MadoquaPower2X: Renewable hydrogen and ammonia for Iberian, European and global markets

WEBINAR

Rogaciano Rebelo
CEO, MadoquaPower2X

Madoqua Power2X

Alberto Litta Modignani
VP Hydrogen, NextChem

NEXTCHEM

AMMONIA ENERGY ASSOCIATION

Tuesday, November 26
3–4 PM CET (9–10 AM EDT)

House rules

AMMONIA ENERGY ASSOCIATION

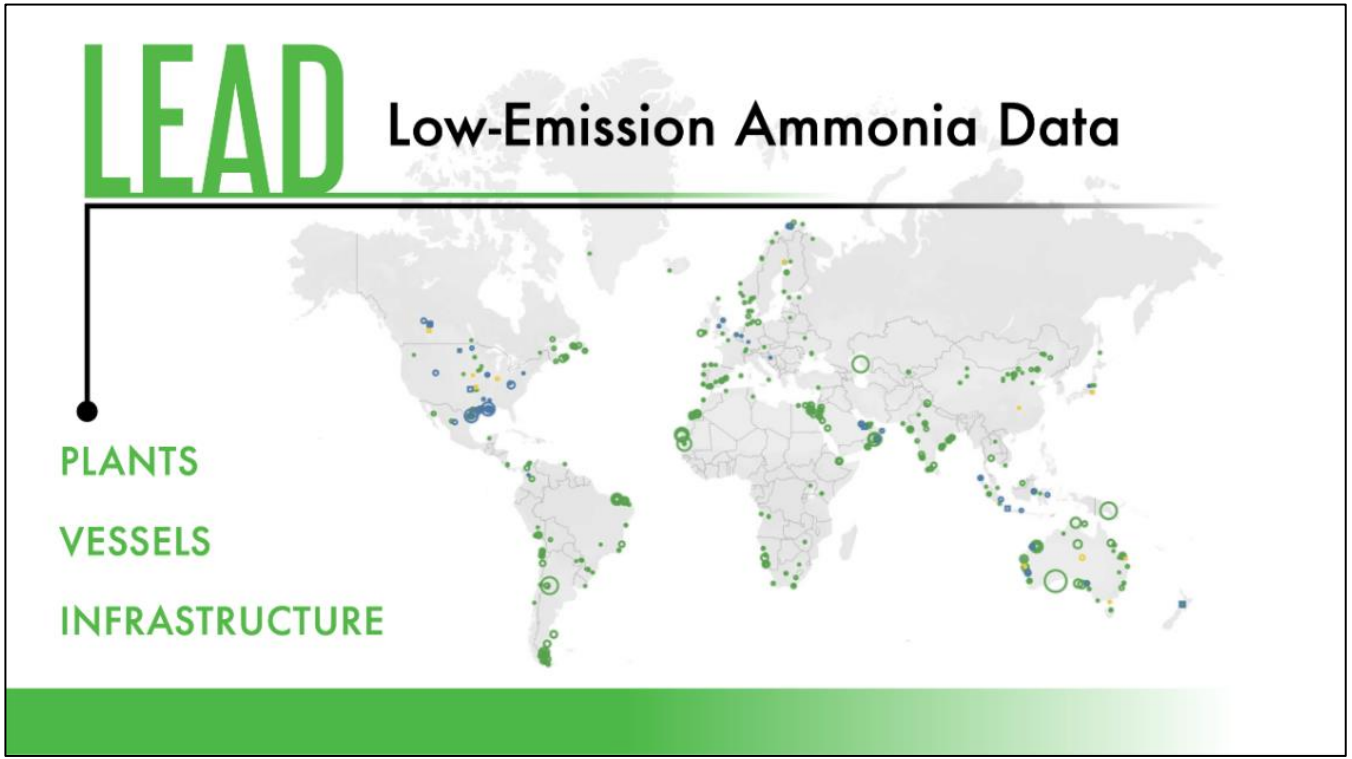
- Any questions for the speakers can be asked in the Q&A section. The questions will be answered by text by the speakers, or will be discussed in the panel.

- The webinar recording of this webinar will be shared with all registrants after the webinar.

- An article about the webinar will be posted on AmmoniaEnergy.org

LEAD Announcement

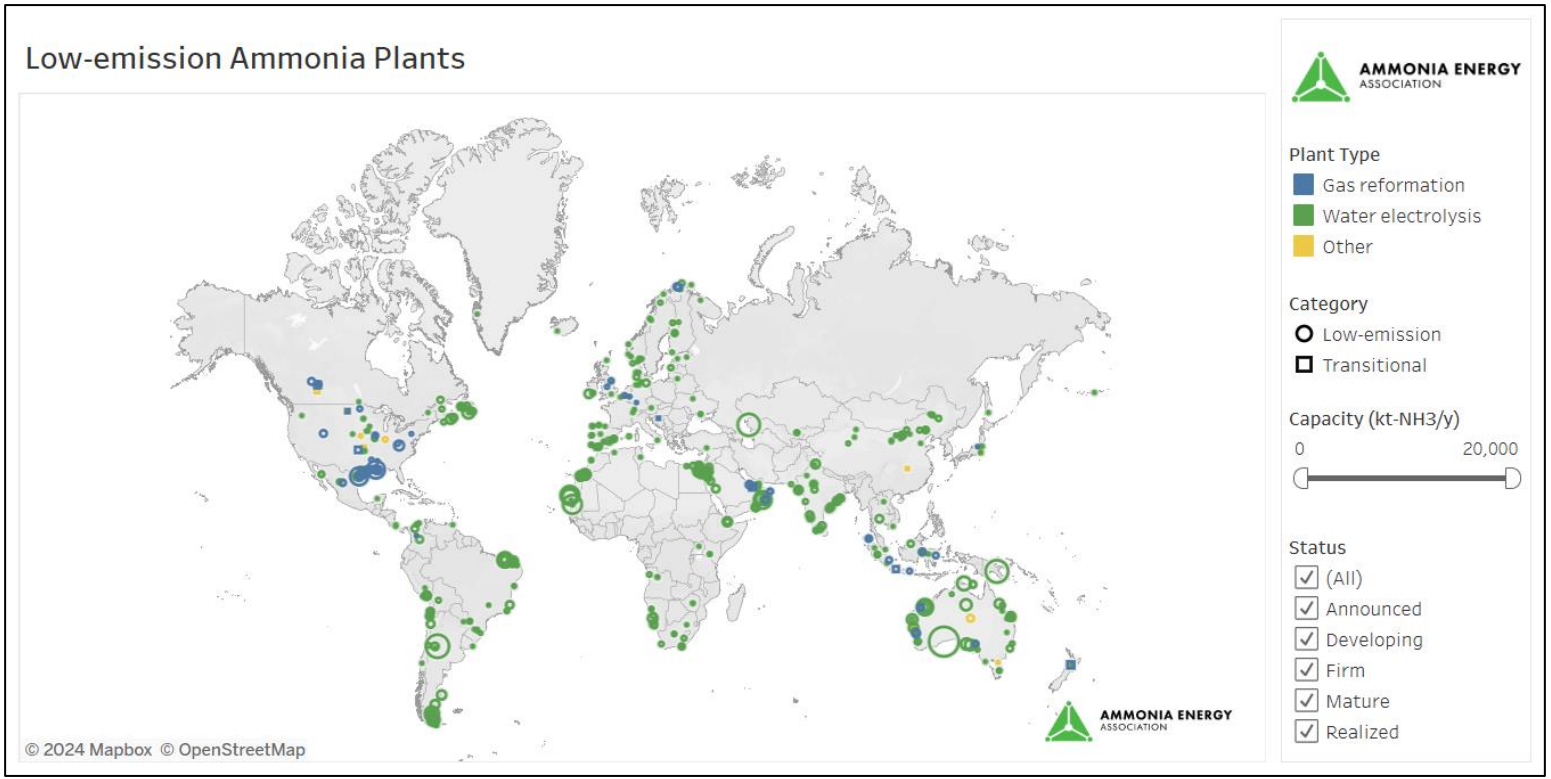
AMMONIA ENERGY ASSOCIATION



ammoniaenergy.org/LEAD

LEAD Announcement

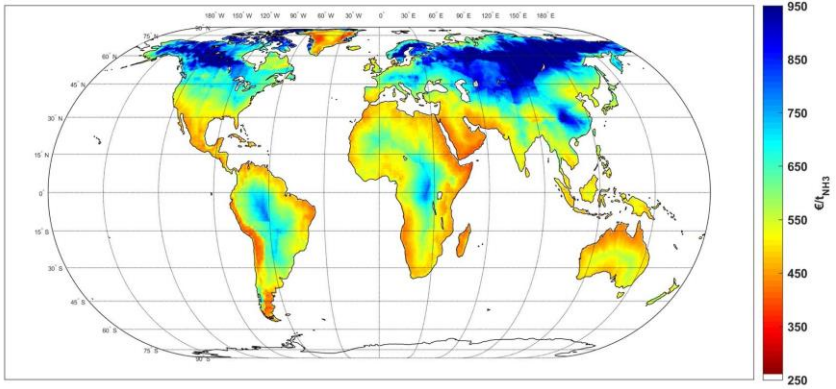
AMMONIA ENERGY ASSOCIATION



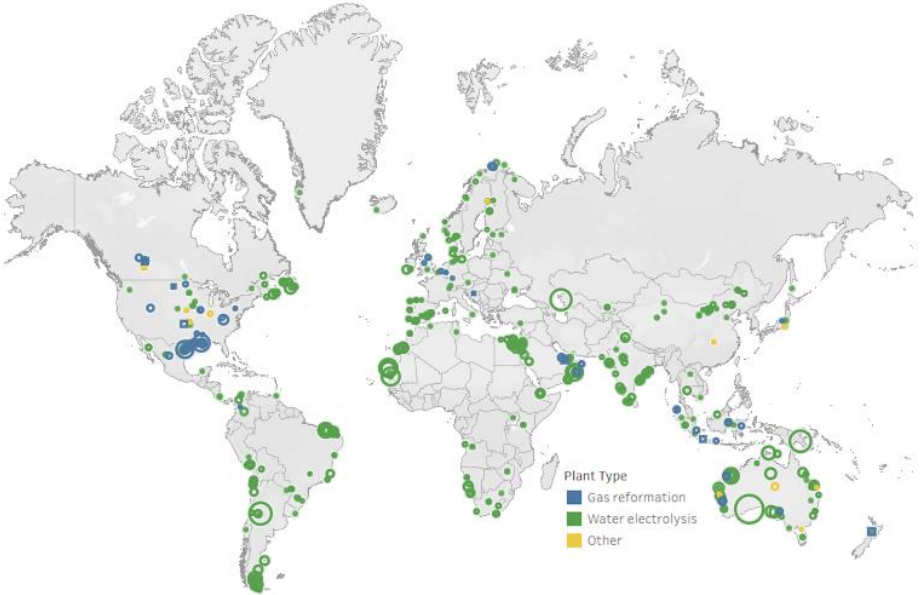
ammoniaenergy.org/LEAD

Renewable ammonia production

AMMONIA ENERGY ASSOCIATION



Levelized cost of renewable ammonia in 2030
Fasihi et al. 2021
https://www.sciencedirect.com/science/article/pii/S0306261920315750

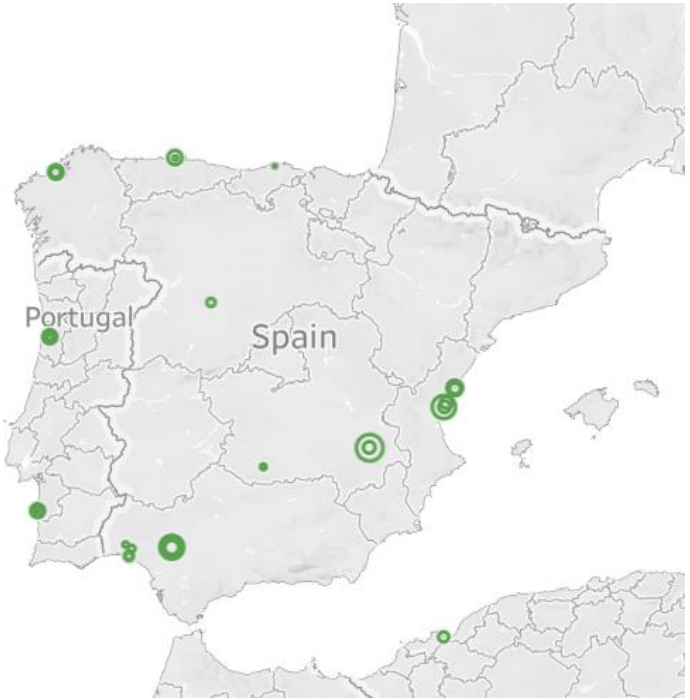


Global Project List: Low-Emission Ammonia Plants
Ammonia Energy Association (November 2024)
ammoniaenergy.org/LEAD

Renewable ammonia production in Portugal

Numerous renewable ammonia projects are under development in the Iberian Peninsula (Portugal and Spain).

- MadoquaPower2X is a renewable project in Sines, southern Portugal
- The first phase aims for 300,000 tons of ammonia production by 2028
- MadoquaPower2X was among the winners of the first subsidy auction from the European Hydrogen Bank, at a bid of €0.48/kg electrolytic hydrogen produced over ten years
- Maire Tecnimont was awarded the FEED for the project



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Madoqua Power2X

Sines Energy Export Project

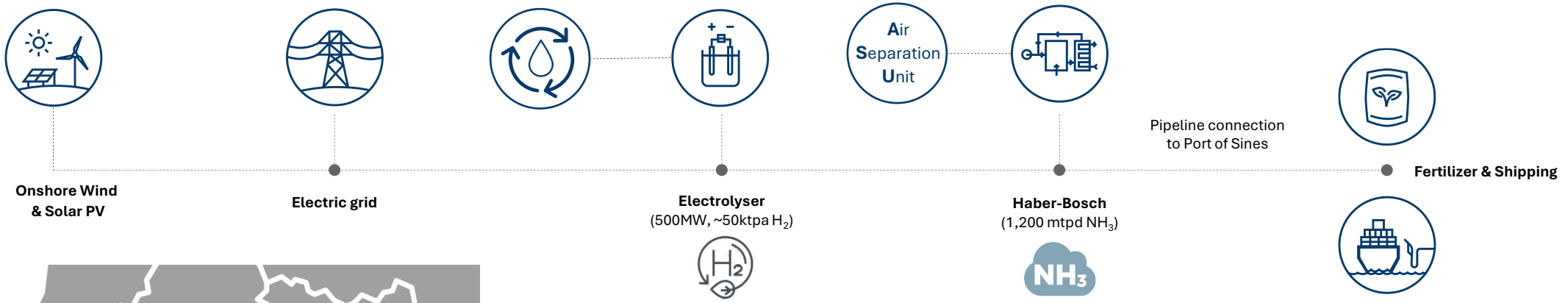
MADOQUA

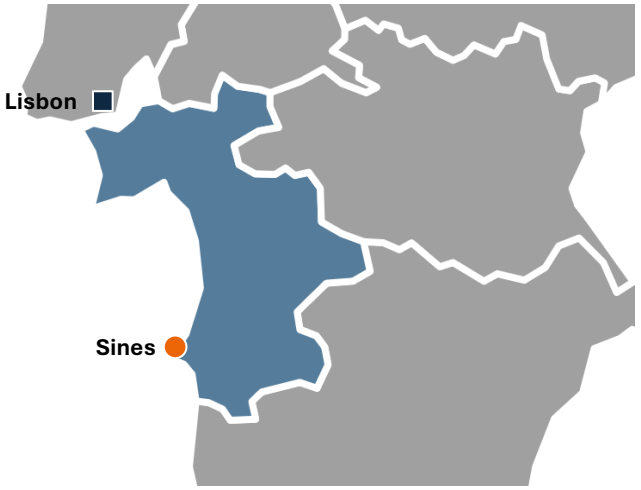
POWER2X
LEADING IN ENERGY

CIP
Copenhagen Infrastructure Partners

MadoquaPower2X Project

Green Ammonia export project in Sines, Portugal





Located in Sines, Portugal, **MadoquaPower2X (MP2X)** is a project enabling the local production of **green hydrogen and green ammonia.**

The project involves the production of green hydrogen using established alkaline-water electrolyser technology and the production of green ammonia through the **Haber-Bosch process with zero CO_2 footprint.**

Hydrogen will be transported through the local hydrogen grid and can be used by other local players, as well as blended into the natural gas grid.

Green ammonia will be transported by pipeline to the Port of Sines and loaded for export and/or used as maritime fuel / green fertiliser manufacturing.

Significant **contribution towards Portugal's National Hydrogen Strategy**. The project will contribute to nearly 25% of Portugal's envisaged electrolyser capacity in 2030.

Portuguese Project of National Interest status is awarded.

MadoquaPower2X Project

Based on strong fundamentals

Project Development

- **59ha** Land Secured
- **560MVA** Grid Connection
- **2m M³** Recycled Wastewater
- **500MW** Electrolyser Capacity
- **300k** Tonnes p.a. RFNBO NH_3
- **+115** Local Jobs Created

✓ **Power** to be sourced through long-term PPA agreements, with majority of power sourced from CIP controlled assets - 1,5MW solar and 700MW wind development pipeline.

✓ **Marine Tecnimont,** contracted for Engineering, with electrolyser selection finalized, and **KBR** selected as ammonia licensor.

Project located at ZILS (zona industrial e logística de Sines)

Estimated project timeline

Timeline	2023		2024		2025		2026		2027		2028		2029	
	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2
Development	Development						Construction				Operation			
Key project milestones						FID / FC/FNTP						COD		

End of 2028 first hydrogen production with **500MW** electrolysis capacity

In 2029 Ammonia process operational with export pipeline to the Port of Sines

International consortium formed of 3 partners

MADOQUA — Portuguese project developer

- Vast non-conventional infrastructure experience
- Operational experience across the globe
- Regulatory experience
- Hands-on and on the ground

POWER2X — Project developer and advisor on energy transition projects

- Leading energy industry and business knowledge
- Deep technical and capital project delivery expertise
- Project development, commercial, and financial expertise

CIP Copenhagen Infrastructure Partners — Greenfield fund manager of renewable energy infrastructure

- EUR3bn Energy Transition Fund (dedicated to develop PtX projects)
- 10-years experience in developing & investing in greenfield renewables globally
- Proven track record in industrializing new industries

MadoquaPower2X Project

Based on strong fundamentals – Plant Layout

MadoquaPower2X Project

Based on strong fundamentals – Pipeline Route

MadoquaPower2X Project - Offtake | Ammonia Outlook

Value chain development and offtake pathways for Portugal and Europe

Input for **Fertilizer** production

80% of the annually produced ammonia is used for fertilizer production.

Large end-market for green ammonia that can be used to produce green fertilizers and achieve significant carbon emission reductions.

Fertilizer

Ammonia as **Hydrogen Carrier**

Reduce exposure to natural gas price fluctuations and adapt to future policy frameworks.

Ammonia is a relatively **stable** and **easy** to transport **vector for hydrogen**.

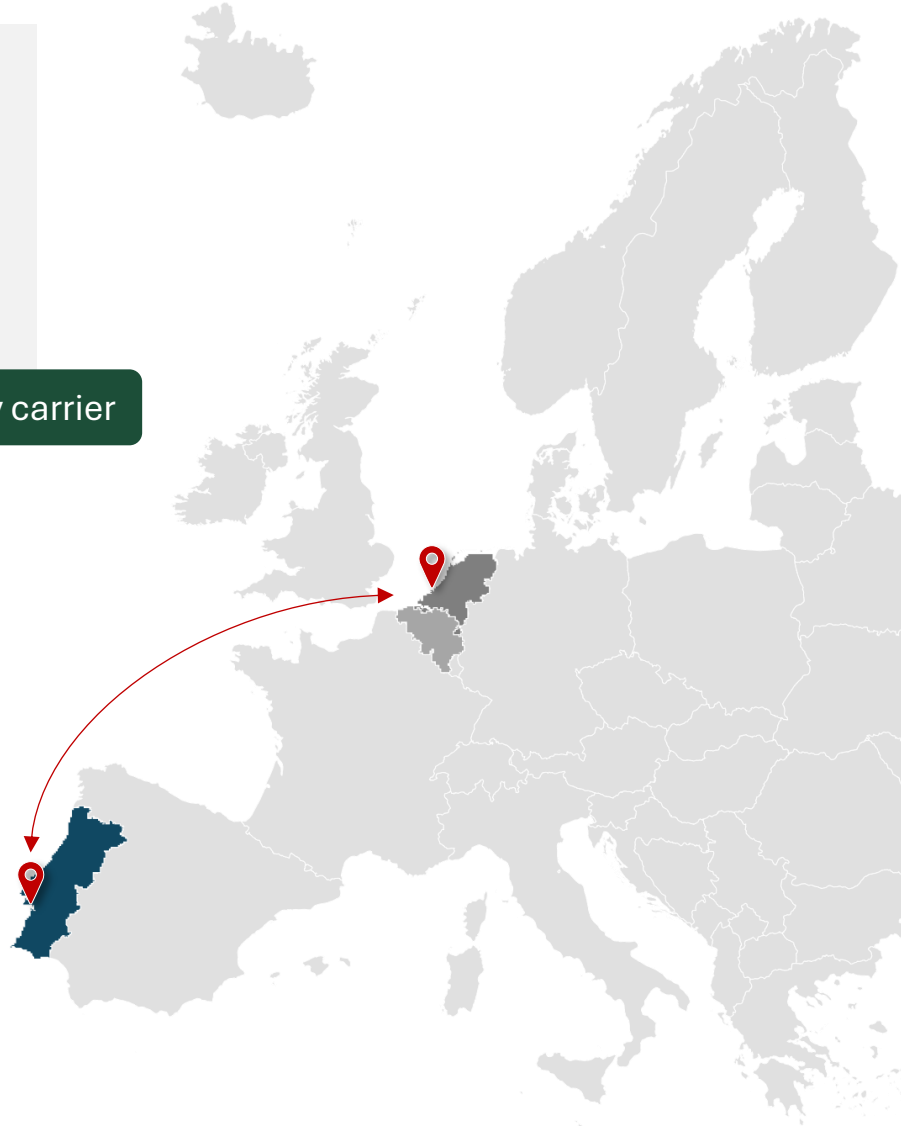
Energy carrier

Ammonia as **Maritime Fuel**

Decarbonize the maritime sector by ensuring refueling capabilities for ammonia fueled vessels.

Support the energy transition.

Maritime fuel



MadoquaPower2X Project

Power Sourcing - Development of solar PV and onshore wind assets in Portugal

1 Facts

- **3+ TWh** annual energy consumption for the project.
- **80%** of operational costs belong to energy consumption.

2 Challenges

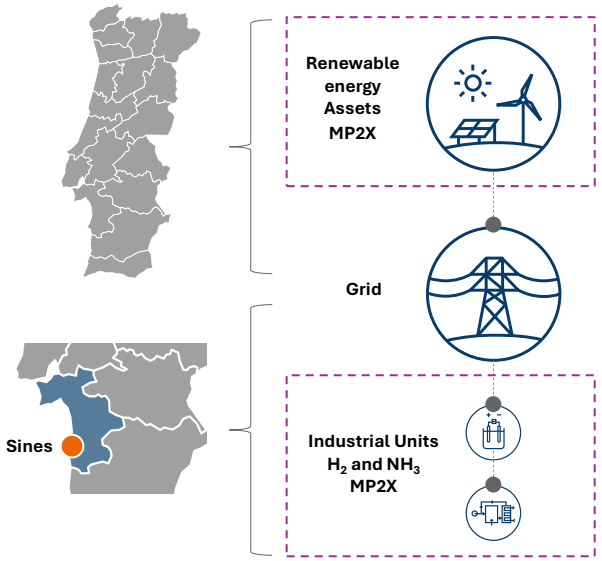
- Ensure a high volume of electricity at a competitive price and for long tenors.
- Ensure alignment with National and European regulations for Renewable Liquid and Gaseous Fuels of Non-Biological Origin (RFNBO) – additionality criteria, temporal and geographical correlation.

3 Strategy

- Focus on internal development of renewable energy assets due to:
  - **Financial and technical competencies >** cost control and price of energy.
  - **Risk Mitigation >** development cycle of the renewable energy assets aligned with the MP2X Project.

4 Execution

Implementation overview



Key points:

Renewable Portfolio MP2X	▪ **1.500 MW solar and 700 MW onshore wind** in different maturity stages. ▪ **5 regions in Portugal** with high quality of solar and wind resources.
Land Leases	▪ **Geographical dispersion** > low correlation between assets results in a more homogeneous power profile, which enables a higher utilization rate of the industrial plants of MP2X. ▪ **Compatibility** with current farming activities of the landowners.
Environmental	▪ **Implementation of mitigation measures, environmental compensations and improvement measures implemented, according to local and national authorities.**

MadoquaPower2X Project

Project highlights and future ambition

Superior project location at Sines, Portugal

- Supportive national vision, high renewables percentage
- Secured 59Ha site, 560MVA grid connection and water supply

Great fit with escalating EU decarbonization and hydrogen ambitions

- One of the early large scale green hydrogen and ammonia projects in EU, onstream by 2029
- Project of National Interest (PIN) status granted
- Top political attention and support from the Portuguese Government

Scalable business plan with future proof monetization options

- End of 2028, first green hydrogen production for phase 1, with 500MW electrolysis capacity and 300 ktpa of decarbonized ammonia. Phase 2 will expand the project to over 1000 ktpa of decarbonized ammonia
- Targeting offtake from shipping and chemical industries

Compelling investment opportunity to lead in green hydrogen

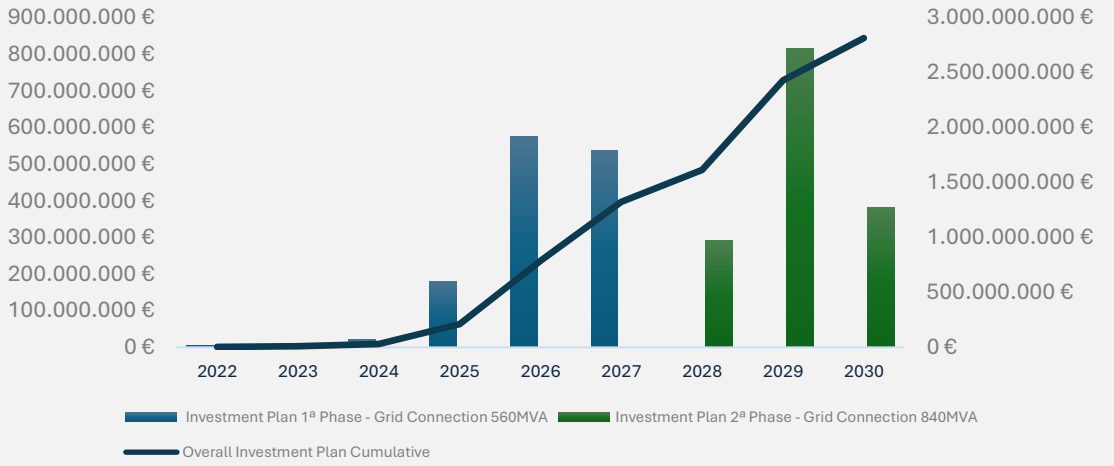
- Copenhagen Infrastructure Partners (CIP) committed as cornerstone investor
- Targeting FID mid 2025, for phase 1, with a €1.3 B investment, Phase 2 with with an investment size of €2.8B
- **Winner of the first European Hydrogen Bank auction with a 245m€ grant**

Strong development team

- Visionary founders/management team, with unparalleled local access and partnership philosophy
- Fully fledged development team with strong sector experience and execution track record

	Phase 1 500 MW Electrolyser	**Phase 2** >1000 MW Electrolyser
Production	**50 ktpa H_2 300 ktpa NH_3**	**150 ktpa H_2 >1000 ktpa NH_3**
Grid Connection	560 MVA	1400 MVA
Land Reserved	59 ha	59 ha
Total Investment	€1.3 Billion	€2.8 Billion
Jobs Created	115 permanent 3,000 indirect	265 permanent 6,000 indirect

Investment Breakdown



Phased approach will ensure **early ammonia production** and the **ability to scale** within an accelerated timespan.

MadoquaPower2X Project

Supporting Portugal's growth

Socio-Economic Impacts

€370 – 380 million
total direct and indirect taxes generated for the Portuguese authorities
(2027 - 2065)

€8 – 14 million
Total direct and indirect taxes generated during the construction phase
(2024 – 2028)

€110 – 120 million
Annual GDP added over the course of the Project
(2027 - 2065)

€140 – 150 million
Annual GDP added during the construction phase
(2024 – 2028)

2500 – 2650
Jobs created per year (jobs/year) and sustained over the course of the project
(2024 - 2065)

5000 – 5300
Jobs created per year (jobs/year) during the construction phase
(2024 – 2028)

Key Aspects

€19.75 million
Average annual project development costs (DEVEX)
(2024 – 2025)

€420 – 430 million
Average annual capital expenditure for the project (CAPEX)
(2024 – 2028)

€463 million
Average annual operational expenditure for the project (OPEX)
(2029 – 2065)

Madoqua Power2X

info@madoquaventures.com

Lagoas Park
Building 5A, Ground Floor
2740 – 244 Porto Salvo
Oeiras, Portugal

MADOQUA

POWER2X
LEADING IN ENERGY

CIP
Copenhagen Infrastructure Partners

NEXTCHEM COMPANY PROFILE

NEXTCHEM
MAIRE Sustainable Technology Solutions

WHO WE ARE

NEXTCHEM is MAIRE’s company dedicated to Sustainable Technology Solutions. Thanks to the extensive know-how of nitrogen, hydrogen, carbon capture, fuels, chemicals and polymers, we offer innovative solutions and processes to fully enable the energy transition.

02

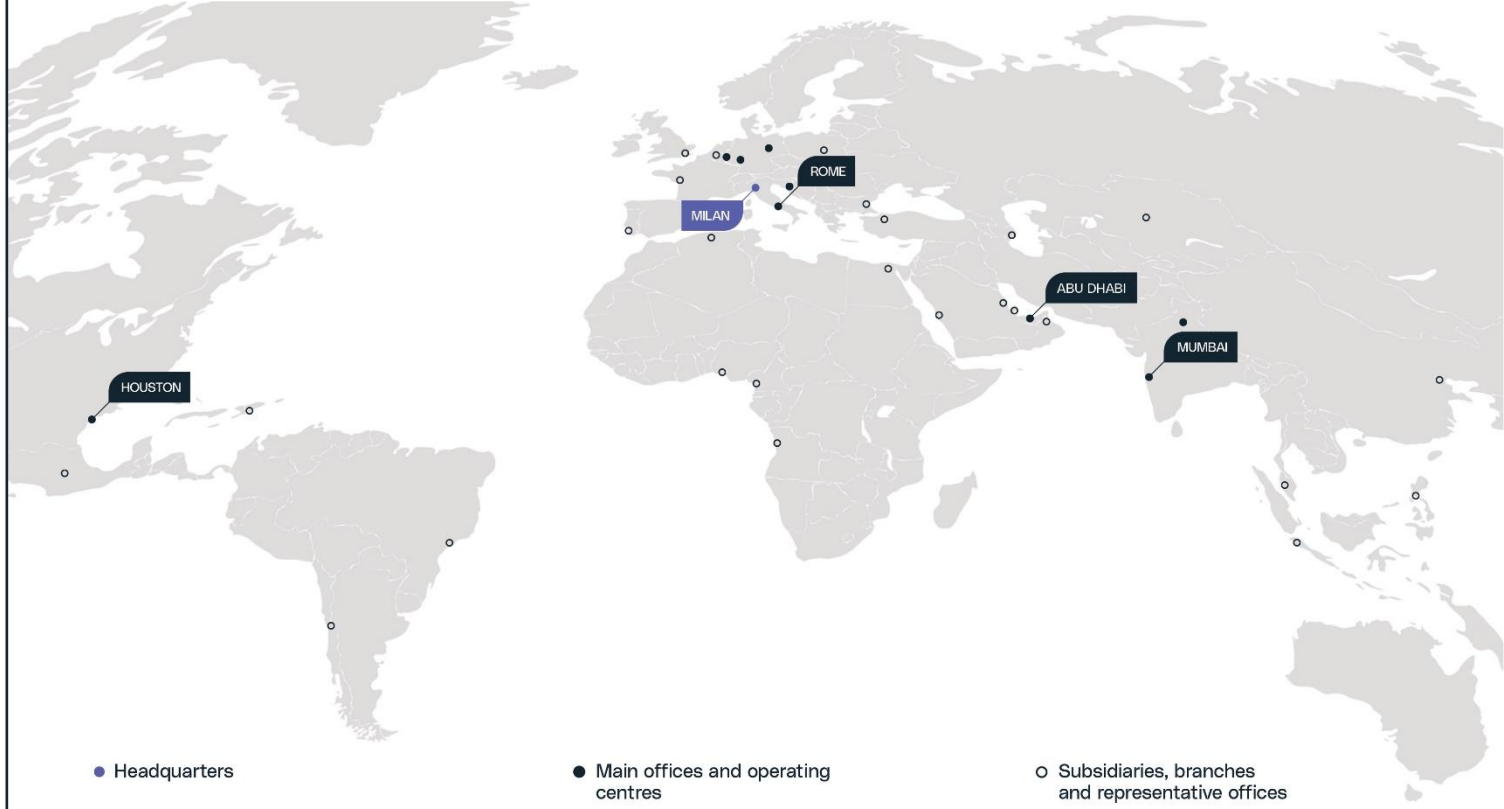
OUR GROUP

We believe in a future where humanity, industries, and the planet can all thrive.

MAIRE AT A GLANCE

We are a technology and Engineering Group that develops and implements innovative solutions to enable the Energy Transition.

We offer Sustainable Technology Solutions and Integrated E&C Solutions in nitrogen fertilizers, hydrogen, circular carbon, fuels, chemicals, and polymers.



4.3
Revenues (€ billion)

15.0
Backlog (€ billion)

129.5
Net Income (€ million)

~45
Countries

~8,300
Employees

29,000+
People engaged worldwide*

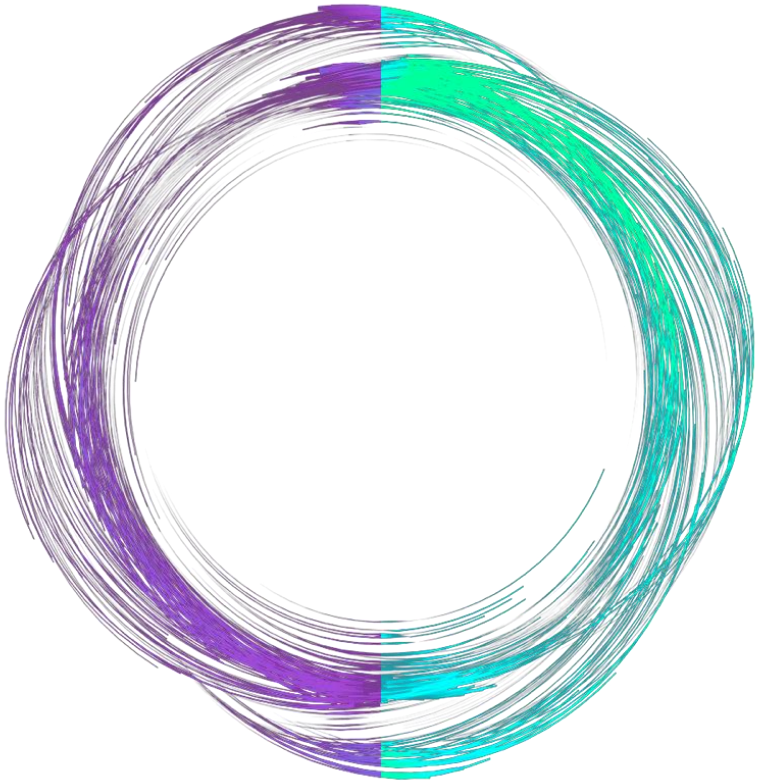
Data as of 31st December, 2023
*The data includes employees, collaborators and sub-contractors

MAIRE CORE BUSINESS

HOME TO THOSE WHO MAKE TO INSPIRE

SUSTAINABLE TECHNOLOGY SOLUTIONS

We offer **Sustainable Technology Solutions** to fully **ENABLE** energy transition. Innovative and sustainable processes, optimizing conventional ones and creating new processes from non-fossil feedstock.



INTEGRATED E&C SOLUTIONS

We **MAKE** energy transition happen through our **Integrated E&C Solutions**. We bring into reality complex plants and frontier projects designed to provide access to the latest technologies.

PROJECT DEVELOPMENT

PROVIDING TOMORROW'S TECHNOLOGY

NEXTCHEM
MAIRE Sustainable Technology Solutions

Technology Licensing

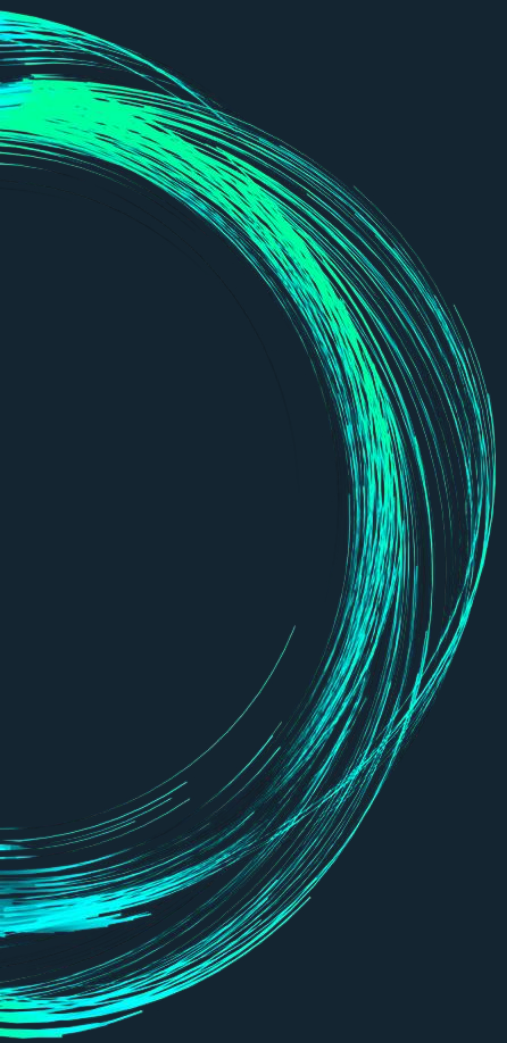
Process Design Package Basic Engineering Design

Proprietary Equipment & Catalysts

Services and Digital Solutions

Selected Specialty Solutions

DELIVERING FUTURE-PROOF PLANTS



TECNIMONT
MAIRE Integrated E&C Solutions

Front End
Engineering Design

Engineering
& Procurement

Engineering, Procurement
& Construction (management)

Upgrading
& Revamping

Operations
& Maintenance

PROJECT DEVELOPMENT REMARKS
OUR DISTINCTIVENESS

MET DEVELOPMENT
MAIRE Project Development

Investors & Financial
Sponsors Involvement

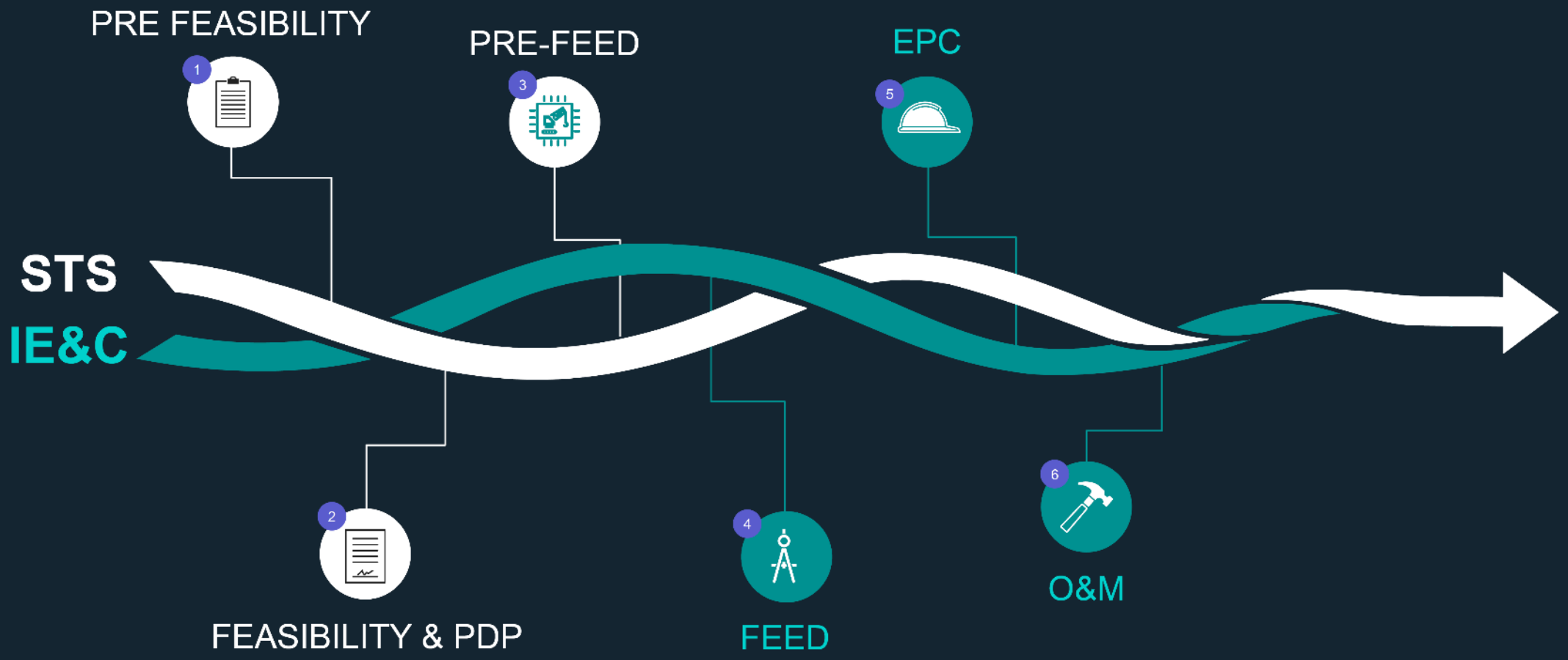
Capital Structuring

Project Structuring:
Feedstock, EPC, Offtake

Public Funding
& Grants Coordination

Co-Development
& Partnering

MAIRE INTEGRATED SERVICES TO CREATE VALUE



STAMICARBON NEXTCHEM KT TECNIMONT

FERTILIZER - OUR LEGACY

1920

Giacomo Fauser
works on the production of ammonia by direct reaction of hydrogen and nitrogen and develops a design of the vessel.

1930
1950

Montecatini Research and Development Center G. Donegani develops original processes for fertilizers production.

1960
1990

Montedison
(and later Tecnimont) focuses on the development of single stream, large capacity ammonia and urea plants and low energy, high capacity urea technology.

2000

Tecnimont & Stamicarbon leverage synergies in urea technology within Maire Tecnimont Group.

FERTILIZERS TECHNOLOGIES

Tecnimont is an approved Contractor of:

STAMICARBON

UREA MELT & GRANULATION

NITRIC ACID - UAN

GREEN AMMONIA

KBR

GREEN & BLUE AMMONIA

HYDROGEN

NITRIC ACID

incro

AMMONIUM NITRATES

NPKs

JM Johnson Matthey

Inspiring science, enhancing life

METHANOL

FORMALDEHYDE

MITSUBISHI HEAVY INDUSTRIES

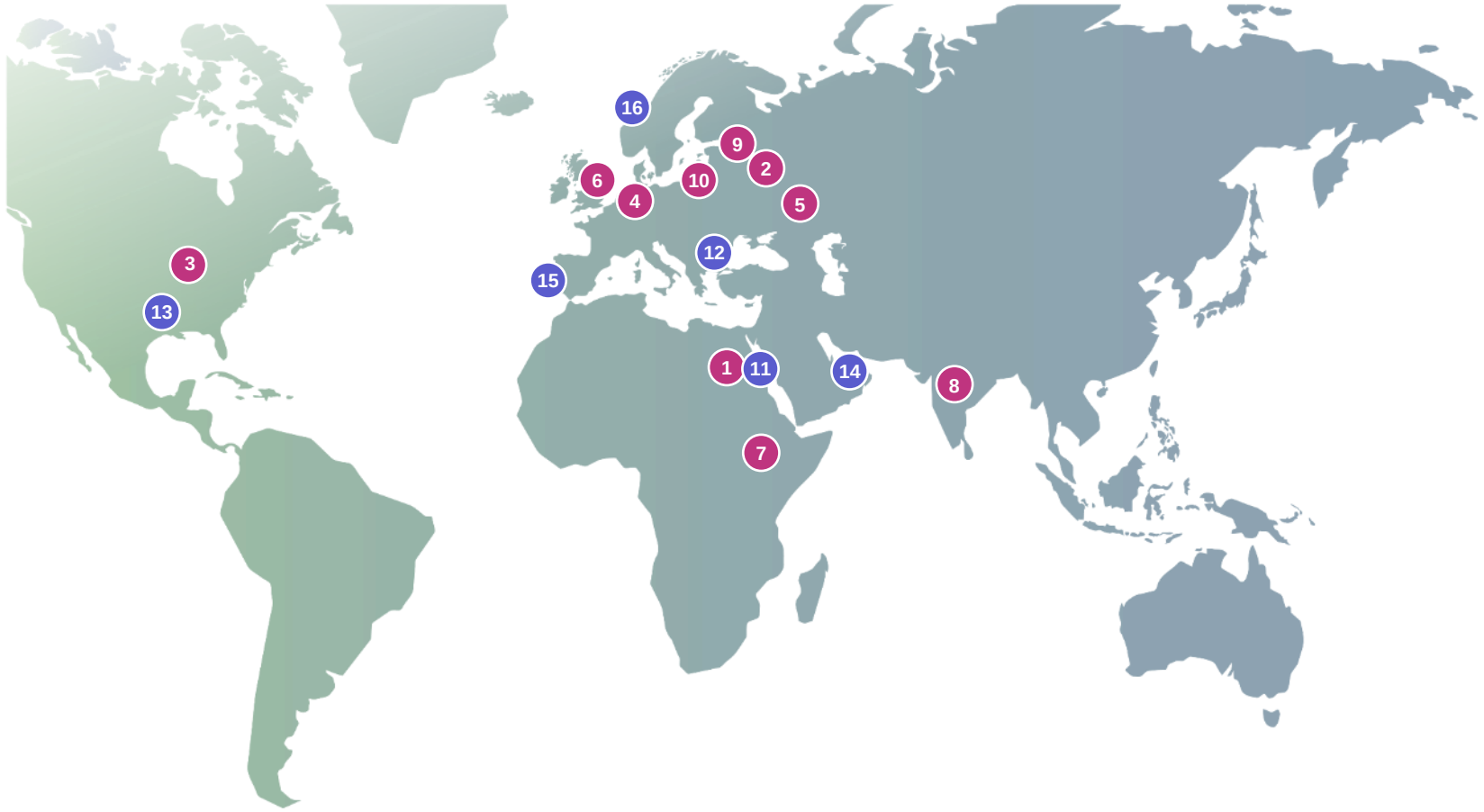
CARBON CAPTURE

espindesa

AMMONIUM NITRATES

ASN - NITRIC ACID

FERTILIZERS MAIN PROJECTS



< 200 Mn Euro €
200 to 500 Mn Euro €€
500 to 1,000 Mn Euro € € €
> 1,000 Mn Euro € € € €

MAIN COMPLETED PROJECTS

1 KIMA - AMMONIA & UREA
Aswan - Egypt
Client: KIMA
Contract type: EPC € € €

2 K1 - AMMONIA
Kingisepp - Russian Federation
Client: EUROCHEM
Contract Type: EPC € € €

3 IOWA FERTILIZER COMPLEX
Wever - Iowa, USA
Client: OCI
Contract type: EP € €

4 YARA U8 GRANULATION
The Netherlands
Client: YARA
Contract type: EPC €

5 VOLGAFERT - UREA
Togliatti - Russian Federation
Client: VOLGAFERT
Contract Type: EPC €

6 H2H - BLUE HYDROGEN
Saltend - UK
Client: EQUINOR
Contract Type: E €

7 OCP - AMMONIA - UREA - NPK
Ethiopia Fertilizer Project ISBL
Client: OCP
Contract Type: E €

8 NANGAL - AMMONIA
Punjab - India
Client: NFL
Contract type: EPC € € €

9 K2 - AMMONIA & UREA
Kingisepp - Russian Federation
Client: EUROCHEM
Contract Type: EPC € € € €

10 ANWIL ASN NITRATES
Wloclawek - Poland
Client: ANWIL
Contract Type: EPC €

ONGOING PROJECTS

11 KIMA - ANNA
Aswan - Egypt
Client: KIMA
Contract type: EPC € €

12 GEMLIK - UREA & UAN
Gemlik - Turkey
Client: GEMLIK
Contract Type: EPC € €

13 BLUE AMMONIA
Beaumont - Texas
Client: OCI
Contract Type: EP € €

14 LOW CARBON AMMONIA
Harvest - Taziz - UAE
Client: FERTIGLOBE
Contract Type: EPC € €

15 MADOQUA - GREEN AMMONIA
Power2X - Sines - Portugal
Client: MADOQUA
Contract Type: E €

16 FFI - GREEN AMMONIA
Holmaneset - Norway
Client: FFI
Contract Type: E €

03

NEXTCHEM

TOGETHER, WE PROPEL THE WAY FORWARD.

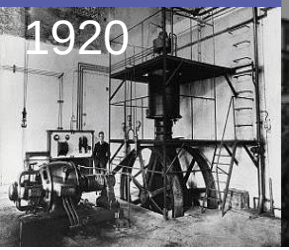
Our technology solutions are designed to make the energy transition happen by slashing the environmental impact of traditional industries, leveraging our consolidated know-how in hydrogen and carbon-capture technologies, transforming waste into valuable resources like chemicals, fuels, and recycled plastic, finding new processes from non-fossil feedstock.

TECHNOLOGY EXCELLENCE STRENGTHENED OVER TIME

AMMONIA REVOLUTION

1920

Fauser Montecatini pioneers the ammonia production process from renewables.



HERE COME THE FERTILIZERS!

1947

Stamicarbon is established in the Netherlands, bringing crucial technological and engineering skills.
This marks the start of a journey towards global leadership in the fertilizer market.

FUELING THE FUTURE

1971

The Italian engineering company Selas Italia (later known as KTI) is founded. Specializing in high-temperature technologies, **KTI** brings expertise in customized, advanced solutions for hydrogen and syngas production.

POLYETHYLENE PIONEERS

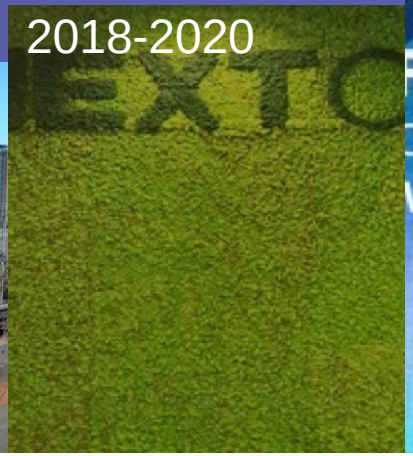
1992

TPI is established, focusing on high-end know-how in planning plants for low-density polyethylene (LDPE) production.

GREEN CHEMISTRY & UPCYCLING

2018-2020

The green acceleration begins: **NEXTCHEM** is launched, spearheading green chemistry and energy transition. The acquisition of **MyReplast Industries** and the creation of **MyRechemical** enhance the group's position in plastic upcycling and waste-to-chemical technologies.



UNBOXING THE FUTURE

2023

The "**Unbox the Future**" **Strategic Plan** is announced. A new unit lights a new phase in the industrial cycle: Sustainable Technology Solutions is formed under **NEXTCHEM**. Acquisitions of **Conser** and **MyRemono expand expertise** in biodegradable plastic and chemical recycling.

HYDROGEN HORIZONS

2024

NEXTCHEM continues its growth with the acquisition of **HyDEP** and **GasConTec. HyDEP** pioneers proprietary solutions for green hydrogen production, while **GasConTec** excels in low-carbon hydrogen, ammonia, and methanol technologies.

MAIRE'S TECHNOLOGICAL ROOTS

NEXTCHEM: THE GREEN ACCELERATION

THE ONGOING BLOOM

04

OUR SOLUTIONS AT A GLANCE

H_2 & CC	NX Reform™ Hydrogen NX Reform™ Blue Hydrogen	Producing cost-effective, low carbon hydrogen integrating CO_2 capture technology
H_2 & CC	NX eBlue™	Reducing natural gas usage and CO_2 emissions in hydrogen production
H_2 & CC	NX CPO™	Leading the way in decarbonizing hard-to-abate sectors
H_2 & CC	NX Decarb™	Optimizing and integrating core carbon capture unit
H_2 & CC	NX SulphuRec™	Reducing the emissions associated to refinery and natural gas processing
Fuels and Chemicals	NX SAF™ BIO	Unlocking the opportunity of a sustainable aviation industry
Polymers	NX Replast™	Solution for plastic upcycling
H_2 & CC	NX HyDep AWE/PEM/AEM	Reliable, high efficiency, high purity and cost-effective electrolysis modules for green H2 production

MYRECHEMICAL

Fuels and Chemicals — NX Circular™ Methanol

Fuels and Chemicals — NX Circular™ Ethanol

Fuels and Chemicals — NX Circular™ SAF

H_2 & CC — NX Circular™ Hydrogen

Our solution for waste-to-X

STAMICARBON

Nitrogen — NX STAMI Nitrates™ — Optimizing nitric acid production

Nitrogen — NX STAMI Green Ammonia™ — Futureproof carbon-free ammonia production

Nitrogen — NX STAMI Urea™ — *Innovators in fertilizer plant technology*

Polymers	NX CONSER™ Aromatics	Driving innovation in TMA technology
Polymers	NX CONSER™ Duetto	Building a sustainable future through biodegradable plastics
Polymers	NX CONSER™ Halo-Butyl Rubber	Solution for sustainable butyl rubber synthesis
Fuels and Chemicals, Polymers	NX CONSER™ C2 Derivatives	Adaptable plant design for tailored production
Polymers	NX CONSER™ C3 Derivatives	Transforming C3 streams into high-value molecules
Fuels and Chemicals, Polymers	NX CONSER™ C4 Derivatives	Transforming C4 streams into high-value molecules

H_2 & CC	NX AdWinHydrogen® Suite	Solutions for large-scale production of hydrogen from natural gas, with low CO_2 footprint using carbon capture
H_2 & CC	NX AdWinAmmonia®	Front-end solutions for large-scale Ammonia production
	NX AdWinAmmonia® Zero	
	NX AdWinAmmonia® Power	
Fuels and Chemicals	NX AdWinMethanol® Suite	Solutions for large scale production of methanol with low CO_2 footprint, from natural gas, bio feedstock and waste.
	NX AdWin® EcoReform	Solution to improve the profitability of existing Steam Reformer methanol plants
	NX AdWinCombined ®	Solutions for large-scale combined production of ammonia and methanol
	NX AdWin® Solvent	Solution for the large-scale production of raw gasoline from natural gas

NEXTCHEM