



## *Advanced material and Reactor for ENergy storage tHrough Ammonia*

### **Newsletter – September 2024**



### **Editorial**

Welcome to this 8<sup>th</sup> ARENHA project newsletter. ARENHA is a European five-year project with global impact seeking to develop, integrate and demonstrate key material solutions enabling the use of ammonia for flexible, safe and profitable storage utilization of energy. Ammonia is an excellent carrier due to its high energy density, carbon-free composition, industrial know-how and relative ease of energy storage. ARENHA demonstrates the feasibility of ammonia as a dispatchable form of large-scale energy storage.

The present newsletter is the eighth release, and it is presenting the progress on the project and highlighting information related to the R&D fields addressed. Hope you will find the info in this newsletter interesting. On our website [www.arenha.eu](http://www.arenha.eu) you will find public presentations, all the public information of the project and many other interesting news. Stay tuned!

### **In this Issue:**

What is ARENHA? .....	2
Highlighths.....	4
Dissemination activities, publications and presentations.....	4

## **What is ARENHA?**

### **The concept**

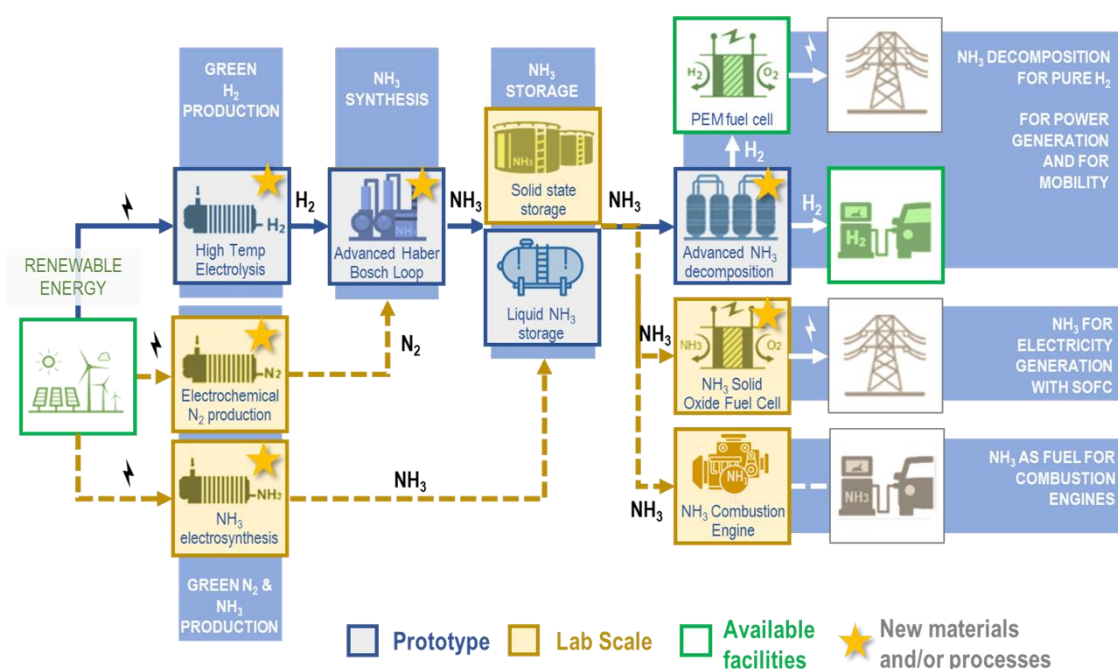
For decades, utility-scale energy storage has been used to balance load and demand within an energy generation system composed mainly of base load power sources enabling thus to large nuclear or thermal generating plant to operate at peak efficiencies. Energy storage has contributed over the time to meet peak demand and regulate frequency beside peak fossil fuel power plants that usually provided the bulk of the required energy. In the aforementioned context where inherent variability of the power generation asset was mainly a minor issue, energy storage capacity remains nevertheless limited for economic reasons storing electricity during low electricity demand and releasing it back into the grid during high demand, typically over a daily cycle.

In the current context of global momentum in favour of renewable electricity catalysed by spectacular levelized production cost decrease, higher storage capacity is required to ensure security and flexibility providing a portfolio of services from grid services to the decarbonization of energy intensive sectors like the transport, industry or heating and cooling sector.

For that purpose, hydrogen produced from electrolysis reveals to be a key pathway to unlock the full potential of renewable and especially for seasonal energy storage of large energy quantity and more specifically for all situations dealing with a large energy-to-power ratio situation. Hydrogen having a low volumetric energy density, it has to be compressed to high pressure, liquefied or combined as hydrogen carrier. Among all possibilities, ammonia is a carbon-free and dispatchable energy carrier allowing storing large quantities of renewable electricity. It is a primary candidate to allow a secure and clean supply of renewable energy for various stationary or mobile applications and with ability to provide a wide range of energy storage services using existing infrastructures and both well-defined regulation and acceptable safety history for over 75 years. If state-of-the-art ammonia production plants produce between 3,000 and 6,000 ton NH<sub>3</sub>/day, its well-known process involves H<sub>2</sub> production from natural gas reforming. Technical challenges remain to be overcome in order to ensure a flexible and cost comparable production of ammonia from intermittent renewable electricity sources. In addition to that, efficient energy discharge processes from NH<sub>3</sub> must be developed in order to best leverage the clean energy produced upstream by the renewable asset.

The ARENHA project aims at using ammonia as a green hydrogen carrier and for that purpose it develops its main activities around the green hydrogen production, ammonia synthesis, storage and dehydrogenation (Figure 1). Innovative materials are developed

and integrated into ground-breaking systems in order to demonstrate a flexible and profitable power-to-ammonia value chain but also several key energy discharge processes. Specifically, ARENHA is developing advanced SOEC for renewable hydrogen production, catalysts for low temperature/pressure ammonia synthesis, solid absorbents for ammonia synthesis intensification and storage, catalysts and membrane reactors for ammonia decomposition for pure hydrogen (>99.99%) production. Energy discharge processes studied in ARENHA tackle various applications from ammonia decomposition into pure H<sub>2</sub> for FCEV, direct ammonia utilization on SOFCs for power and ICEs for mobility.



**Figure 1. Power-to-ammonia-to-usage value chain in ARENHA**

## Project objectives.

ARENHA will demonstrate the full power-to-ammonia-to-usage value chain at TRL 5 and the outstanding potential of green ammonia to address the issue of large-scale energy storage through LCA, sociological survey, techno-economic analysis deeply connected with multiscale modelling. For this purpose, breakthrough technologies will be developed and integrated along the overall value chain. The main technical objectives on material and system level are the following:

- To develop and integrate innovative solid oxide cell materials into a flexible high temperature electrolysis demonstration unit producing 1.5 Nm<sup>3</sup>/hr hydrogen at ambient pressure to be connected on a real PV plant.

- To develop and integrate innovative materials into a synthesis loop enabling to operate a flexible Haber Bosch production unit of 10 kgNH<sub>3</sub>/day at lower pressure (<50 bar) and temperature (<450 °C).
- To develop and integrate innovative materials into a decomposition reactor able to generate 10 Nm<sup>3</sup>/hr of pure hydrogen (>99.99%) from green ammonia.
- To develop and test innovative materials and solutions for the alternative direct synthesis and utilization of next-generation green ammonia.
- To demonstrate ammonia as a flexible energy carrier through the development of a fully integrated prototype for green ammonia synthesis and decomposition.
- To assess the social acceptance, techno-economic-environmental feasibility, and replication potential of the developed value chains.

## **Highlights**

### **ARENHA M48 Consortium Meeting (15<sup>th</sup> April 2024)**

This face-to-face meeting of the ARENHA project took place during April the 15<sup>th</sup> of 2024 and was held in Bilbao (Spain). This meeting was the fifth face-to-face meeting and boosted the cooperation between each of the partners of the project.

### **Doctoral degree awarded**

On May 24<sup>th</sup>, Valentina Cechetto was awarded a doctoral degree at the Technical University of Eindhoven. Her thesis, titled 'Ultra-pure Hydrogen Production via Ammonia Decomposition in Packed Bed Membrane Reactors,' was carried out within the framework of the ARENHA project.

### **ARENHA in the press**

Since the production of a Press release by CNH2 in M48, ARENHA project has appeared in different media, especially energy-related online newspapers, like [EnergyNews.es](#), [H2-Hidrógeno verde](#) and [Enlit](#). It was also mentioned in the website of the [Basque Hydrogen Corridor](#).

## **Dissemination activities, publications and presentations**

ARENHA public presentations as well as open access articles and public reports are available online in the dissemination section of the project website: [www.arenha.eu](http://www.arenha.eu).

## 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., *Journal of Material Chemistry A*, **2020**, 8, 24098- 24107. <https://doi.org/10.1039/D0TA08313E>.
2. Valentina Cechetto, Luca Di Felice, Jose A. Medrano, Camel Makhoulfi, Jon Zuniga and Fausto Gallucci. H<sub>2</sub> 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 Kukkk, 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(49), 21220-21230. <https://doi.org/10.1016/j.ijhydene.2022.04.240>
6. Adrien Mercier, Christine Mounaïm-Rousselle, Pierre Brequigny, Jean Bouriot, and Clément 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>.
9. Valentina Cechetto, Serena Agnolin, Luca di Felice, A. Pacheco Tanaka, M. Llosa Tanco and Fausto Gallucci, “Metallic Supported Pd-Ag Membranes for Simultaneous Ammonia Decomposition and H<sub>2</sub> Separation in a Membrane Reactor: Experimental Proof of Concept. *Catalysts* **2023**, 13(6), 920; <https://doi.org/10.3390/catal13060920>.
10. Valentina Cechetto, Luca Di Felice and Fasuto Gallucci, Advances and Perspectives of H<sub>2</sub> Production from NH<sub>3</sub> Decomposition in Membrane Reactors. *Energy Fuels* **2023**, 37, 15, 10775–10798>; <https://doi.org/10.1021/acs.energyfuels.3c00760>.
11. F. Kukkk, S. Pylypko, E. Lust, and G. Nurk. Influence of Hydrogen Electrode Active Layer Thickness on Electrochemical Performance of Solid Oxide Cell Operating in

## Conference proceedings or presentations.

1. C. Mounaïm-Rousselle, P. Brequigny, S. Houillé, C. Dumand. Potential of Ammonia as future Zero-Carbon fuel for future mobility: Working operating limits for Spark-Ignition engines. SIA Powertrain & Energy 2020, Nov 2020, Online, France. <https://hal.archives-ouvertes.fr/hal-03188481>.
2. V. Cechetto, L. D Felice, A. Arratibel Plazaola and F. Gallucci. Ammonia inhibition on H<sub>2</sub> 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. C. 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-23th, 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. Z. Sahin, V. Cechetto, L. Di Felice, F. Gallucci, H<sub>2</sub> 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. CNH<sub>2</sub>, Assess stage and opportunities of ammonia as an element for decarbonising the shipping sector, World Hydrogen & Ammonia Shipping. 15-16/12/2021.
9. 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. Rousselle 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. 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. <https://research.tue.nl/en/publications/adsorbent-materials-for-residual-ammonia-removal-from-hydrogen-pr>
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. V. Verde, Á. R. Santos, F. Gallucci, Techno-Economic Analysis of a Small-Scale, 1st Symposium on Ammonia Energy, 1-2 September 2022 Cardiff, UK.
16. B. David, M. 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. Sergii 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. Elena 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, Kofu (Yamanashi Prefecture, Japan), 24 January 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 (Florida, USA), 22-27 January2023.
24. Anastasiia Karabanova, Development of Sorbents for Novel Ammonia Synthesis Routes, 6th European Power to Ammonia® Conference, Rotterdam (The Netherlands), 8 & 9 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, Université d'Orleans (France), 11-13 July 2023.
26. Mary HANHOUN, Raphael BRIERE, Elena MONGE, Assia SAKER, Pierre OLIVIER, Anne PRIEUR-VERNAT, "Preliminary environmental impacts of ARENHA project with life cycle assessment", the 11th International Conference on Life Cycle Management, Lille (France), 6-8 September 2023.
27. V. Verde, A. Saker, A. Berrady, A. Ramirez Santos, P. Olivier, F. Gallucci, "Integration of Solid Oxide Electrolysis and Enhanced Ammonia Synthesis for Green Ammonia Production: A Techno-economic Analysis", the European PhD Hydrogen Conference (EPHyC 2024), 20-22 March 2024.
28. Valentina Cechetto, Alba Arratibel Plazaola, Serena Agnolin, Gaetano Anello, Luca Di Felice, F. Gallucci. "Techno-economic assessment of a decentralized plant for hydrogen production from ammonia decomposition", 16th International Conference on Catalysis in Membrane Reactors (ICCMR16), Donostia-San Sebastián (Spain), 16-18 October 2023. Oral presentation.
29. J.L. Viviente, F. Gallucci, R. Campana, X. Sun, S. Megel, W.I.F. David, C. Liang, S. Pylypko, J.A. Medrano, C. Dumand, C. Rouselle and A. Saker, "Advanced materials and Reactors for ENergy storage tHrough Ammonia (ARENHA)", 16th International Conference on Catalysis in Membrane Reactors (ICCMR16), Donostia-San Sebastián (Spain), 16-18 October 2023. Oral presentation.
30. KUMAR, Richi, Mr SHANKAR, Ojas; Dr TRTIK, Pavel; Ms BYBJERG BROCK, Mette; Dr OKKELS BIRK, Jonas; Prof. KAISER, Andreas; Dr SUN, Xiufu, KARABANOVA, Anastasiia, "Ammonia Sorbents for Novel Ammonia Synthesis Routes studied using in situ neutron imaging", MLZ User Meeting 2023, Munich (Germany), 4-5 December 2023.
31. European Green Ammonia Summit 2024. Dusseldorf, Germany. March 6th-7th, 2024
32. Serrano, Clara. Arenha presentation. European Hydrogen Energy Conference 2024 (EHEC 2024). Bilbao (Spain). March 6th-8th, 2024. <https://ehc.info/ehc2024/>
33. European PhD Hydrogen Conference (EPHyC 2024). March 20th-22th, 2024
34. Serrano, Clara. "How CNH2 promotes the application of hydrogen technologies". Hannover Messe 2024. Energizing a Sustainable Industry. Hannover (Germany). April 22th-26th, 2024. <https://www.hannovermesse.de/de/landingpage/img/>
35. World Hydrogen 2024 Summit & Exhibition. Rotterdam Ahoy, Netherlands. May 13th-15th, 2024
36. Jesús Ruiz de Pascual, CNH2's Head of the Vehicles Laboratory. "Cómo el CNH2 promueve las tecnologías de Hidrógeno. Proyectos relevantes". 4th June, 2024.
37. NH3 Event Europe 2024. Rotterdam, Netherlands. June 6th-7th, 2024. <https://nh3event.com/>
38. Verde, Vito; Gurbuz, Ersan; Olivier, Pierre; Saker, Assia; Gallucci, Fausto. Techno-Economic Analysis of a Multi-Module High-Temperature Electrolysis System Under Intermittent Operation IX Symposium on Hydrogen, Fuel Cells and



- Advanced Batteries (HYCELTEC 2024). Milazzo (Italy). June 30- July 3, 2024. <https://www.hyceltec2024.it/>
39. Stefan Megel, Jonas Peter, Sebastian Hielscher, Stefan Rothe, Nikolai Trofimenko, Sindy Mosch et al., NH<sub>3</sub>-SOFC and SOEC-operation with MK35x stacks. Proceedings of the 16th European SOFC & SOE Forum. Lucerne, Switzerland. 2-5 July, 2024. <https://www.efcf.com/2024>
  40. Vito Verde, Ersan Gurbuz, Pierre Olivier, Assia Saker, Fausto Gallucci. "Techno Economic Analysis of a Multi-Module High Temperature Electrolysis System Under Intermittent Operation". Poster at the 16th European SOFC & SOE Forum. Lucerne, Switzerland. 2-5 July, 2024. <https://www.efcf.com/2024>

## Patents

1. Patent application by PV: P1600269NL00 on the advanced ammonia synthesis loop process that has been filled on the 2nd of May 2022 by PV.
2. Patent application by TUE: V. Cechetto, L. Di Felice, F. Gallucci, "System to produce ultrapure hydrogen from ammonia", application number: NL N2027727, application date: March 9<sup>th</sup>, 2021 (NL)
3. Patent application by PV: "Ammonia Synthesis Loop", Patent Application in Netherland No. 2031757 (internal reference P1600269NL00), filled on the 2nd of May 2022.

## Press articles

1. Katrin Schwarz, EU-Projekt ARENHA: Grünes Ammoniak für die Energiewende, on Fraunhofer IKTS website. [https://www.ikts.fraunhofer.de/de/presse/news/2020\\_10\\_13\\_eu\\_projekt\\_arenha.html](https://www.ikts.fraunhofer.de/de/presse/news/2020_10_13_eu_projekt_arenha.html).
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". <https://www.energetica21.com/revistas-digitales/septiembre-2021>
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 CNH<sub>2</sub> 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/>
7. E. Monge. Ciudad Real High Tech | Amoníaco para mover los barcos. Cadena SER: [cadenaser.com/audio/1698236388013/](https://cadenaser.com/audio/1698236388013/) (radio interview)

8. “El Proyecto 'ARENHA', en el que participa el CNH2 de Puertollano, avanza en la utilización de amoníaco como vector energético renovable”. La Comarca de Puertollano (local newspaper). Press release publication. <https://www.lacomarcadepuertollano.com/articulo/puertollano/proyecto-arenha-avanza-desarrollo-prototipos-utilizacion-amoniaco-como-vector-energetico-renovable/20240319134632538297.html>
9. De Aragón, Esther. El proyecto ARENHA da pasos para desarrollar prototipos para el uso del amoníaco como vector energético. H2 Hidrógeno verde. <https://hidrogeno-verde.es/proyecto-arenha-uso-amoniaco-vector-energetico/>
10. De Aragón, Esther. Los avances del proyecto ARENHA para el uso del amoníaco como vector energético. Energy News- Todo Energía. <https://www.energynews.es/uso-amoniaco-proyecto-arenha/>
11. “H2SITE entrega su planta de descomposición de amoníaco a Fertiberia para ser operada por el CNH2”. Cluster Energía.” <https://www.clusterenergia.com/noticias-asociados-2/h2site-entrega-su-planta-descomposicion-amoniaco-a-fertiberia-para-ser-operada-por-cnh2>

## PhD Thesis

1. Valentina Cechetto (2024). Ultra-pure hydrogen production via ammonia decomposition in packed bed membrane reactors. Technische Universiteit Eindhoven, ISBN: 978-90-386-6030-1

## Upcoming events

<b>January 27-28, 2025</b>	Winter School on Membranes and Membrane Reactors 2025. Eindhoven (Netherlands). <a href="https://www.andreahproject.eu/2024/10/09/winter-school-membrane-and-membrane-reactors-2025/">https://www.andreahproject.eu/2024/10/09/winter-school-membrane-and-membrane-reactors-2025/</a>
<b>March 5-6, 2025</b>	2 <sup>nd</sup> European Green Ammonia Summit 2025. Dusseldorf (Germany). <a href="https://www.wplgroup.com/aci/event/european-green-ammonia-summit/">https://www.wplgroup.com/aci/event/european-green-ammonia-summit/</a>
<b>March 2025</b>	FINAL WORKSHOP presenting the ARENHA project results at CNH2 demo plant
<b>June 5-6, 2025</b>	NH <sub>3</sub> Event Europe 2025. Rotterdam, Netherlands. <a href="https://nh3event.com/">https://nh3event.com/</a>
<b>June 22-26, 2025</b>	1st International Conference on Sustainable Energy Technologies (ICSET 2025) Lipari (Italy). <a href="https://www.icsetenergy.com/">https://www.icsetenergy.com/</a>
<b>July 1-4, 2025</b>	Low Temperature Fuel Cells, Electrolysers & H <sub>2</sub> Processing (EFCF 2025) <a href="https://www.efcf.com/2025">https://www.efcf.com/2025</a>

***October 21-23, 2025***

International Conference on Sustainable Energy and Process Technologies. Eindhoven (The Netherlands). [SEPTechConference – Conference on Energy and Process Technology](#)

***December 2-4, 2025***

Argus Clean Ammonia Europe Conference. Rotterdam (Netherlands) <https://www.argusmedia.com/es/events/conferences/clean-ammonia-europe-conference>

**ARENHA in figures:**

11 partners (6RES, 2 IND, 3 SME)

7 countries

5,684,325 € project

Start: April 2020

Duration: 60 months

**Key milestones:**

October 2024 - Ammonia synthesis and decomposition prototypes ready

March 2025 - Ammonia- based energy storage system integrated and validated.

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More information about ARENHA (including a non-confidential presentation of the project) is available at the project website: <https://arenha.eu/>

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**Disclosure:** The present document reflects only the author's views, and neither the NMP Team nor the European Union is liable for any use that may be made of the information contained therein.