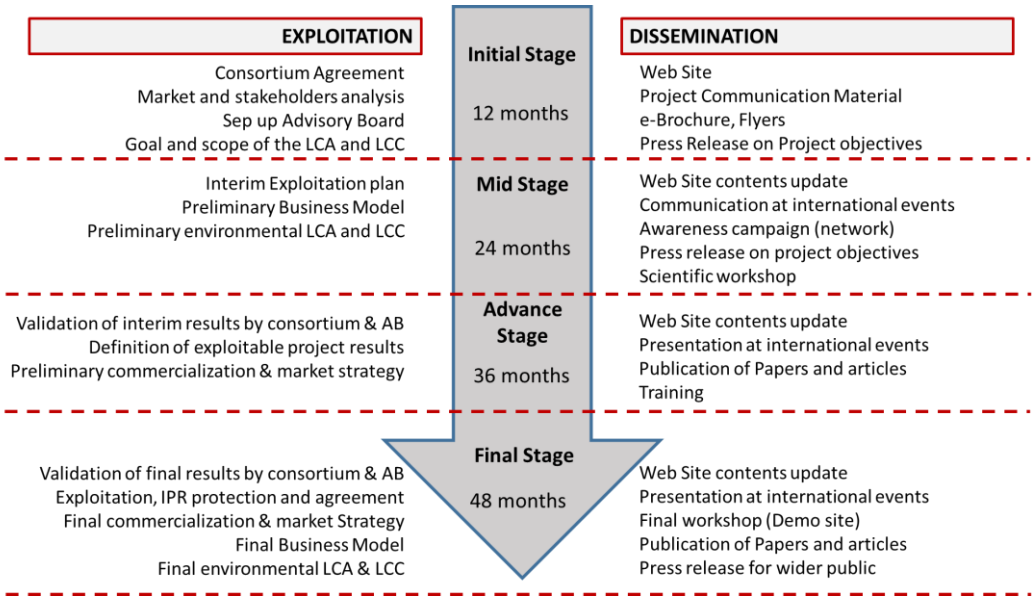

Figure 1. Stage of exploitation and dissemination activities

3. DISSEMINATION AND COMMUNICATION ACTIVITIES

3.1. Dissemination and communication KPIs progress

The table below shows the progress towards the achievement on the KPIs of the dissemination and communication activities. In this table, it is shown the KPIS for the global project, the impact achieved at M18 and the achievement achieved at M36 (numbers of M36 also include the numbers since the beginning of the project).

Table 1. Progress of the measurable objectives during this period

Dissemination tools		Expect impact (whole project)	Achieved Impact M18	Achieved Impact M36
Project Website	Monthly visits	300	(*)	708
	Duration of visits	3 min	(*)	1 min 35 s
	Downloads per month	20	(*)	(*)
	Total subscription of stakeholders	100	(*)	(*)
	References from other webpages	5	2	5
Partners Website	References from partners websites	11	3	3
Linkedin, Twitter, Youtube	Post/messages/tweets	200	23	165
	Visits to posts	>50	-	>15.784
	Videos	2	1	1
	Total videos visualisations	>1000	204	661
Newsletters	Publications	6	0	5
News/Press Releases	Publications	10	2	7
Journal Articles	Journalistic articles	6	0	5
Leaflet	Copies	1200	0	150
Attendance To Events:	Attended conferences with presentations/posters	20	6	>23
Exhibitions, Conferences & Networking Events	Oral communication at congresses & events	6	-	>8
	Attended industrial events / fairs	10	0	11
	Events for the general public	3	0	2
	Flyers distributed	1200	1	150
Organized Workshops, Webinars & Training	Workshops	2	0	2
	Registrations	>30	0	>43
	Webinars / training	1	0	-

3.1.1. Branding: graphical templates and branding elements

Additionally, to the existing project logo, leaflet and poster, a card a new poster was created during this period and is shown below:

Figure 2. ARENHA card design

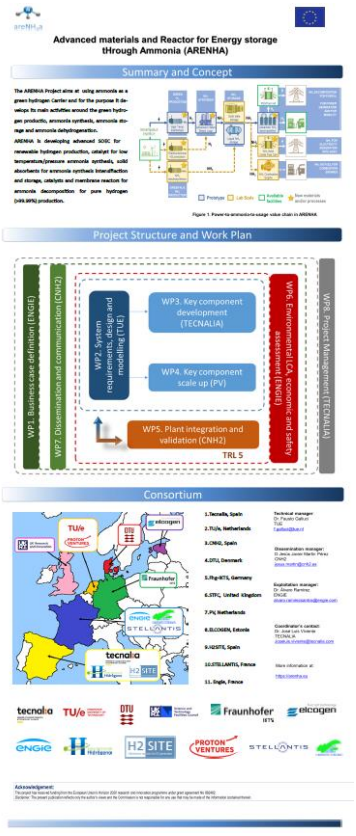

Figure 3. New poster design

3.1.2. Public website and social media networks

The website (https://arenha.eu/) has been continuously updated with all the publishable information from the project partners. This web site is provided by TECNALIA and managed by TECNALIA and CNH2, and contains all public information about the project, organised in the following main sections: Home, About, Partners, Technology Public Documents, News & Events, Links, Contact Us and Newsletters.

Figure 4. ARENHA Website lasts updates

A social media campaign is actively carried out in order to ensure adequate coverage of project activities on the social networks. The project uses LinkedIn, Twitter and YouTube as additional distribution channels of the project results. Therefore, ARENHA project will have a *Twitter profile* "@ARENHA_H2020", a *LinkedIn profile "ARENHA Project",* a *LinkedIn group* titled ARENHA Project is also being used and also

other accounts from each partner are used to further widespread the ARENHA project. In this sense, a new LinkedIn account has been created under the professional account type, which eases the creating of new posts as well as provides the statistics about the posts.

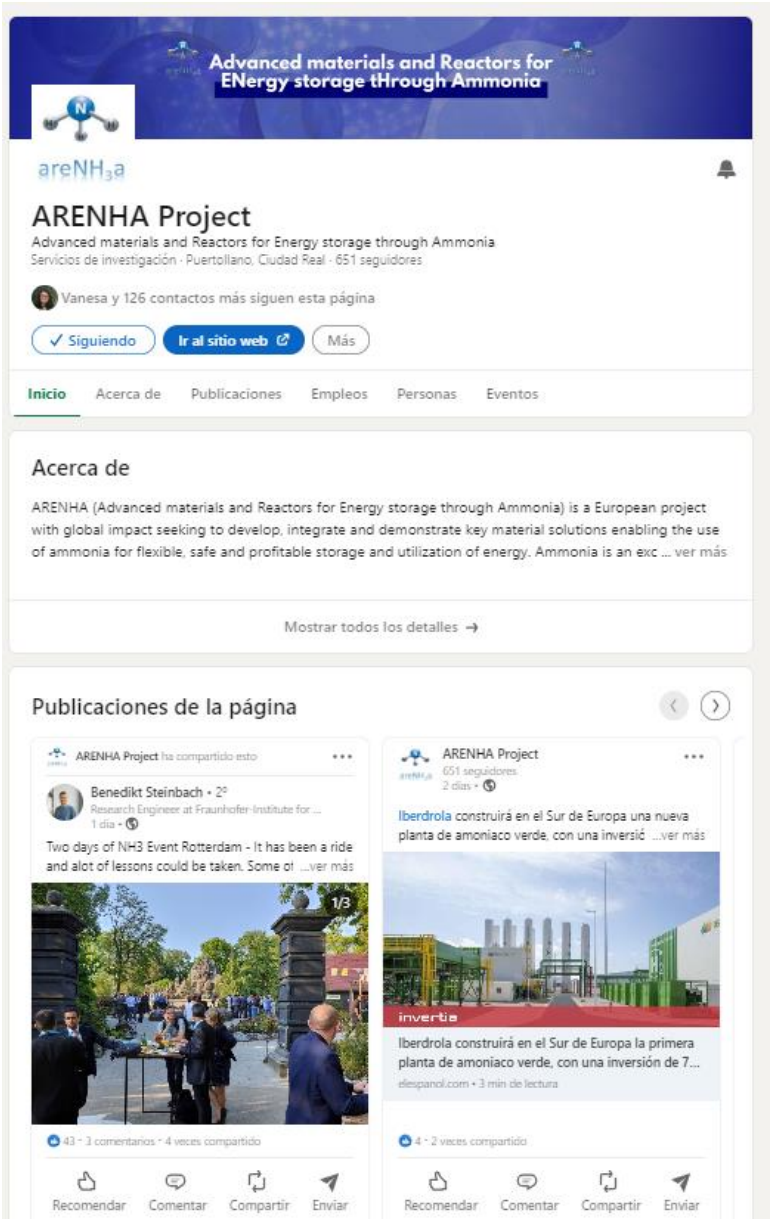

Figure 5. New LinkedIn account

For twitter, a new design of the account was also made, and it is shown below:

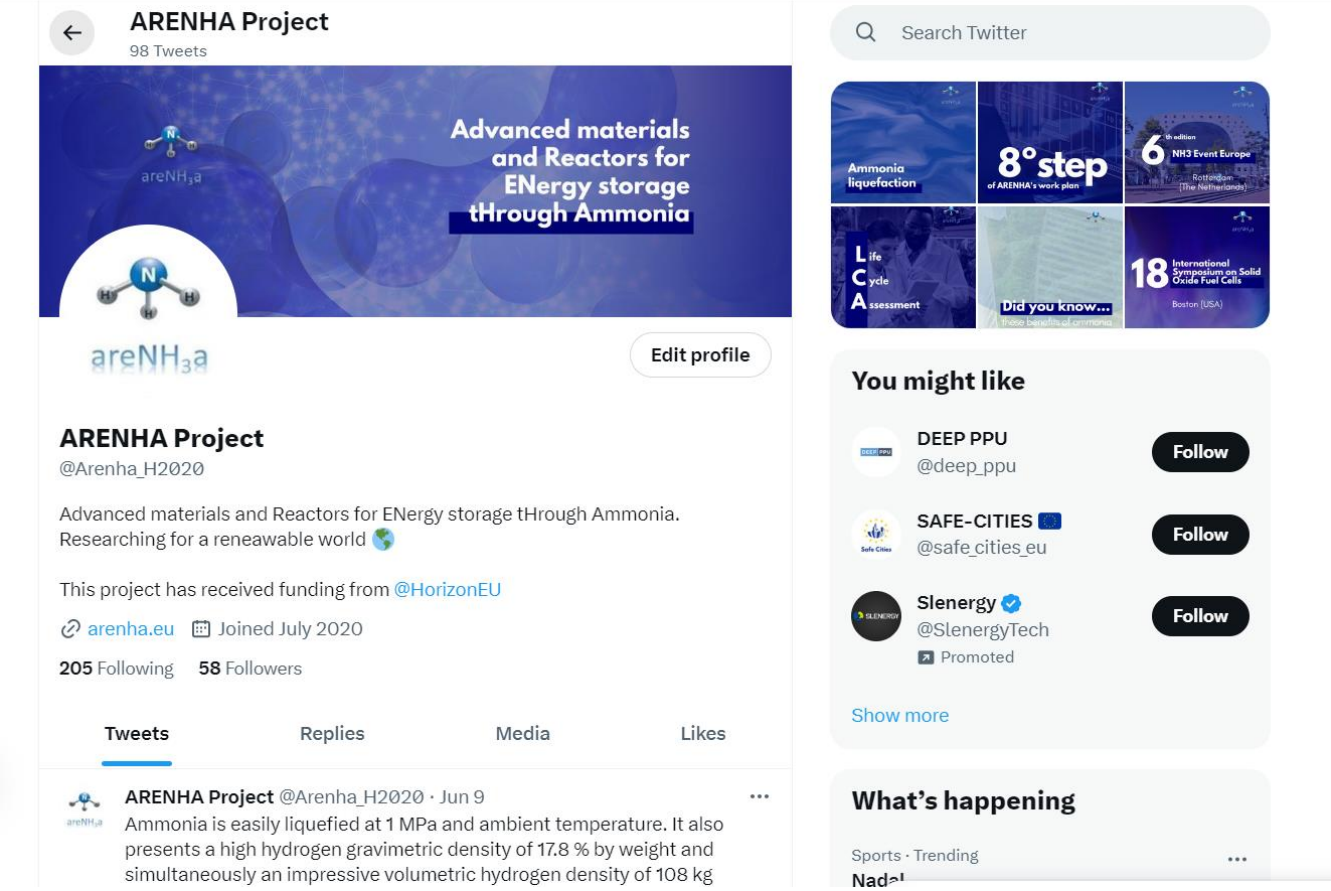

Figure 6. Twitter ARENHA account new design

3.1.3. Publications and newsletters

Apart from social media, ARENHA project is developping periodic publications and newsletters in its own website as the project objectives are being reached. These press and news releases are being held every six months from the beginning of the project.

All project partners will exploit their own press offices and contacts in order to ensure a publicity of the project outcomes. The group leaders are responsible for establishing media contacts and partnerships, especially in the role of newsmaker for interested journalists. Dissemination of the project via press and media occurs using of press releases, events, announcement in the journals and professional groups in the social media. The next table shows all publications updated to M36 and including info from the beginning of the project are listed below.

Peer Reviewed Articles

1. Jaysree Pan, Heine Anton Hansen and Tejs Vegge, Vanadium oxynitrides as stable catalysts for electrochemical reduction of nitrogen to ammonia: the role of oxygen., *J. Mater. Chem. A*, **2020**, *8*, 24098- 24107. https://doi.org/10.1039/D0TA08313E.
2. Valentina Cechetto, Luca Di Felice, Jose A. Medrano, Camel Makhloufi, Jon Zuniga and Fausto Gallucci. H2 production via ammonia decomposition in a catalytic membrane reactor. *Fuel Processing Technology*, **2021**, *216,* 106772. https://doi.org/10.1016/j.fuproc.2021.106772.
3. Christine Mounaïm-Rousselle, Pierre Brequigny, Clément Dumand and Sébastien Houille, Operating Limits for Ammonia Fuel Spark-Ignition Engine, *Energies*, **2021**, *14*(14), 4141, https://doi.org/10.3390/en14144141.

4. Freddy Kukk, Sergii Pylypko, Enn Lust and Gunnar Nurk, Influence of Active Layer Thickness of Reversible Solid Oxide Cells on the Electrochemical Performance of Water Electrolysis, *ECS Transactions,* **2021**, *103*(1), 511, https://doi.org/10.1149/10301.0511ecst.
5. Valentina Cechetto, Luca Di Felice, Rocio Gutierrez Martinez, Alba Arratibel Plazaola and Fausto Gallucci. Ultra-pure hydrogen production via ammonia decomposition in a catalytic membrane reactor., *International Journal of Hydrogen Energy*, **2022**, *47*, 21220-21230. https://doi.org/10.1016/j.ijhydene.2022.04.240
6. A. Mercier, C. Mounaïm-Rousselle, P. Brequigny, J. Bouriot, and C. Dumand, Improvement of SI engine combustion with ammonia as fuel: Effect of ammonia dissociation prior to combustion, *Fuel Communications*, **2022**, *11*, 100058, https://doi.org/10.1016/j.jfueco.2022.100058.
7. Valentina Cechetto, Cynthia Lan Struijk, Luca Di Felice, Anouk W.N. de Leeuw den Bouter, and Fausto Gallucci, Adsorbents development for hydrogen cleanup from ammonia decomposition in a catalytic membrane reactor., *Chemical Engineering Journal*, **2023,** *455*, 140762. https://doi.org/10.1016/j.cej.2022.140762.
8. Christine Mounaïm-Rousselle, Adrien Mercier, Pierre Brequigny, Clément Dumand, Jean Bouriot and Sébastien Houillé, Performance of ammonia fuel in a spark assisted compression Ignition engine, *International Journal of Engine Research*, **2023,** *23* (5), 781, https://doi.org/10.1177/14680874211038726.

Press articles

1. Katrin Schwarz, EU-Projekt ARENHA: Grünes Ammoniak für die Energiewende, on Fraunhofer IKTS website.
2. Christian Eckart, Ammonia as a tamer for green hydrogen. Public media article on the German newspaper “Background Tagesspiegel”
3. E. Monge, V. Sendarrubias, J. Martín, El proyecto ARENHA demostrará el potencial del amoniaco como forma de almacenamiento energético, Public media article on the Spanish newspaper “Energética”.
4. María Hernández Solana, Elena Monge Ruiz, Un proyecto con dinero europeo impulsa el uso del amoniaco verde para almacenar energía, The objective.
5. V. Sendarrubias, E. Monge, J. Martin, Nueva reunión del consorcio del proyecto ARENHA en el que participa el CNH2 de Puertollano, La comarca de Puertollano.
6. J.L. Viviente. Advance materials and reactors for energy storage through ammonia. Issue 13 of The Innovation Platform. Energy Storage section, Pages 176-179. https://www.innovationnewsnetwork.com/publication/the-innovation-platform-issue-13/

3.1.4. Conference and other events

Participation in conferences and other events will be a significant part of the dissemination project. The objective of these events is to present ARENHA project to general public including research organisations, potential users, industry and other stakeholders. A list of assisted conferences assisted by any ARENHA partner is shown below.

1. Christine Mounaïm-Rousselle, Pierre Brequigny, S Houillé, C Dumand. Potential of Ammonia as future Zero-Carbon fuel for future mobility: Working operating limits for Spark-Ignition engines. SIA POWERTAIN & ENERGY 2020, Nov 2020, Online, France. France. https://hal.archives-ouvertes.fr/hal-03188481.
2. V. Cechetto, L. D Felice, A. Arratibel Plazaola and F. Gallucci. Ammonia inhibition on H2 produced via ammonia decomposition in a catalytic membrane reactor. World Online Conference on Sustainable technologies. March 17-19, 2021. Oral presentation. https://wocst.org/index.php.
3. Camel Makhloufi. Utilising Liquid Ammonia for Cost-effective storage and distribution of large Quantities of Renewable Energy. 14th Energy World Forum. May 19th, 2021. Oral presentation. https://energystorageforum.com/session/utility-utilising-liquid-ammonia-.

4. F. Kukk, S. Pylypko, E. Lust, and G. Nurk. Influence of active layer thickness of Reversible solid oxide cells on the electrochemical performance of water electrolysis. SOFC XVII conference. July 18th-23rd, 2021. Oral presentation. https://www.electrochem.org/sofc-xvii/.
5. Christine Mounaim-Rousselle. Ammonia as zero-carbon fuel for Internal Combustion Engine: where are we today? 15th International Conference on Engines and Vehicles. September 12th-16th, 2021. Keynote Lecture. https://www.sae-na.it/.
6. José Luis Viviente. Advanced materials and Reactors for Energy storage tHrough Ammonia (ARENHA). Online workshop: NON-BATTERY BASED ENERGY STORAGE: Four sustainable European solutions. September 15th, 2021. Oral presentation. https://recycalyse.eu/recycalyse-joint-workshop/.
7. Zançat Sahin, Valentina Cechetto, Luca Di Felice, Fausto Gallucci, H2 Production through Ammonia Decomposition in a Catalytic Membrane Reactor: A computational and experimental study, 12th International Conference on Hydrogen Production (ICH2P-2021 – On-line conference). September 19th-23rd, 2021. Oral presentation. https://www.innomem.eu/event/12th-edition-of-the-international-conference.
8. CNH2, Assess stage and opportunities of ammonia as an element for decarbonising the shipping sector, World Hydrogen & Ammonia Shipping. 15-16/12/2021.
9. J.L. Viviente, F. Gallucci, R. Campana, X. Sun, S. Megel, W.I.F. David, G. van Zee, S. Pylypko, J.A. Medrano, C. Dumand, C. Rouselle and A. Ramirez-Santos. Advanced materials and Reactors for ENergy storage tHrough Ammonia (ARENHA). European Hydrogen Energy Conference 2022 (EHEC2022). Madrid (Spain), May 18th-20th, 2022. Oral presentation.
10. C. Dumand, C. Mounaïm-Rousselle, P. Gaillard, E. Gérard, J. Dedeurwaerder, J. Op de Beeck. Ammonia powertrain for a carbon free mobility, SIA Powertrain & Energy 2022, June 15th-16th, 2022, Rouen (France). Oral presentation.
11. J.L. Viviente. Advanced materials and Reactors for ENergy storage tHrough Ammonia (ARENHA). 15th International Conference on Catalysis in Membrane Reactors (ICCMR15), Tokyo (Japan). July 31st-August 4th, 2022. Keynote Lecture.
12. V. Cechetto, L. Di Felice, F. Gallucci. Adsorbent materials for residual ammonia removal from hydrogen produced via ammonia decomposition in a catalytic reactor. 15th International Conference on Catalysis in Membrane Reactors (ICCMR15), Tokyo (Japan). July 31st-August 4th, 2022. Oral presentation.
13. Z. Sahin, V. Cechetto, A. Rahimalimamaghani, F. Gallucci, M. Gazzani, L. Di Felice, M. Llosa Tanco, A. Pacheco Tanaka. Ammonia decomposition in Ru-based catalytic membrane reactors. 15th International Conference on Catalysis in Membrane Reactors (ICCMR15), Tokyo (Japan). July 31st-August 4th, 2022. Oral presentation.
14. V. Cechetto, L. Di Felice, F. Gallucci, Hydrogen production and purification via ammonia decomposition in a catalytic membrane reactor, 1st Symposium on Ammonia Energy, 1-2 September 2022 Cardiff, UK.
15. Vito Verde, Álvaro Ramirez Santos, Fausto Gallucci, Techno-Economic Analysis of a Small-Scale, 1st Symposium on Ammonia Energy, 1-2 September 2022 Cardiff, UK
16. Bill David, Matthew Cummings, 1st Symposium on Ammonia Energy, 1-2 September 2022 Cardiff, Keynote Speech, UK https://www.ammoniasymposium2022.com/
17. G. Nurk, S. Pylypko, E. Lust, Modification of the state-of-the-art solid oxide cells to increase performance and durability in electrolysis operation, Graduate School of Functional Materials and Technologies Scientific Conference, Tallin 2022
18. S. Pylypko, ELCOGEN SOFC/SOEC cell and stack technology, 4th International Workshop on Degradation Issues of Fuel Cells and Electrolysers, Corfu, Greece 03.05.2022
19. E. Monge, ARENHA Advanced materials and Reactors for Energy storage tHrough Ammonia, H2 Revolution International Congress, Puertollano, 29.10.2022
20. Xiufu Sun, HANNOVER MESSE 2022, Advanced materials and Reactors for ENergy storage tHrough Ammonia (ARENHA), May30-June 2.

21. Elena Monge, Present ammonia among other European projects about green energy production, storage and usage, IMPROVEMENT Project Conferences, 29/11/2022.
22. Carlos Merino, Widespread the knowledge of the ammonia as an energy carrier in Japan to establish synergies for future projects between Spain and Japan within this sort of technology, The 11th NEDO CDTI Joint Workshop, 2023.
23. ELCOGEN, Providing a platform for the state-of-the-art presentations and information exchange on the cutting-edge ceramic and composite technologies., 47th International Conference and Exposition on Advanced Ceramics and Composites, Daytona Beach, 2023.
24. Anastasiia Karabanova, Development of Sorbents for Novel Ammonia Synthesis Routes, 6th European Power to Ammonia® Conference June 2023.
25. Valentina Cechetto, "A Comparison Between Pd-Ag and Carbon Molecular Sieve Membranes for Hydrogen Separation During Ammonia Decomposition in A Membrane Reactor", 2nd Symposium on Ammonia Energy, July 2023.

In addition, a list of upcoming events related to ARENHA project is also available the ARENHA website. Main events for 2023 and 2024 are listed below.

Upcoming events in 2023

July 4-7, 2023: Low Temperature Fuel Cells, Electrolysers & H2 Processing (EFCF 2023), Lucerne (Switzerland) https://www.efcf.com/2023

July 9-14, 2023: 13th International Congress on Membranes and Membrane Processes (ICOM 2023), Chiba (Japan).http://icom2023.jp/

July 11-13, 2023: 2nd Symposium on Ammonia Energy, University of Orleans (France). https://ammonia-energy.sciencesconf.org/

August 20-24, 2023: 2023 Safety in Ammonia Plants & Related Facilities Symposium. Westin Grand Munich, Germany.https://www.aiche.org/conferences/annual-safety-ammonia-plants-and-relat…

*October 18-20, 2023:*16th International Conference on Catalysis in Membrane Reactors. Donostia-San Sebastián (Spain). http://www.iccmr16.org/

November 2023: Argus Clean Ammonia Europe Conference. Hamburg (Germany). https://www.argusmedia.com/en/conferences-events-listing/clean-ammonia-e…

Upcoming events 2024

May 2024: European Hydrogen Energy Conference (EHEC 2024). Bilbao (Spain)

July 2-5, 2024: 15th European SOFC & SOE Forum (EFCF2024), Lucerne (Switzerland). https://www.efcf.com/

Finally, two main workshops have been carried out during this period:

1. "Introduction to novel technologies related to ammonia-based energy storage". Paris, 6th April 2022. Organized by ENGIE.
2. "NH3 Academy". Rotterdam, 29th March 2023. Organized by PROTON VENTURE.

4. INTERNAL COMMUNICATION TOOLS

The internal dissemination has a special significance for the progress of the project and coordinates the science and communication activities between ARENHA partners. Periodic meeting about WP7 have been celebrated established from M18 every 2 months aiming to coordinate and engage all partners in the dissemination and communication activities.

Up to this date, a project Kick-off meeting, 6 Consortium Meetings (M6, M12, M18, M24, M30, M36) and 4 Project Technical Committee meetings (M3, M9, M15, M18) were celebrated.

In addition, common project presentation and protocols were created for internal use. Internal mailing lists for the consortium, the different bodies and for each WP were also created to facilitate the communication between the partners. And finally, a confidential private data management forum website (SharePoint) was created to provide direct communication and continual information exchange between the partners.

ANNEX

Table 1. List of the publications in LinkedIn.

Date	Title
24.03.2023	Don´t miss the opportunity to join this event organized by PV under the scope of ARENHA Project!
24.03.2023	Under the scope of the ARENHA Project, we will celebrate an event about ammonia energy. Hosted by PV, this includes the participation of some of our most experienced research. Join the event on: https://lnkd.in/geMxxF56
23/03/2023	4️⃣ The 4th step of the work plan focuses on the scale-up of key components already worked on in WP3 as well as those for the pilot plant. The ammonia-based energy system is designed, built and commissioned. These are prototypes to be developed: ⚪ SOEC stack modules and balance of plant components (BoP) of electrolyser system for hydrogen production. ⚪ Ammonia synthesis system prototype based on Haber Bosch with an advanced absorber. ⚪ Ammonia decomposition membrane reactor prototype.
22/03/2023	Since the start of the ARENHA project in 2020, a series of conferences have been held on the use of ammonia as a resource for the storage and distribution of renewable energy, focusing on hydrogen. As a gesture of transparency, and to facilitate the consultation of professionals in the field and the public, we have included a directory of all these conferences on our website. 🎥 You can access the complete list here. ➡️ https://lnkd.in/dwzpvWy8
20/03/2023	We present CNH2 - Centro Nacional del Hidrógeno (National Hydrogen Center), an entity dedicated to the research and development of hydrogen technologies, related to the production, storage, purification and conversion into energy. Its work at ARENHA is based on the testing of processes, characterisation, standardisation, certification or validation of technological developments achieved by the production sector to improve the competitiveness of companies and promote the implementation of hydrogen and fuel cell technologies.
16/03/2023	3️⃣ Item 3 of ARENHA's work plan has focused on the development of key components, prior to its final escalation to TRL 5. It includes the following actions: ✔️ New materials for SOEC stacks, optimised for hydrogen production. ✔️ Materials for ammonia synthesis ✔️ Materials for solid state storage of ammonia ✔️ Membranes and membrane reactors for ammonia decomposition ✔️ Materials and systems for the generation of energy from green ammonia 💻 https://arenha.eu/
15/03/2023	📣 The latest newsletter, which we launched via email last December, is now available on the website. In it we explain in detail the project, some case studies, the latest events and conferences that have taken place and the calendar with the next meetings. Available on the newsletter page. ➡️ http://bit.ly/3T8hCKs
13/03/2023	Don´t miss the NH3 academy hosted by Proton Ventures that will take place on March 29th this year! https://lnkd.in/dX7TfGKA
13/03/2023	Introducing the Eindhoven University of Technology, ARENHA's partner dedicated to specialised research in engineering science and technology.

	Their Sustainable Process Engineering research group is being one of the pillars of our project, as their work focuses on the development of integrated reactors, based on improved knowledge and the use of advanced reactor models. This combines state-of-the-art numerical modelling, non-invasive experimental techniques and experimental demonstration of novel reactor concepts.
09/03/2023	Do you want to know more details about the objectives and studies developed in ARENHA? We are at your disposal to answer your questions and inform you about this fruitful project. 👉 http://bit.ly/3yeThch
08/03/2023	The low energy density and difficulties associated with gas handling are the main drawbacks associated with hydrogen, which have so far prevented its related technologies from gaining popularity for commercial application in the field of energy production. ✔ One solution to overcome these drawbacks is to store hydrogen in the chemical bonds of hydrogen-bearing compounds, such as ammonia.
08/03/2023	We are glad to announce that ARENHA project has been published in the Issue 13 of The Innovation Platform that you can see below; https://lnkd.in/dmT9MGe4
06/03/2023	ARENHA is developing advanced SOECs for... ◯ The production of renewable hydrogen. ◯ Catalysts for low temperature/pressure ammonia synthesis. ◯ Solid sorbents for ammonia synthesis intensification and storage. ◯ Catalysts and membrane reactors for ammonia decomposition for the production of pure hydrogen (>99.99%).
03/03/2023	Stay tuned to the NH3 Academy event organized by Proton Ventures. ARENHA project will be presented as well as other ammonia related topics. More info will be made available soon.
02/03/2023	TECNALIA Research & Innovation is one of ARENHA's partners. Its goal: to transform knowledge into new business opportunities for industry. Its team of 72 scientists works in the following areas of our project: 1️⃣ Membrane technology and process intensification. 2️⃣ Waste valorisation, based on the recovery of critical and high-tech metals.
01/03/2023	The second point of the ARENHA work plan translates the general framework that has already been established in WP2. A set of specifications for the new value chain for energy storage, in line with the previous business model and end-user inputs. In addition, it will bring together all the modelling related to each technology and the complete system design.
27/02/2023	Energy discharge processes studied in ARENHA tackle various applications from ammonia decomposition into pure H2 for FCEV, direct ammonia utilization on SOFCs for power and ICEs for mobility.
23/03/2023	The first step in ARENHA has been to define the business case, identifying the needs and obstacles provided by the market, as well as the regulatory framework and potential risks. By using appropriate techniques, the project is oriented towards truly profitable techniques and sets the framework for high impact exploitation actions.
22/02/2023	In total, 11 organisations from seven European countries are part of the ARENHA project, so that a complete supply chain has been created: ◯ TECNALIA Research & Innovation ◯ Eindhoven University of Technology ◯ CNH2 - Centro Nacional del Hidrógeno ◯ DTU - Technical University of Denmark ◯ Fraunhofer IKTS

	United Kingdom Research and Innovation Proton Ventures Elcogen H2SITE Stellantis ENGIE
21/02/2023	Ammonia is characterised as a manageable, carbon-free energy carrier for large-scale energy storage. It thus ensures a clean supply covering a wide range of services. Although it has been in use for several decades, its use in this context is reaching great heights as it has become an innovative and environmentally friendly proposition.
17/02/2023	Last January, CNH2 represented by Carlos Merino, participated in the 11th NEDO CDTI Workshop in Japan where ARENHA project was highlighted as a project that assess green ammonia as an energy vector. El pasado mes de enero, el CNH2 representado por Carlos Merino participó en la 11 edición del NEDO CDTI Workshop en Japón donde se destacó el proyecto ARENHA como proyecto que promueve el uso del amoniaco verde como vector energético.
16/02/2023	The ARENHA work plan consists of 8 work packages spread over 48 months of research and development. We list each of the Work Package as follows: 1 Business case definition 2 System requirements, design and modelling 3 Development of key components 4 Key components scale up 5 Plant integration and validation 6 Environmental LCA, economic and safety assessment 7 Dissemination and communication 8 Project management
15/02/2023	Over the last decades, hydrogen has gained considerable attention as an ideal and clean energy source. Its reaction with oxygen produces in fact only water as by-product and high efficiencies for energy conversion are achieved when hydrogen is employed as feedstock for power production in fuel cells.
13/02/2023	ARENHA stands for Advanced Materials and Reactors for ENergy Storage tHrough Ammonia, a name that perfectly defines the central aim of the project around ammonia as an excellent solution for flexible energy storage and use.
09/02/2023	Ammonia is traditionally produced from hydrogen and nitrogen, using the well-known Haber-Bosch process. The conversion is typically carried out at 150-250 bar and 400-500 °C, while the feed gas mixture is passed through a series of fixed beds containing an Fe-based catalyst. As the conversion in the reactor does not usually exceed 15 %, the unreacted components are recovered in the reactor, after separation of the ammonia product by quench condensation.
08/02/2023	Sectors such as transportation, industry, or thermal activities, which require greater energy storage capacity, will benefit the most from the advances we are working on at ARENHA
06/02/2023	Since ARENHA started in 2020, our partners have been organising and participating in different dissemination events about the project. The event calendar will continue to expand throughout 2023, with new activities in which we will continue to publicise the objectives set in ARENHA and the latest advances.
03/02/2023	What is the ARENHA project? Several scientific entities are developing and integrating material solutions that enable the use of ammonia for energy storage and cost-effectiveness.

	We tell you more details in this video.
03/02/2023	In addition to being easy to liquefy, ammonia has a high hydrogen gravimetric density by weight and, in turn, by volume (108 kg h2/m3 of liquified NH3). This reduces the cost of transporting hydrogen per unit of stored energy, as well as acting as a CO2-free energy storage medium.
02/02/2023	Find out the latest news about ARENHA in our newsletter, where we tell you about the latest developments in the project and how ammonia plays a role in the use of renewable energies.
24.01.2023	Check this last news! The world's first ammonia truck is 5 times more efficient than an electric one, and recharges in 8 minutes https://lnkd.in/dpN72z3k
16.01.2023	Check out last news about green ammonia Projects aiming the de-carbonization of the Spanish industry.
16.01.2022	Do you... - have an interest in decarbonization projects including green ammonia? - understand Spanish? Then the following article shared by the EU-funded ARENHA Project is worth a read.
14.12.2022	El pasado 30 de noviembre se presentaron los proyectos ARENHA y GREENHYSLAND, financiados por el H2020, bajo el ciclo de conferencias organizado por el proyecto IMPROVEMENT, del cual el CNH2 - Centro Nacional del Hidrógeno es líder. Los principales objetivos y progreso de ambos proyectos fueron mostrados y discutidos". El Proyecto ARENHA fue presentado por Elena Monge Ruiz, y el Proyecto GreenHysland con José María Ruiz Álvarez ARENHA and GREENHYSLAND projects, both H2020 founded programs, were presented on November 30th during the Conferences organized under the scope of the IMPROVEMENT project, led by #CNH2. Objectives and main progress of both projects were shown and discussed". The ARENHA Project was presented by Elena Monge Ruiz and the GreenHysland Project by José María Ruiz Álvarez ARENHA project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 862482 GREENHYSLAND project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (now Clean Hydrogen Partnership) under Grant Agreement No 101007201. This Joint Undertaking receives support from the European Union's Horizon 2020 Research and Innovation programme, Hydrogen Europe and Hydrogen Europe Research. #GreenhyslandProject #ARENHAProject #Improvementproject #Hydrogen #Ammonia #Agreement
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July 2022	Our last paper at the TU/e SUSTAINABLE PROCESS ENGINEERING group on development of metallic supports for membrane production as part of MACBETH project. A nice cooperation with H2SITE On-site H2 recovery & generation.

	Gold open access at https://lnkd.in/eFuJpjnW Serena Agnolin Jon Meléndez Rey Luca Di Felice #membranes #membranereactors #hydrogen EIRES – Eindhoven Institute for Renewable Energy Systems
July 2022	The Ammonia Energy Association summarizes research ongoing on low pressure ammonia synthesis. AMBHER project is developing new structured #catalysts and #membranes to produce ammonia at milder conditions as hydrogen carrier.
August 2022	Almost ready to kick off the 15th International Conference on Catalysis in Membrane Reactors #ICCMR15 in #Japan with the Plenary lecture of Alfredo Pacheco Tanaka. our group TU/e SUSTAINABLE PROCESS ENGINEERING will deliver 16 talks including Plenary and Keynotes. the work carried out in MACBETH, ARENHA Project, C2FUEL, AMBHER project, #Microsync, #MemCat, Bizeolcat Project will be presented at the conference.
August 2022	The AMBHER project is being presented at the International Conference on Catalysis in Membrane Reactors, #ICCMR15, in #Tokyo (Japan). Our coordinator Viviente José Luis from TECNALIA Membrane Technology is presenting a Poster about the project.
August 2022	The TU/e SUSTAINABLE PROCESS ENGINEERING group (plus a few friends) at the #ICCMR15 in Japan. Nice experience, and next year is San Sebastian in Spain for #ICCMR16
17.10.2022	The European ARENHA Project (Advanced materials and Reactors for Energy storage tHrough Ammonia) project aims to global impact seeking to develop, integrate and demonstrate key material solutions enabling the use of ammonia for flexible, safe and profitable storage and utilization of energy under the form of green ammonia, celebrated its M30 consortium meeting has been held last October 6th, 2022. The meeting was hosted by DTU in Lyngby (near Copenhagen, Denmark). The status and progress of the project in the different work packages was discussed addressing: the business case; the systems requirements, design and modelling; the key component developments and the initial steps for the prototypes set-ups and, finally, the environmental LCA, economic and safety assessment. The consortium also discussed specific short-term activities to be carried out in the coming months. Despite few deviations due to the COVID19 impact the project is progressing as planned. Further information will be presented in the ARENHA public website in coming months The project coordinated by Tecnalia Research & Innovation and has a European consortium composed of TU/e, ENGIE, CNH2, DTU, FhG-IKTS, STFC, PV, ELCOGEN, H2SITE, PSA. It gathers all the experience to demonstrate the concept called "power-to-ammonia-to-usage", in all its value chain, based on the development of innovative materials and systems. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 862482. Further information on the project can be found at the following link: https://arenha.eu/ and social media Twitter: @ARENHA_H2020. If you want to receive the ARENHA Newsletter please register in: https://lnkd.in/dVmV4W9S
18.10.2022	El proyecto europeo ARENHA (Advanced Materials and Reactors for Energy storage tHrough Ammonia), que tiene como objetivo desarrollar, integrar y demostrar soluciones de materiales clave que permitan el uso de amoniaco verde para el almacenamiento y utilización de la energía de forma flexible, segura y rentable, celebró su reunión de seguimiento el pasado 6 de octubre de 2022 en Lyngby (cerca de Copenague, Dinamarca). El estado y el progreso del proyecto en los diferentes paquetes de trabajo fue discutido en la reunión abordando: el caso de negocio; los requisitos de sistemas, diseño y modelado; los desarrollos de componentes clave y los pasos iniciales para la configuración de prototipos y, finalmente, el Análisis de Ciclo de Vida ambiental, evaluación económica y de seguridad. El consorcio también discutió actividades específicas a corto plazo que se llevarán a cabo en los próximos meses. A pesar de las algunas desviaciones debidas al impacto de COVID19, el proyecto avanza según lo previsto. El proyecto coordinado por TECNALIA Research & Innovation y cuenta con un consorcio europeo compuesto por TU/e, ENGIE, CNH2, DTU, FhG-IKTS, STFC, PV, ELCOGEN, H2SITE, PSA. Reúne toda la experiencia para demostrar el concepto denominado "power-to-ammonia-to-usage", en toda su cadena de valor, basado en el desarrollo de materiales y sistemas innovadores.

	Este Proyecto ha recibido financiación de la Unión Europea a través del programa de investigación e innovación H2020 bajo el acuerdo Nº 862482. Puede encontrarse más información sobre el proyecto en el siguiente enlace: https://arenha.eu y en las redes sociales de LinkedIn: ARENHA Project y Twitter: @ARENHA_H2020. Si desea recibir información de la newsletter, por favor, regístrese en el siguiente enlace: https://lnkd.in/e5i88QGr
17.10.2022	El proyecto europeo ARENHA (Advanced Materials and Reactors for Energy storage tHrough Ammonia), que tiene como objetivo desarrollar, integrar y demostrar soluciones de materiales clave que permitan el uso de amoniaco verde para el almacenamiento y utilización de la energía de forma flexible, segura y rentable, celebró su reunión de seguimiento el pasado 6 de octubre de 2022 en Lyngby (cerca de Copenague, Dinamarca). El estado y el progreso del proyecto en los diferentes paquetes de trabajo fue discutido en la reunión abordando: el caso de negocio; los requisitos de sistemas, diseño y modelado; los desarrollos de componentes clave y los pasos iniciales para la configuración de prototipos y, finalmente, el Análisis de Ciclo de Vida ambiental, evaluación económica y de seguridad. El consorcio también discutió actividades específicas a corto plazo que se llevarán a cabo en los próximos meses. A pesar de las algunas desviaciones debidas al impacto de COVID19, el proyecto avanza según lo previsto. El proyecto coordinado por TECNALIA Research & Innovation y cuenta con un consorcio europeo compuesto por TU/e, ENGIE, CNH2, DTU, FhG-IKTS, STFC, PV, ELCOGEN, H2SITE, PSA. Reúne toda la experiencia para demostrar el concepto denominado “power-to-ammonia-to-usage”, en toda su cadena de valor, basado en el desarrollo de materiales y sistemas innovadores. Este Proyecto ha recibido financiación de la Unión Europea a través del programa de investigación e innovación H2020 bajo el acuerdo Nº 862482. Puede encontrarse más información sobre el proyecto en el siguiente enlace: https://arenha.eu y en las redes sociales de LinkedIn: ARENHA Project y Twitter: @ARENHA_H2020. Si desea recibir información de la newsletter, por favor, regístrese en el siguiente enlace: https://lnkd.in/e5i88QGr
28.10.2022	Presentación del Proyecto Europeo "ARENHA" Elena Monje - CNH2 - Centro Nacional del Hidrógeno
03.10.2022	Hablamos de Hidrógeno y Amoniaco en el Congreso H2 Revolution International Congress, de la ciudad de #Puertollano, con la exposición de nuestra compañera Elena Monge Ruiz, y en el Proyecto en el que estamos inmersos en el CNH2 - Centro Nacional del Hidrógeno, el Proyecto ARENHA. Si quieres saber más sobre este gran Proyecto, puedes visitar nuestra página www.cnh2.es
02.10.2022	Hablamos de Hidrógeno y Amoniaco en el Congreso H2 Revolution International Congress, de la ciudad de #Puertollano, con la exposición de nuestra compañera Elena Monge Ruiz, y en el Proyecto en el que estamos inmersos en el CNH2 - Centro Nacional del Hidrógeno, el Proyecto ARENHA. Si quieres saber más sobre este gran Proyecto, puedes visitar nuestra página www.cnh2.es
02.10.2022	Presentación de nuestros proyectos en el Congreso H2 Revolution International Congress, celebrado en la ciudad de #Puertollano, en la que el Hidrógeno verde ha tenido un papel protagonista, así como el potencial y compromiso con el Pacto Verde Europeo.
22.07.2022	ARENHA newsletter M24 is available on the website of the project. Click on the next link to check the latest news about ARENHA!
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05.07.2022	#GreenAmmonia is one of the most important use cases for #greenhydrogen. Ammonia is essential for fertilizers (aka. food for 8bn people), and there is no other solution. Currently, 50 million tons of #hydrogen are produced for ammonia production, and the CO2 emissions are 500 million tons.

	To learn everything on this vital but completely neglected aspect of the energy transition, join our free webinar with Charley Rattan: "#Green #Ammonia - The other #Hydrogen": https://lnkd.in/e3qfYCXj What do you think? Wouldn't it make sense to start in an industry that emits huge amounts of CO2 and that has no alternative?
18.07.2022	Dear Network, I am happy to share with you our first paper about pre-treatments of metallic filters for Pd-based membranes preparation. In this article we tackle the issue of surface roughness by introducing a ceramic based smoothening layer, which allowed us to deposit Pd on these very unrefined supports. More work will follow for pore size distribution improvement and gas permeance increase, so feel free to stay tuned :) #membranes #hydrogen #MACBETH_2020
20.06.2022	"ARENHA dissemination material was present at HMI by the partner of the project Fraunhofer IKTS"
26.05.2022	News!! #GreenAmmonia #NewFuels #Sustainability #GreenPower #GreenHydrogen
26.05.2022	Another great collaboration with TU/e SUSTAINABLE PROCESS ENGINEERING group released a paper on ammonia decomposition for pure hydrogen production within the ARENHA Project. The paper is open access at: https://lnkd.in/eNeYxgPt
24.05.2022	Participamos en las #EHEC2022 #Madrid 18-20; la conferencia europea de referencia en el campo de la energía del #Hidrógeno. Podrás visitarnos en el stand del Cluster de Energía | Basque Energy Cluster y conocer nuestras COMPETENCIAS TECNOLÓGICAS e industriales en el ámbito del hidrógeno. TECNALIA participará activamente en el congreso realizando varias presentaciones orales. Ekain Fernandez presentará los proyectos Elkartek H2BASQUE y Cervera H24NEWAGE. Viviente José Luis presentará el proyecto europeo ARENHA. Y Diego García López presentará el proyecto Elkartek BIDERATU. Immanuel Vincent y Cuneyt Karakaya moderarán sesiones sobre Electrólisis para producción de hidrógeno, y electrocatalizadores/electrodos, respectivamente.
07.04.2022	Our colleagues Elena Monge Ruiz and Jesús J. Martínús have participated on the ARENHA Consortium Meeting Month 24 celebrated on Paris 6th of April. #ARENHAProject, #ProyectoARENHA, #parisFR #France, #Ammonia, #Hydrogen, Fertiberia TECH España
06.04.2022	Today the ARENHA Project meeting is ongoing at ENGIE Lab CRIGEN in France. Valentina Cechetto is presenting the work on membrane reactors for ammonia cracking carried out at TU/e SUSTAINABLE PROCESS ENGINEERING, TU/e Chemical Engineering and Chemistry in collaboration with TECNALIA
06.04.2022	Nuestros compañeros Jesús J. Martín, de la Unidad de Gestión de Proyectos y Elena Monge Ruiz, de la Unidad de Ingeniería Aplicada han asistido al primer Workshop de ARENHA Project.
01.04.2023	ARENHA Project First Workshop: Introduction to novel technologies related to ammonia-based energy storage. We are pleased to invite you to the 1st Workshop of the ARENHA Project. This special dissemination workshop will introduce novel materials and technologies related to ammonia-based energy storage covering the whole power-to-ammonia-to-applications. Lectures are given by scientists of both academia and industry. More information and registration: https://lnkd.in/gVn6gHKB
30.03.2022	We are glad to announce that our colleague Viviente José Luis will give a Keynote Lecture at the 15th International Conference on Catalysis in Membrane Reactors to be held from July 31st – August 4th, 2022, in the Waseda University, Tokyo, Japan.
30.03.2022	Avanzando hacia el amoniaco verde y hacia fertilizantes bajos en carbono
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22.02.2022	"Huelva será el kilómetro cero de Europa en producción de amoniaco verde"
21.02.2022	"Huelva será el kilómetro cero de Europa en producción de amoniaco verde"
15.02.2022	Project Catalina: GW-scale green ammonia in Spain
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02.02.2022	ES#SPAIN: Large-scale production project of #GreenHydrogen and #GreenAmmonia announced Copenhagen Infrastructure Partners announces partnership with Enagás, Naturgy, Grupo Fertiberia and Vestas (letter of intent signed committing to work together to realize the Project)
01.02.2022	ES#SPAIN: Large-scale production project of #GreenHydrogen and #GreenAmmonia announced Copenhagen Infrastructure Partners announces partnership with Enagás, Naturgy, Grupo Fertiberia and Vestas (letter of intent signed committing to work together to realize the Project)

04.01.2022	El coche volador de Madrid: para 2 personas, amoniaco de combustible y llegará en 2023
15.12.2021	Our colleagues from CNH2 - Centro Nacional del Hidrógeno, Elena Monge Ruiz and David Fernández Rodríguez from #ARENHA and #MACBETH have participated in the World Hydrogen and Ammonia Shipping Conference taking place on December 15th . This conference aims to assess the state and potential on hydrogen and ammonia and which challenges must be overcome to implement these technologies safely and profitably in vessels and ports. #Ammonia, #Hydrogen, #ARENHAProject, #MacbethProject, Emilio Nieto. Dr.
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16.11.2021	CNH2 - Centro Nacional del Hidrógeno, de la mano de Elena Monge Ruiz, de la Unidad de Ingeniería Aplicada, ha comentado el Proyecto ARENHA (ARENHA Project) en un artículo para la revista The Objective. CNH2 - Centro Nacional del Hidrógeno se encuentra involucrado en el proyecto, que tiene como objetivo demostrar el potencial del amoniaco como forma de almacenamiento energético, así como su posterior uso para generación de energía.

Table 2. Twitter publications.

Date	Title
23/03/2023	The 4th step of the work plan focuses on the scale-up of key components already worked on in WP3 as well as those for the pilot plant. The ammonia-based energy system is designed, built and commissioned.
22/03/2023	ARENHA Project @ARENHA_H2020 · Mar 22 We have included a directory of all these conferences on our website.
20/03/2023	Its work at ARENHA is based on the testing of processes, characterisation, standardisation, certification or validation of technological developments achieved
20/03/2023	by the production sector to improve the competitiveness of companies and promote the implementation of hydrogen and fuel cell technologies.
16/03/2023	3 tem 3 of ARENHA's work plan has focused on the development of key components, prior to its final escalation to TRL 5. It includes the following actions: ✔ New materials for SOEC stacks, optimised for hydrogen production. ✔ Materials for ammonia synthesis
16/03/2023	✔ Materials for solid state storage of ammonia ✔ Membranes and membrane reactors for ammonia decomposition ✔ Materials and systems for the generation of energy from green ammonia
15/03/2023	The latest newsletter, which we launched via email last December, is now available on the website. It is available on the newsletter page. → http://bit.ly/3T8hCKs
13/03/2023	Introducing the @TUeindhoven , ARENHA's partner dedicated to specialised research in engineering science and technology. Their Sustainable Process Engineering research group is being one of the pillars of our project.
13/03/2023	Their work focuses on the development of integrated reactors, based on improved knowledge and the use of advanced reactor models. This combines state-of-the-art numerical modelling, non-invasive experimental techniques and experimental demonstration of novel reactor concepts.
09/03/2023	Do you want to know more details about the objectives and studies developed in ARENHA? We are at your disposal to answer your questions and inform you about this fruitful project. 👉 http://bit.ly/3yeThch
08/03/2023	Low density and gas handling difficulties are the drawbacks of hydrogen, which have so far prevented its technologies from being applied in energy production.
08/03/2023	One solution would be to store hydrogen in the chemical bonds of hydrogen-bearing compounds, such as ammonia.
06/03/2023	ARENHA has been published in the Issue 13 of The Innovation Platform. Check this info in the link below
06/03/2023	ARENHA is developing advanced SOECs for... ◉ Production of renewable hydrogen. ◉ Catalysts for low temperature/pressure ammonia synthesis. ◉ Solid sorbents for ammonia synthesis intensification and storage. ◉ Catalysts and membrane reactors for ammonia decomposition.
02/03/2023	The second point of the ARENHA work plan translates the general framework that has already been established in WP2.
02/03/2023	A set of specifications for the new value chain for energy storage, in line with the previous business model and end-user inputs. In addition, it will bring together all the modelling related to each technology and the complete system design.
27/02/2023	Energy discharge processes studied in ARENHA tackle various applications from ammonia decomposition into pure H2 for FCEV, direct ammonia utilization on SOFCs for power and ICEs for mobility.

23/02/2023	The first step in ARENHA has been to define the business case. By using appropriate techniques, the project is oriented towards truly profitable techniques and sets the framework for high impact exploitation actions. @ENGIEgroup
22/02/2023	In total, 11 organisations from seven European countries are part of the ARENHA project, so that a complete supply chain has been created:
22/02/2023	@tecnalia @TUeindhoven @cnh2_es @DTUtweet @FraunhoferIKTS @UKRI_News @protonventures @Elcogen_EU Hydrogen Onsite @Stellantis @ENGIEgroup
21/02/2023	Ammonia is characterised as a manageable, carbon-free energy carrier for large-scale energy storage. It thus ensures a clean supply covering a wide range of services. Although it has been in use for several decades, its use in this context is reaching great heights.
16/02/2023	4 Key components scale up 5 Plant integration and validation 6 Environmental LCA, economic and safety assessment 7 Dissemination and communication 8 Project management
15/02/2023	Hydrogen reaction with oxygen produces in fact only water as by-product and high efficiencies for energy conversion are achieved when hydrogen is employed as feedstock for power production in fuel cells.
13/0322023	ARENHA stands for Advanced Materials and Reactors for ENergy Storage tHrough Ammonia, a name that perfectly defines the central aim of the project around ammonia as an excellent solution for flexible energy storage and use.
09/03/2023	Ammonia is traditionally produced from hydrogen and nitrogen, using the well-known Haber-Bosch process. The conversion is typically carried out at 150-250 bar and 400-500 °C, while the feed gas mixture is passed through a series of fixed beds containing an Fe-based catalyst.
09/03/2023	As the conversion in the reactor does not usually exceed 15 %, the unreacted components are recovered in the reactor, after separation of the ammonia product by quench condensation.
08/03/2023	Sectors such as transportation, industry, or thermal activities, which require greater energy storage capacity, will benefit the most from the advances we are working on at ARENHA.
06/03/2023	Since ARENHA started, our partners have been organising and participating in different dissemination events.
06/03/2023	The event calendar will continue to expand throughout 2023, with new activities in which we will continue to publicise the objectives set in ARENHA and the latest advances.

03/03/2023	In addition to being easy to liquefy, ammonia has a high hydrogen gravimetric density by weight and, in turn, by volume (108 kg h2/m3 of liquified NH3). This reduces the cost of transporting hydrogen per unit of stored energy, as well as acting as a CO2-free energy storage medium
01/03/2023	Find out the latest news about ARENHA in our newsletter, where we tell you about the latest developments in the project and how ammonia plays a role in the use of renewable energies.