GREEN HYDROGEN PROJECT SHEET

POWER TO LIQUIDS

HIF PROJECT

Contact details: Clara Bowman
COO, HIG Global
clara.bowman@hifglobal.cl

HIF is expected to yield the world's first industrial-scale plant that will produce synthetic climate-neutral fuels for export.

PRODUCTION

A wind plant will power an electrolyzer which will produce green hydrogen. This will be combined with captured carbon dioxide to produce synthetic methanol. A portion of this methanol will be converted into synthetic gasoline (eGasoline).

PROJECT OWNER AND PARTNERS

PROJECT OWNER

TEAM OF COMPANIES

SIEMENS ENERGY : Co-developer and technology provider.

ENEL : Renewable power developer.

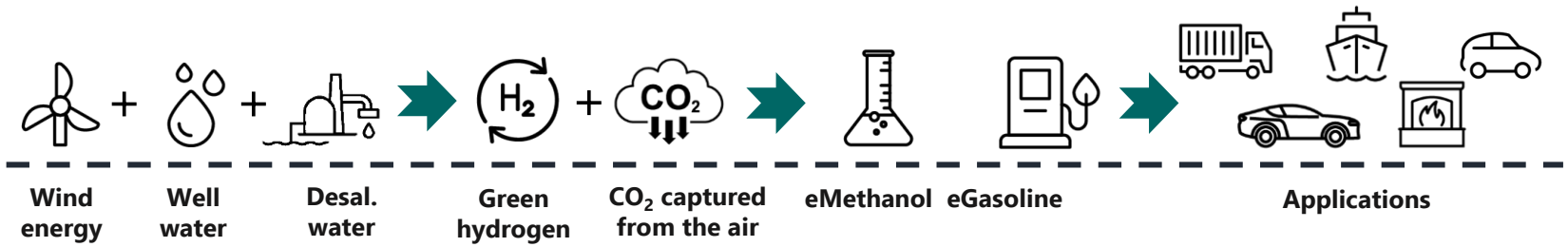
ENAP : Chilean National Oil company. Infrastructure provider.

GASCO : Co-developer and offtaker.

PORSCHE : Co-developer and offtaker.

Siemens received an **8 million euros grant** from the *German Federal Ministry for Economic Affairs and Energy* to develop this project.

HOW IT WORKS



STATUS

Pilot phase started construction and is expected to enter operations by **May 2022**.

Phase I is currently in development and the environmental assessment is being prepared.

PROJECTIONS

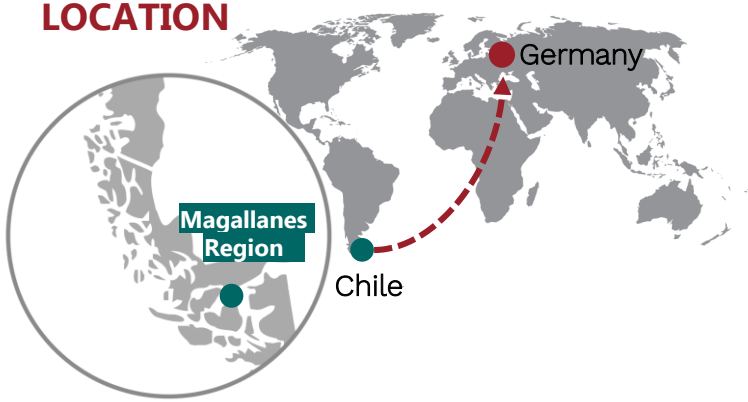
Pilot		Phase I	
131 m³ eGasoline per year	51 million USD investment	70,000 m³ eGasoline per year	755 million USD investment
3.4 MW wind energy	2022 expected year for operation start	300 MW wind energy	2024 expected year for operation start

OFFTAKE

PORSCHE is planning to use the eFuels from Chile in pilot projects. These include using eFuels in Porsche's Experience Centers and sports cars.

MABANAFT, the Marquard & Bahls trading division which focuses on oil, announced an MoU highlighting the purchase of up to **500 million liters of carbon neutral eGasoline per year** from this project.

LOCATION



GREEN HYDROGEN PROJECT SHEET

POWER TO AMMONIA

HNH ENERGY PROJECT

Contact details: Helmut Kantner
Managing Director, AustriaEnergy
helmut.kantner@austriaenergy.com

The HNH Energy project aims to produce green ammonia on a large scale in Magallanes for export, leveraging abundant wind resources present in the region.

PRODUCTION

Wind energy is used to power an electrolysis plant, which uses desalinated water to obtain oxygen and hydrogen. Hydrogen will then be combined with nitrogen captured from the air through the *Haber-Bosch process,* to produce green ammonia. The project also contemplates the construction of port infrastructure for export.

PROJECT OWNERS

AustriaEnergy

Development, construction, operation and management of utility scale energy projects with close to **1 GW** developed in **Chile,** thereof 300 MW in operation and close to 300 MW under construction.

Development and operation of renewable power plants with over **100 MW** installed capacity and over **500 MW** in development in Europe.

ÖKOWIND
Erneuerbare Energieerzeugungs GmbH

CIP
Copenhagen Infrastructure Partners

Fund management company specialized in offering tailor-made **investments** in **energy infrastructure assets** globally, in particular within renewables and the greenfield segment.

HOW IT WORKS

Wind energy | **Desal. water** | **Green hydrogen** | **Nitrogen captured from the air** | **Green ammonia** | **Applications**

STATUS

The project is in a conceptual engineering development stage and holds a lease over the terrain. Wind capabilities are being measured and environmental baselines are being defined.

3,000 million USD

Total investment, starting operation in

2027

PROJECTIONS

1,700 MW

Wind energy installed capacity

850,000 NH_3

Tonnes green ammonia per year

150,000 H_2

Tonnes hydrogen for green ammonia production per year

FUNDING

Copenhagen Infrastructure Partners (CIP) funds seek to invest in renewable energy infrastructure projects which can assist to transition the global economy into a net-zero emissions scenario by 2050.

LOCATION

GREEN HYDROGEN PROJECT SHEET

POWER TO AMMONIA

AES ANDES PROJECT

Contact details: Luis Sarrás
Green & Fuels Hydrogen Director, AES South America
lsarras@aes.com

Taking advantage of strong winds and solar radiation in Chile, the project aims to produce green ammonia on a large scale for export and maritime transportation fueling.

PRODUCTION

Using renewable energy and water from a desalination plant, the project will produce green hydrogen through an electrolysis process, which combined with nitrogen captured from the air will be used to produce green ammonia.

PROJECT OWNER AND PARTNERS

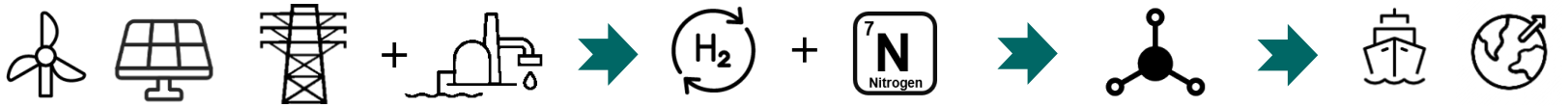
PROJECT OWNER aes Chile

PARTNER COMPANIES

AES ANDES is a subsidiary of **AES Corporation**, a global energy company with over **5 GW** of installed capacity. For over 2 years, the company has been developing ammonia related initiatives in countries such as Brazil, Argentina and Colombia, as well as Chile.

AES ANDES has a (BBB-) credit rating and over **3.5 GW** of installed capacity in **Chile.** It is a partner in the project and will be the developer and technology provider.

HOW IT WORKS



Wind energy | **Solar energy** | **Energy from the grid** | **Desal. water** | **Green hydrogen** | **Nitrogen captured from the air** | **Green ammonia** | **Applications**

STATUS

Studies are being executed to define the right set up for the desalination and production plants. Target markets are being assessed.

1,500 million USD
Total investment , starting operation
in **2025**

PROJECTIONS

800 MW
Renewable energy

250,000 NH_3
Tonnes green ammonia per year

50,000 H_2
Tonnes hydrogen for green ammonia production per year

OFFTAKE

AES ANDES has signed an MoU with its undisclosed investment grade partner. It is a world-class hydrogen producer and exporter.

In the MoU they have committed **100% of the green ammonia production** for maritime fuel and international export for a tenor of up to **30 years.**

LOCATION

GREEN HYDROGEN PROJECT SHEET

POWER TO AMMONIA

HyEx PROJECT

Contact details: Ursula Bustamante
Project Manager, Enaex
Ursula.Bustamante@enaex.com

Asunción Borrás
Sr. VP Business Development H2BU, Engie
asuncion.borras@engie.com

HyEx seeks to produce green ammonia in the North of Chile for domestic and international consumption, replacing imports.

PRODUCTION

Using renewable energy and desalinated water, the project will produce green hydrogen through an electrolysis process.

Hydrogen will be then combined with nitrogen, captured from the air, and through *Haber-Bosch process* will produce green ammonia. During the pilot phase, all production will be sent by truck to ENAEX´s plant, replacing some of its current imports. The second phase considers large scale ammonia production for ENAEX consumption, export and additional applications.

PROJECT OWNER AND PARTNERS

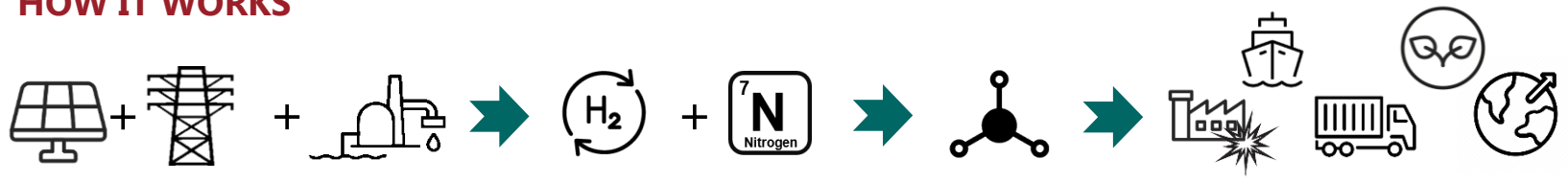
PROJECT OWNERS

Enaex ENGIE

ENGIE is a global reference company in low-carbon energy and services, having a Business Unit dedicated to renewable hydrogen since 2018. The current portfolio of renewable H_2 projects under development and in construction is over 70 projects in 10 countries over four continents.

ENAEX is the main ammonium nitrate producer and supplier of comprehensive rock fragmentation services for the mining industry in Latin America. With over 100 years of experience and presence in 10 countries, ENAEX is actively committed to sustainability.

HOW IT WORKS



Solar energy | **Energy from the grid** | **Desalinated Water** | **Green hydrogen** | **Nitrogen captured from the air** | **Green ammonia** | **Applications**

STATUS

A feasibility study of the project is being conducted.

An environmental impact study is currently being evaluated by the Environmental Assessment Service.

The project was awarded with **9,5 MUSD** from **CORFO**

PROJECTIONS

Pilot		Industrial Plant	
18,000 Tonnes green ammonia per year	**200 million** USD investment	**700,000** Tonnes green ammonia per year	**2,000 million** USD investment
26 MW Electrolysis capacity	**2025** expected year for operation start	**2.0 GW** Electrolysis capacity	**2030** expected year for operation start

OFFTAKE

ENGIE has a strategic commercial partnership with **ENAEX**, which will utilize 350,000 tonnes of ammonia per year for its ammonium nitrate Prillex plant, **replacing** the current grey ammonia import.

Remaining production will be **commercialized** in local markets for mining applications and fertilizer production, as well as exported to international offtakers.

LOCATION

POWER TO X

ATACAMA HYDROGEN HUB PROJECT

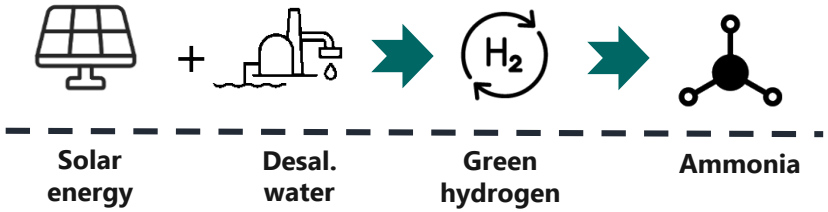
Contact details: Nicolás Errázuriz
Managing Partner, Four Trees Merchant Partners Inc.
nerrazuriz@fourtreescapital.com

GREEN HYDROGEN PROJECT SHEET

The ATACAMA HYDROGEN HUB project aims to build a large-scale electrolysis facility with export potential in the northern Antofagasta Region.

Atacama Hydrogen Hub
Atacamahydrogenhub.com

HOW IT WORKS



TIMELINE & BUDGET

Prefeasibility	RTB	Production
5 M USD	50 M USD	3,000 M USD
2022	2025	2027

PRODUCTION

Solar energy is used to power an electrolysis plant, which uses desalinated water to obtain oxygen and hydrogen. A Haber-Bosch plant transform the hydrogen to obtain green ammonia for exportation.

PROJECT OWNER AND PARTNERS

PROJECT OWNER

HUMBOLDT HIDRÓGENO VERDE H2V

PARTNER COMPANIES

COMPLEJO PORTUARIO MEJILLONES

HUMBOLDT HIDROGENO VERDE (H2V) is a company created by Chilean entrepreneurs for the development of hydrogen production, transportation and application projects in the north of Chile. It is the developer of the project.

COMPLEJO PORTUARIO MEJILLONES (CPM), subsidiary of Codelco, Chile's national copper corporation, is a port located in the Antofagasta Region. It will provide infrastructure for the project.

STATUS

The first phase is focused in pre-feasibility, conceptual engineering, environmental and community viability and land assuring. It is already in place forecasting closing during first quarter 2022.

5 million USD

Total investment for the prefeasibility stage

PROJECTIONS

110 kton green hydrogen per year (metric tons)

600 kton green ammonia per year (metric tons)

2027

550 kton green hydrogen per year (metric tons)

2035

OFFTAKE

Considers a large scale hydrogen and ammonia production, and aims to foster efficient supply chains such as shared gas pipelines in collaboration with other players to enable large scale exportation.

Plans envisage setting up electrolysis units with a total capacity of

10 GW

by 2035

LOCATION

GREEN HYDROGEN PROJECT SHEET

POWER TO AMMONIA

FARADAY PROJECT

Contact details: Manuel Tagle
General Manager Latam at Mainstream Renewable Power
manuel.tagle@mainstreamrp.com

Leveraging their expertise in power generation and hydrogen technologies, Aker and Mainstream have joined forces to develop a large-scale green ammonia project in Chile.

PRODUCTION

Using renewable energy and water from a desalination plant, the project will produce green hydrogen through an electrolysis process, which combined with nitrogen captured from the air will be used to produce green ammonia.

PROJECT OWNER AND PARTNERS

PROJECT OWNER

AKER CLEAN HYDROGEN

MAINSTREAM RENEWABLE POWER

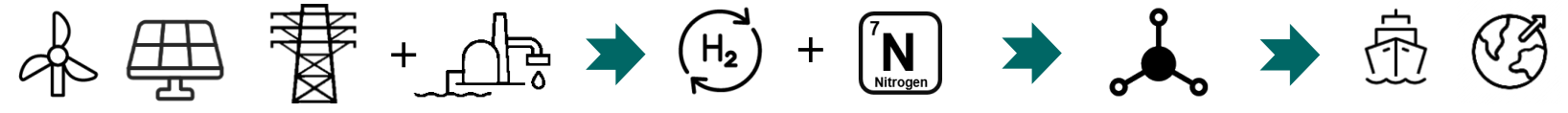
PARTNER COMPANIES

ACH and MRP are subsidiaries of **AKER Horizons**, a company dedicated to incubating and developing companies that solve fundamental challenges to sustainable existence – or planet – positive investing.

ACH is a developer and operator of clean hydrogen production at industrial scale. With a proven execution model and unique end-to-end asset integration and optimalization capabilities.

MRP is one of the renewable mayor in Chile and has a worldwide pipeline of 12,1GW of wind and solar energy, with over 1,4 GW under construction and 1,1 GW in operation.

HOW IT WORKS



Wind energy | Solar energy | Energy from the grid | Desal. water | Green hydrogen | Nitrogen captured from the air | Green ammonia | Applications

STATUS

Studies are being executed to define the right set up for the desalination and production plants. Target markets are being assessed.

5,400 million USD

Total investment , starting operation in

2027

FINAL PHASE PROJECTIONS

3,500 MW

Renewable energy

1.3 million NH_3

Tonnes green ammonia per year

250,000 H_2

Tonnes hydrogen for green ammonia production per year

OFFTAKE

AKER Clean Hydrogen has signed an MoU with its undisclosed investment grade partner.

LOCATION

POWER TO METALS

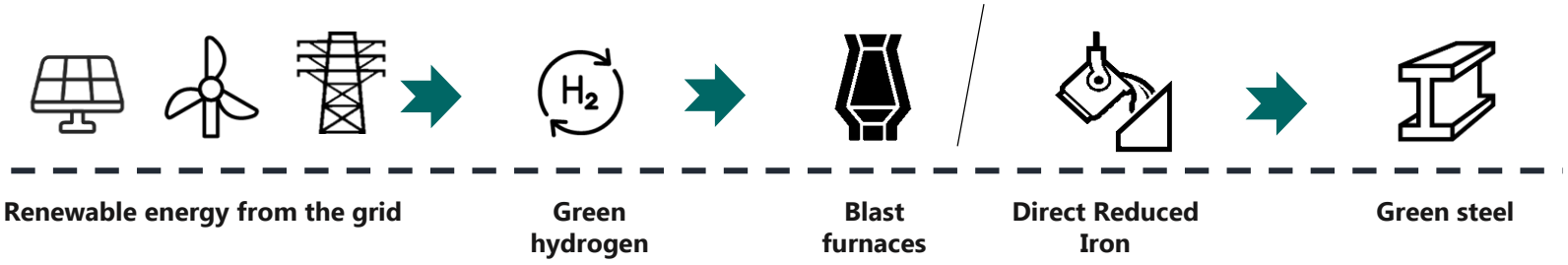
GREEN STEEL PROJECT

Contact details: Rodrigo Briceño
General Manager, Compañía Siderúrgica Huachipato
rbriceno@cap.cl, rbriceno@csh.cl

GREEN HYDROGEN PROJECT SHEET

HUACHIPATO steel mill is part of the integrated iron and steel CAP Group and is the main steel producer in Chile. The company is planning to reduce CO2 emissions from its steel production processes developing technology that allows the incorporation of green hydrogen along its value chain.

HOW IT WORKS



PRODUCTION

Production of green hydrogen in the south-central zone of Chile through an electrolysis process using renewable energy. The green hydrogen will be used for two purposes:

- Blending into CAP's blast furnaces to reduce consumption of coke and eventually replace it entirely.
- Direct reduction of iron ore and green steel production.

PROJECT OWNER

SIDERÚRGICA HUACHIPATO
UNA EMPRESA DEL GRUPO CAP

The Huachipato steel mill was founded in 1950.
Supplies metallurgical, mining, and construction sectors in Chile.
Annual revenue: 500 MUSD.

The project was awarded by **CORFO** with a **subsidy** of **US$3,6 million** for its development.

STATUS

A feasibility study for the pilot phase is being carried out with an experienced technological partner. It has a potential to reduce in 2% the coke usage in the reduction process.

30 million USD
Total investment , starting operation in
2025

PARTNERSHIP

CAP and **Paul Wurth**, an SMS Group company, signed a Technological Cooperation Agreement (March 2021), to explore the feasibility of reconverting CAP's operations to produce green steel, and intensified their cooperation with a new agreement (July 2021).

PROJECTIONS*

12 MW
Electrolyzer installed capacity

1,550 H_2
Tonnes green hydrogen per year

* Scaling up the project up to 20 MW of electrolysis is under evaluation.

WHY

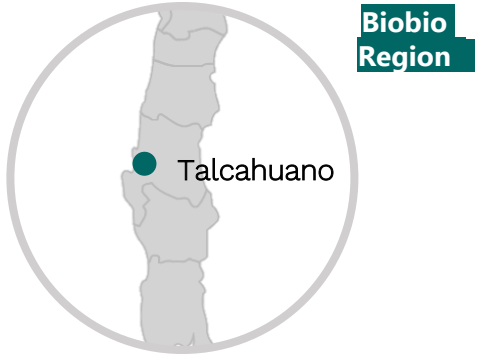
6% of global CO2 emissions originate in steel production

87% of the CO2 emissions associated with steel production can be reduced by direct reduction of iron ore using green hydrogen

TECHNOLOGY

Production of Direct Reduced Iron through green hydrogen has the potential to dramatically reduce CO2 emissions in the steelmaking industry. Several pilots are under planning in Europe and if feasible the scalability potential is considerable.

LOCATION



GREEN HYDROGEN PROJECT SHEET

POWER TO AMMONIA

H1 Magallanes PROJECT

Contact details: Fernando Begher
Director, Southern Cone Energy
fernando.begher@southern-cone-energy.com

CWP Global is developing the "H1 Magallanes" project in Chile with the assistance of its regional company H1 America with the target to build a world-scale green hydrogen and ammonia production facility.

PRODUCTION

The project will consist of upstream wind power generation, and downstream green hydrogen & green ammonia production. Ancillary systems will be installed for water desalination, intelligent hydrogen storage, back-up power, ammonia storage and export facilities. The aim is to construct a world-scale ammonia synthesis train which will enable economies of scale and competitive cost.

PROJECT OWNER / DEVELOPER

CWP has 15 years of experience from large-scale renewable power generation projects with a successful track record of **over $3 US bn of financed assets**. CWP Global is part of the Green Hydrogen Catapult initiative.

CWP Global is one of the main shareholders in the **26 GW *Asian Renewable Energy Hub*** project in Australia. This project is one of the most advanced PtX sites in the world in terms of development and permitting - it has received "Major Project Status" recognition from the government and environmental approval for the first phase.

The Asian Renewable Energy Hub
Nyangumartamili wangal pa janyja

10 GW	2,400 kWh/m2/year
16 GW	8.6 m/s

HOW IT WORKS

Wind energy | **Desal. water** | **Electrolysis** | **Green hydrogen** | **Nitrogen captured from air** | **Green ammonia** | **Applications – export to global market**

STATUS

Feasibility studies are being executed, as well as environmental screening and wind resource assessment on selected potential sites.

The projects are expected to start operations in

2028

PHASE ONE PRODUCTION CAPACITY

2,200 MW
Wind energy installed capacity

1,000,000 NH_3
Tonnes green ammonia per year

170,000 H_2
Tonnes green hydrogen per year

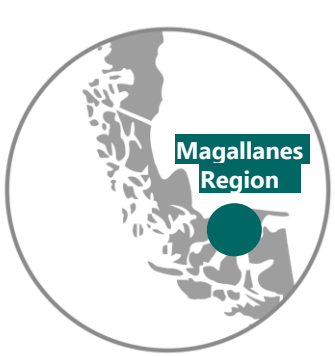
***This first phase is expected to be expanded in tandem with global market growth.**

OFFTAKE

CWP Global and its Group team have decades of experience in global commodity trading and are using this know-how to structure long-term bankable ammonia off-take agreements with various partners around the world.

MARINE FUEL | **POWER GENERATION** | **FERTILIZERS**

LOCATION



GREEN HYDROGEN PROJECT SHEET

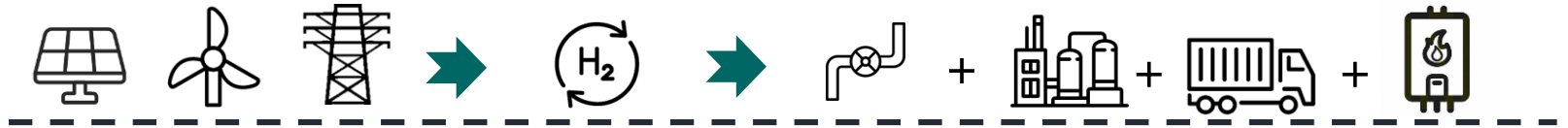
POWER TO X

QUINTERO BAY H2 HUB PROJECT

Contact details: Alfonso Salinas
Sustainable Development Manager, GNL Quintero
alfonso.salinas@gnlquintero.com

GNL Quintero the largest LNG regasification terminal in Chile located in the Quintero bay, aims to take advantage of its proximity to industrial areas with high energy demand and grey hydrogen consumption to produce green hydrogen for the domestic market.

HOW IT WORKS



Renewable energy from the grid → Green hydrogen → Blending into gas pipelines + Industrial feedstock + Mobility + Furnaces

PRODUCTION

Production of green hydrogen in the central zone of Chile, even though facing higher energy prices, could be competitive due to closeness to potential offtakers.

This positions hydrogen as an attractive alternative to replace local demand for fossil fuel and grey hydrogen using renewable energy from the grid and thus reducing emissions in several industries.

PROJECT OWNER AND PARTNERS

PROJECT OWNER: GNL Quintero

PARTNER COMPANIES: enagas, acciona

GNL Quintero is a terminal for the reception, offload, storage and regasification of Liquefied Natural Gas (LNG). In operation since 2009, it supplies the demand for natural gas in the central region of Chile, transporting gas both through piping and trucks. 20% of the company is owned by the Chilean National Oil Company (**ENAP**).

STATUS

A prefeasibility study and conceptual engineering for the pilot phase were carried out.

An environmental impact study is currently being evaluated by the Environmental Assessment Service.

The project was awarded by CORFO with a subsidy of **US$5.7 million** for its development, and is expected to start operation in **2025**

PROJECTIONS

10 MW
Electrolyzer installed capacity

430 H_2
Tonnes green hydrogen per year

OFFTAKERS IN THE HUB

- **Puerto Ventanas** — Valparaiso Port operator
- **Terminal Pacífico Sur** — Valparaiso port operator
- **Melón** — Cement producer
- **Codelco** — National Copper Company (owns a refinery in Ventanas)
- **Enex** — Fuel distributor with interest in mobility projects

GREEN HYDROGEN PROJECT SHEET

POWER TO POWER

SAN PEDRO DE ATACAMA PROJECT

Contact details: Rodrigo Pineda
Energy Division Manager, Cummins Chile Distributor
rodrigo.pineda@cummins.cl

The San Pedro de Atacama project has the ambitious goal of incorporating green hydrogen and renewable energy into existing fossil fuel generation systems in isolated areas such as the one located in San Pedro de Atacama in the north of Chile, with the highest radiation levels in the world.

PRODUCTION

The project aims to modify the existing isolated power system operated by "Cooperativa Eléctrica de San Pedro de Atacama (CESPA)", to incorporate solar photovoltaic generation, battery storage, hydrogen technologies to provide a high-renewable share power supply to the cultural and tourist hotspot of San Pedro de Atacama.

PROJECT OWNER AND PARTNERS

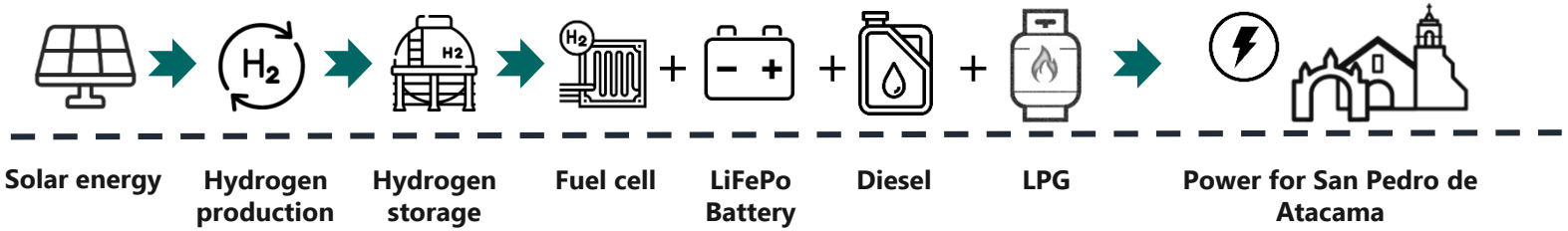
PROJECT OWNER Cummins Chile

KEY POTENTIAL PARTNER CESPA Cooperativa Eléctrica de San Pedro de Atacama

The isolated grid owner and operator has still not joined the project.

CUMMINS is a leading company that provides power solutions, working with diesel, natural gas, biogas, battery and hydrogen (production and fuel cells). It is the project owner and developer.

HOW IT WORKS



STATUS

The project has completed a pre-feasibility study, where the configuration of the technology mix was optimized with promising results.

The study was carried out by HINICIO, a strategic consulting firm focused on sustainable energy

2022-2023
expected year operation start

PROJECT DETAILS

- **143** Tonnes green hydrogen per year
- **2.2 MW** Electrolyzer
- **500 kg** Hydrogen storage
- **600 kW** Fuel cell
- **1.3 MW** Diesel engines
- **4.2 MW** Solar PV plant
- **2.6 MW** LiFePo Battery
- **10 million** USD investment

OFFTAKE

The clients and beneficiaries would be the residents and visitors of the community of San Pedro de Atacama, who would enjoy a cleaner supply of 24/7 electricity.

The generator and energy distributor would be **CESPA**, the local utility for the isolated grid.

LOCATION

GREEN HYDROGEN PROJECT SHEET

POWER TO X

HOASIS PROJECT

Contact details: Mario Gomez
President, TCI Gecomp
mariogomez@tci-chile.com

The HOASIS Project, in the Antofagasta region, promotes hydrogen as a solution for increasing energy independence and supporting local development based on circular economy.

PRODUCTION

2GW large-scale production of green hydrogen and oxygen to produce ammonia, which will be used in reforestation, precision agriculture, waste recovery and creation of synergies with local industries.

HOASIS also contemplates the construction of **2.000 Ha** of greenhouses to produce local crops and the reforestation of the area from the planting of **100 Ha** of tree crops.

PROJECT OWNER AND PARTNERS

PROJECT OWNER TCI GECOMP

PARTNER COMPANIES

TCI GECOMP specializes in renewable energy projects, with more than 1 GW installed in Europe and Latin America.

Currently, **TCI** is expanding its business to develop projects and services related to green hydrogen in Europe, Africa and Latin America.

HOW IT WORKS

Solar energy | **Energy from the grid** | **Desal. water** | **Green hydrogen** | **Oxygen** | **Green ammonia** | **Applications**

STATUS

The project is undergoing a pre-feasibility analysis. Waiting for the concession of 10,000ha to start the environmental procedures.

5,000 million USD total investment, starting construction in **2025**

PROJECTIONS

250,000 NH_3
Tonnes of green ammonia per year

102,000 H_2
Tonnes green hydrogen per year

140,200 tonnes
Agricultural products per year

OFFTAKE

The project has been receiving interest foreign offtakers, mainly in Asia and Northern Europe, for the export of green ammonia.

HOASIS considers the production of fertilizers and agricultural products, to support the development of a local ecosystem with positive impacts on the area.

LOCATION

GREEN HYDROGEN PROJECT SHEET

POWER TO TRANSPORT

H_2 SOLAR PROJECT

Contact details: Marcelo Saavedra
Commercial Director Large Industries, Air Liquide
Marcelo.saavedra@airliquide.com

The project seeks to develop an ecosystem for zero-emission commuting of mining workers from the cities to the mine sites in the Andes Mountains.

PRODUCTION

Solar power will be used to produce green hydrogen by electrolysis. This hydrogen will be stored in a hydrogen refueling station to supply buses for the commute of mining workers.

The project aims to deploy Fuel Cell Electric Buses that can meet the desert conditions such as altitude, extreme temperatures, among others.

PROJECT OWNER AND PARTNERS

PROJECT OWNER

Air Liquide

ATAMOSTEC

PARTNER COMPANIES

cea

UA Universidad de Antofagasta

CDEA Centro Desarrollo Energético Antofagasta

AIRLIQUIDE	Co-developer and technology provider. Hydrogen production and refueling station infrastructure.
CDEA	Antofagasta Energy Development Center. Co-developer. Renewable power provider.
CEA LITEN	Technological research institute. Co-developer. Design of pilot infrastructure and feasibility study developer.
ANTOFAGASTA University	Co-developer. Technical local capacity building.
ATAMOSTEC	Solar energy laboratory. Co-developer. Integration of energy supply and hydrogen production.

HOW IT WORKS

Solar energy + **Desal. water** → **Green hydrogen** → **Hydrogen Storage** → **Refueling station** → **Fuel Cell Electric Buses**

STATUS

Pilot project is under development working on a pre-feasibility study.

10 million USD
Est. investment of the pilot phase

2022
expected start of operations

PROJECTIONS

Pilot

- **48** Tonnes of green hydrogen per year
- **10 million** USD investment
- **1.2 MW** Solar energy
- **1-3** Buses under operation

Second Phase

- **20** Buses under operation

2023

Third Phase

- **50** Buses under operation

2025

LAND AND RESOURCE

The 1.2 MW solar plant called **Lalcktur** belongs to CDEA.

It was constructed for research purposes and is already in operation.

OFFTAKE

The **H2 SOLAR** project is looking for a vehicle supplier partner to develop the pilot and for mining companies that would be willing to decarbonize their Scope 3 emissions.

LOCATION

GREEN HYDROGEN PROJECT SHEET

POWER TO AMMONIA

LLAQUEDONA GREEN HYDROGEN

Contact details: Jaime Vasquez Sapunar
jaimevasquez@llaquedona.com

LLAQUEDONA will use the strong winds in Tierra del Fuego island, with over 60% measured capacity factor, to produce green ammonia for export.

PRODUCTION

Wind energy is used to power an electrolysis plant to obtain oxygen and hydrogen. Hydrogen will then be combined with nitrogen captured from the air through a *Haber-Bosch process,* to produce green ammonia.

PROJECT OWNER AND PARTNERS

PROJECT OWNER Sociedad de Inversiones Albatros Ltda.

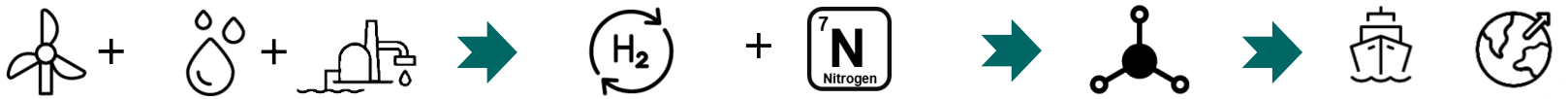
PARTNER COMPANIES alfanar, ENAP

ALBATROS has been involved in the real estate market in the Magallanes region for over 30 years and is committed to the promotion of renewable energies and energy efficiency.

ALFANAR is engaged in manufacturing a wide range of low, medium and high voltage electrical products, EPC solutions for conventional and renewable power plants worldwide and engineering services. It will contribute as developer, investor and EPC contractor.

*** ENAP** is the Chilean National Oil company. Their participation in the project is under negotiation.

HOW IT WORKS



Wind energy | **Well water** | **Desal. water** | **Green hydrogen** | **Nitrogen captured from the air** | **Green ammonia** | **Applications**

STATUS

The project counts with conceptual engineering and prefeasibility study developed by Engie Impact.

2 billion USD
total investment of the project

2027
year operation start

PROJECTIONS

1,150 MW
Wind energy

500,000 NH_3
Tonnes green ammonia per year

85,000 H_2
Tonnes hydrogen for green ammonia production per year

LAND AND RESOURCE

20,000 hectares
of land are in control of the company

Over 60% wind capacity factor
has been obtained by 3 measuring towers operating for over one year

OFFTAKE

LLAQUEDONA project is looking out for partners to establish offtake agreements.

LOCATION

GREEN HYDROGEN PROJECT SHEET

POWER TO MOBILITY

HYDRA PROJECT

Contact details: Luis Marín
Hydra Project Director
lmarin@mining3.com

Consuelo Glaría
Hydrogen Solution Developer H2BU, Engie
consuelo.glaria@engie.com

The HYDRA project aims to decarbonize the mining sector by developing fuel cell + battery power trains to retrofit mining haul trucks and replacing diesel consumption.

THE PROJECT

The Hydra project considers replacing the internal combustion engine of large capacity mining haul trucks (> 200 tonnes) with a hybrid system of hydrogen fuel cells and batteries.

This will replace about 3,000 liters of diesel consumption per truck per day, equivalent to a daily hydrogen consumption of up to 1 metric ton.

PROJECT OWNER AND PARTNERS

PROJECT OWNER

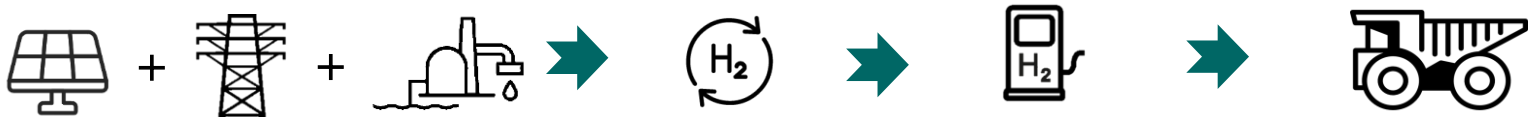
PARTNER COMPANIES

*** A consortium is being set up with partners along the value chain.**

ENGIE is a global reference company in low-carbon energy and services, having a Business Unit dedicated to renewable hydrogen since 2018. The current portfolio of renewable H_2 projects under development and in construction is over 30 projects in 10 countries over four continents. **ENGIE** is also developing a mining project in South Africa (Rhyno Project).

MINING3 is a mining research organization led by the global mining industry to develop and deliver transformational technology to improve the mining industry's productivity, sustainability, and safety.

HOW IT WORKS



Solar energy | **Energy from the grid (green PPA)** | **Desal. water** | **Green hydrogen** | **Refueling station** | **Mining haul trucks**

STATUS

The projects is on its second phase of development. Prefeasibility study is undergoing.

Design and construction of a modular fuel cell and battery powertrain prototype (100-200 kW) to assess performance under mining conditions is expected to be ready during 2021.

PROJECT IMPLEMENTATION

Phase 1
2018-2019
Business case validation

Phase 2
2021- 2022
Prefeasibility study
Fuel cell power train **prototype** development
Prototype laboratory test
18 months duration
2 million USD budget

Phase 3
Minimum Viable Product of H2 supply chain and H2 power system
Proof of concept within a mining vehicle
18-24 months duration
40 million USD budget

Phase 4
Scale up of H2 in mining Industrialization with **OEM's**
Trigger H2 **export**

OFFTAKE

A key pillar for the development of the **HYDRA** Project is the early engagement of mining companies and OEMs, as they will be the end users and providers, respectively.

This project has received a **subsidy of $330,000 USD** from the Chilean Economic Development Agency **CORFO**, for the development of Phase 2.

LOCATION

For more information: **http://engie.mining3.com/hydra/en/**

POWER TO GAS

H2GN PROJECT

Contact details: Jorge Matamala
Deputy General Manager, Gas Valpo
jmatamala@gasvalpo.cl

GREEN HYDROGEN PROJECT SHEET

H2GN will be the first project in Chile and Latin America to blend green hydrogen into a natural gas distribution network

PRODUCTION

An electrolyzer will produce green hydrogen powered by renewable energy from the grid and by a 9 KW photovoltaic power supply system installed on the same site.

The green hydrogen will be stored and then injected into the natural gas network in the cities of Coquimbo and La Serena.

The hydrogen content will be progressively increased from 5% up to 20% in volume. A reduction of 340 tons of carbon dioxide per year is expected.

PROJECT OWNER

PROJECT OWNER

Gasvalpo

GasValpo is the oldest natural gas distribution company in Chile. Along its subsidiary **Energas**, Gasvalpo supplies over **100,000** residential, commercial and industrial **customers** through its more than 1,800 kilometers of network.

HOW IT WORKS

Renewable energy from the grid | **Water** | **Green hydrogen** | **Hydrogen Storage** | **Blending process** | **Residential and commercial costumers**

STATUS

The projects is currently in its **third phase**, meaning the project design is ready and the equipment's are currently being purchased and installed.

1 million USD total investment, starting operation in **2022**

PROJECT IMPLEMENTATION

Phase 1
Project design and permit application for the green hydrogen production and blending.

Phase 2
Mapping of customers' appliances and definition of procedures.

Phase 3
Deployment of the 0.15 MW electrolyzer for the green hydrogen production and injection system.

Phase 4
Incremental blending of hydrogen into the network

OFFTAKE

GasValpo through its subsidiary **Energas**, operates a 60 km low-pressure polyethylene network in the Chilean cities of Coquimbo and La Serena. Green hydrogen will be injected to this network, supplying approximately 1,800 residential and commercial customers with blend of natural gas and green hydrogen.

LOCATION

GREEN HYDROGEN PROJECT SHEET

POWER TO AMMONIA

Vientos Magallánicos PROJECT

Contact details: Loreto Rivera
New Business and Stakeholders Manager, RWE
loreto.rivera@rwe.com

The project integrates the wind potential of the Magallanes region with a green hydrogen and ammonia production plant for export to European markets.

PRODUCTION

A wind power plant will be installed to supply a group of electrolyzers with renewable energy for the production of green hydrogen.

Nitrogen will be obtained from an air separation unit to produce green ammonia through the Haber-Bosh process.

The project contemplates a pilot phase and a commercial phase. The capacities of each are still under study,.

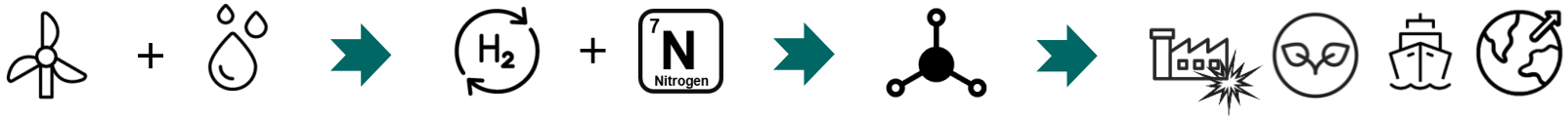
PROJECT OWNER

PROJECT OWNER RWE

RWE is a German energy company founded in 1898, based in Essen. With extensive experience in the energy sector, the company has approximately 20,000 employees in its various markets and subsidiaries.

The company is present throughout the entire energy value chain and its operating business is divided into four branches: RWE Renewables, RWE Supply & Trading, RWE Generation and RWE Power.

HOW IT WORKS



Wind energy + **Water** → **Green hydrogen** + **Nitrogen captured from the air** → **Green ammonia** → **Applications**

STATUS

The project is currently in a pre-feasibility stage. A prefeasibility study is currently being held.

1,850 million USD
Total investment, starting operation in
2030

COMMERCIAL PHASE PROJECTIONS

700 MW
Wind energy installed capacity

350,000 NH_3
Tonnes green ammonia per year

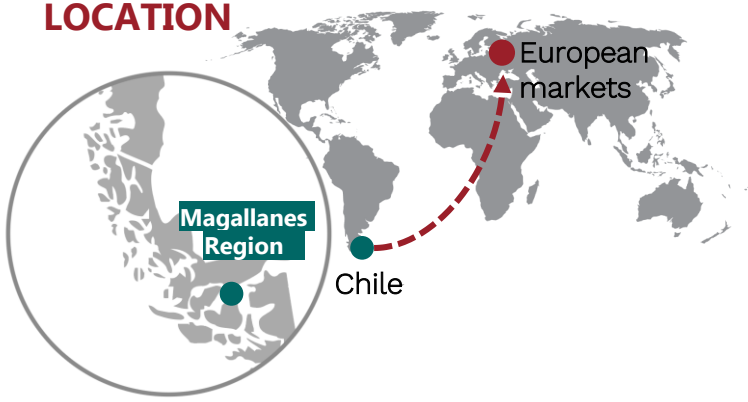
63,000 H_2
Tonnes of green hydrogen per year for **ammonia production**

OFFTAKE

The green ammonia is planned to be exported to international markets, mainly European markets. The first phase of the project will apply to international mechanisms for the promotion of renewable technologies.

In parallel multiple potential off takers are being contacted as RWE has a strong presence in the European markets.

LOCATION



GREEN HYDROGEN PROJECT SHEET

POWER TO MOBILITY

Hydrogen Forklifts PROJECT

Contact details: Ignacio Gomez
Technology and Innovation Manager, Walmart Chile
ignacio.gomez@walmart.com

The project aims to retrofit existing battery powered forklifts with fuel cell's at one of Walmart's distribution centers in Chile to power them with green hydrogen produced on site.

PRODUCTION

It consists on a green hydrogen production plant which will use solar energy and water to feed its electrolyzers. The battery powered forklifts are used to move merchandise pallets inside distribution center. Their batteries will be retrofitted to be powered by fuel cells to run on green hydrogen.

PROJECT OWNER AND PARTNERS

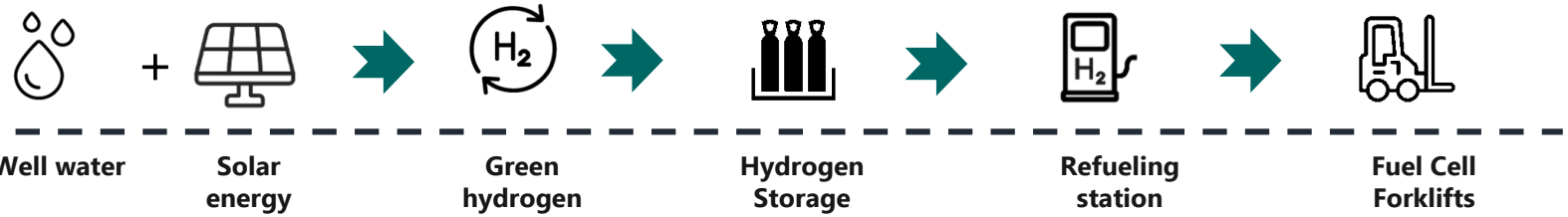
PROJECT OWNER — Walmart Chile

PARTNER COMPANIES — ENGIE, PLUG POWER

Walmart Chile : Project Owner
Engie : Electrolyzer supply
Plug power : Fuel Cell supplier

Walmart Chile is a leader in Chile's supermarket industry with its multi-format strategy that best caters to the needs of customers throughout the country. Walmart Chile is a subsidiary of Walmart. Based in the U.S., Walmart operates approximately 10,500 stores and clubs under 48 banners in 24 countries and eCommerce websites, employing 2.2 million associates around the world.

HOW IT WORKS



Well water — Solar energy — Green hydrogen — Hydrogen Storage — Refueling station — Fuel Cell Forklifts

STATUS

The project already has an environmental assessment and permits to be deployed. The hydrogen plant is currently under construction.

15 million USD
Total investment,
starting operation in
2022

PROJECT DETAILS

- **10.8** Kilograms green hydrogen per hour
- **0.6 MW** Electrolyzer
- **4,120** MWh solar energy per year
- **259** Forklifts will be retrofitted

OFFTAKE

The whole fleet of battery forklifts currently in operation in Walmart's distribution center located in Quilicura in the Metropolitan region, will be retrofitted to operate on green hydrogen produced on site.

LOCATION

GREEN HYDROGEN PROJECT SHEET

POWER TO X

UCSC PROJECT

Contact details: Ricardo Lizana Fuentes
Academic of the Engineering Department, UCSC
ricardolizana@ucsc.cl

The project consists of the deployment of a green hydrogen pilot plant and the use in applications within the university campus, to create and transfer capabilities, build human capital and promote the development of the hydrogen industry in the Biobio region.

PRODUCTION

Renewable energy from the university's micro-grid will be used for small scale green hydrogen production.

The hydrogen obtained will be stored and used for two purposes: power to power through a back up generation system, and power to mobility, through the implementation of a refueling station and the retrofit of electric vehicles with fuel cells to run on green hydrogen.

PROJECT OWNER AND PARTNERS

PROJECT OWNER UCSC

SPONSOR SEREMI Región del Biobío – Ministerio de Energía

Universidad Católica de la Santísima Concepción (UCSC) is a higher education institution located in the Biobio region, dedicated to the comprehensive training of people, as well as the generation and transfer of knowledge.

HOW IT WORKS

Renewable generation micro- grid | **Water** | **Green hydrogen** | **Hydrogen Storage** | **Refueling station** | **Fuel cell electric vehicle** | **Back up generation**

STATUS

This project received a **subsidy of 800,000 USD** from the **Biobío Regional Government** through a Regional Development National Fund.

The projects is currently under construction and is expected to start operating in

2022

PROJECT DETAILS

- **0.8** Tonnes green hydrogen per year
- **25 kW** Electrolyzer
- **44 kW** Renewable generation
- **800,000** USD investment

INNOVATION AND CAPACITY BUILDING

The project has received support expressions from several Chilean institutions such as **Cidere Biobio; Irade; Pelicano Solar Company; SuperTrans; Chile California Council; Corma Biobio; Fraunhofer Chile Research and H2Chile**.

Researchers from different universities have expressed their interest; among them Bath University, Duke University, Imperial College London, Wisconsin Electric Machines and Power Electronics Consortium (WEMPEC), Universidad de Concepción, Universidad del Bíobio, Universidad Andrés Bello, Universidad de los Andes.

LOCATION

GREEN HYDROGEN PROJECT SHEET

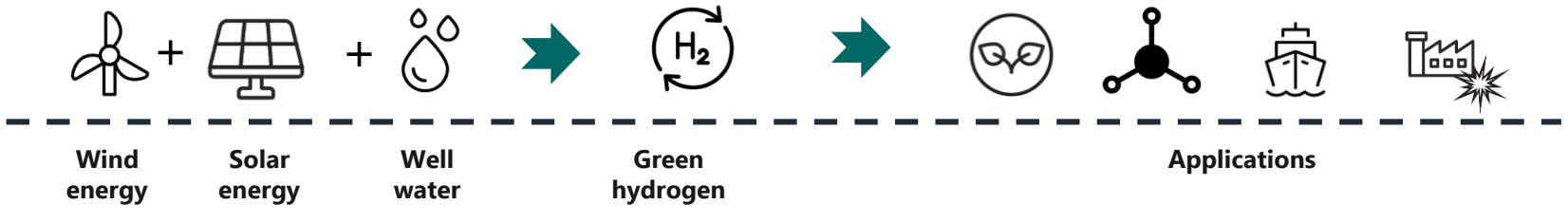
POWER TO X

Zorzal PROJECT

Contact details: Martín Elton
General Manager
melton@tikuna.cl

Zorzal is expected to generate competitive green hydrogen taking advantage of the strong winds and available solar radiation in the Bio Bio region, located in the heart of chilean paper pulp and grain production area.

HOW IT WORKS



PRODUCTION

Wind and solar surplus energy from small scale distributed generation plants connected to the grid will be used to split water obtained from well through an electrolysis process, obtaining oxygen and green hydrogen.

The hydrogen will be then used to produce industrial products for the forestry and agriculture industry.

PROJECT OWNER

PROJECT OWNER

TIKUNA energía circular

Tikuna focuses on medium size solar and wind projects development, construction and O&M, with close to 120 MW developed in Chile.

Tikuna has 36.5 MW in operation, close to 18 MW under construction and 350 MW under development.

More info: **www.tikuna.cl**

STATUS

The project is in a development stage and holds a lease over the terrain. Wind and solar capabilities are being measured and environmental baselines are being defined.

30 million USD
Total investment, starting operation in
2023

PROJECTIONS

10.5 MW
Wind energy installed capacity

9 MW
Solar energy installed capacity

300 H_2
Kg of green hydrogen per day

OFFTAKE

Currently analyzing potential offtakers in the region, such as the paper pulp industry and fertilizer industry located close to the project.

LOCATION

POWER TO POWER

Renewstable Kosten Aike PROJECT

Contact details: Cristina Martin
Vicepresident for Latinamerica
cristina.martin@hdf-energy.com

GREEN HYDROGEN PROJECT SHEET

Kosten Aike aims to supply non-intermittent electricity to the Aysen isolated grid from renewable resources using green hydrogen, fuel cell and energy storage technologies.

PRODUCTION

The energy produced by the wind power plant is used to generate green hydrogen through an electrolysis process. The hydrogen is then stored in specialized tanks. In the hours when there is no wind energy production, hydrogen is reconverted into electricity through fuel cells, providing the Aysen isolated grid with a non-intermittent electricity supply.

PROJECT OWNER AND PARTNERS

PROJECT OWNER

HDF MASS STORAGE ENERGY

PARTNER COMPANIES

Eolica Kosten Aike SpA

Hydrogène de France (HDF Energy) is a French independent power producer specialized in the development of non-intermittent renewable energy generation plants, thanks to the storage of energy in the form of hydrogen.

Kosten Aike Spa is the developer of the Kosten Aike wind power plant in the Aysen region, which is currently being acquired by HDF for the development of this project.

HOW IT WORKS

Wind energy + **Water from a stream** → **Green hydrogen** → **Hydrogen storage** → **Fuel cell** → **Battery** → **Stable electricity to the Aysen isolated grid**

STATUS

The Kosten Aike wind power plant is under assessment of the Chilean Environmental Assessment Service. The Renewstable Kosten Aike project is in basic engineering stage.

190 million USD

Total investment, starting operation in

2025

PROJECTIONS

36 MW

Wind energy installed capacity

12 MW

Fuel cell installed capacity to deliver stable electricity supply

900 H_2

Tonnes of green hydrogen per year

OFFTAKE

Two options are considered for the commercialization of the stable carbon free energy supply provided by the project:

1. Power purchase agreement between the project and the Aysen's grid operator.
2. Opt to the National Energy Comission (CNE) tariff system.

TECHNOLOGY

The project has a centralized energy control system that coordinates all the components of the plant to obtain a stable electricity production profile, allowing the replacement of fossil fuel base generation sources typically used in isolated areas without compromising the proper functioning of the grid.

LOCATION

POWER TO X

HyPro Aconcagua PROJECT

Contact details: Agustín Amadeo
General Manager, Linde Gas Chile
agustin.amadeo@linde.com

GREEN HYDROGEN PROJECT SHEET

Linde seeks to replace part of its grey hydrogen production, supplying the Aconcagua refinery in the Valparaiso region with green hydrogen, by reducing its natural gas consumption and carbon footprint.

PRODUCTION

Linde proposes to integrate a PEM electrolyzer plant to its grey hydrogen plant in the Valparaiso region to produce green hydrogen from water and renewable energy and distribute it through an existing pipeline to its current grey hydrogen customer. The facility would also provide new customers with green hydrogen.

PROJECT OWNER AND PARTNERS

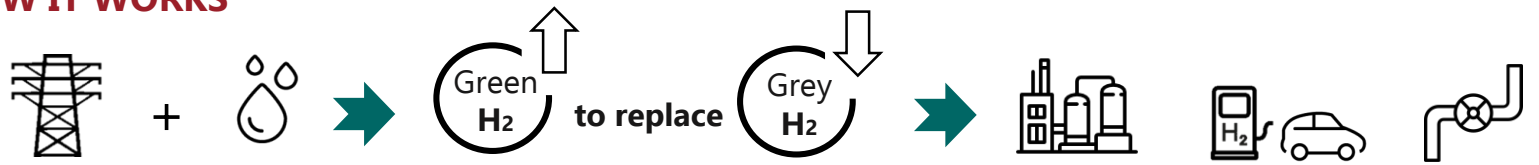
PROJECT OWNER — Linde

PARTNER COMPANIES — ITM POWER, Energy Storage | Clean Fuel

Linde is a leading industrial gases and engineering company with experience in the production, processing, storage and distribution of hydrogen, operating for over 15 years in Chile. Linde has nearly **200** hydrogen fueling stations installed, over **80** hydrogen electrolysis plants around the world and operates the world's largest liquid hydrogen distribution system.

ITM Power is the largest manufacturer of PEM electrolyzers, and has a joint venture with Linde, called ITM Linde Electrolysis.

HOW IT WORKS



Renewable energy from the grid | **Water** | **Green hydrogen** | **Grey hydrogen** | **Refinery** | **Fuel for mobility** | **Blending**

STATUS

The project is in a conceptual engineering stage. Progress is being made in the interconnections with the existing grey hydrogen plant, to move on to detailed engineering.

50 million USD

Total investment, starting operation in

2024

PROJECTIONS

24 MW

Electrolyzer installed capacity

3,600 H_2

Green hydrogen tonnes per year

OFFTAKE

The project has an MoU with his current grey hydrogen customer, the Chilean National Oil company **ENAP,** for the purchase of 1300 tonnes/year of green hydrogen, which will be destined to the production of "clean fuels" with low content of sulfurs at ENAP's Aconcagua refinery.

The project has also an MoU with COPEC, a mayor diesel distributor, to provide green hydrogen in its refueling stations for mobility applications. Other possible offtakers are gas companies for blending and other domestic customers in the region.

LOCATION

GREEN HYDROGEN PROJECT SHEET

POWER TO MOBILITY

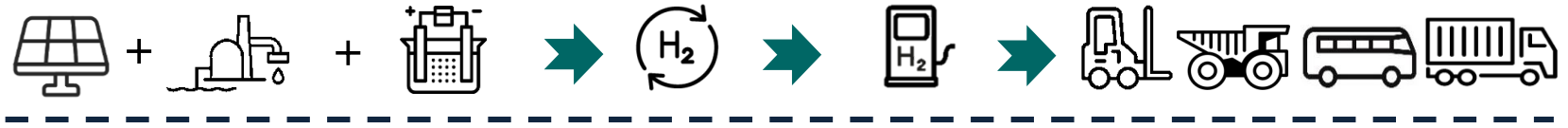
Hydrogen Generation Unit

Contact details: Juan Somavía
Manager of External Affairs and Government Relations
juan.somavia@angloamerican.com

Anglo American has deployed a pilot to power a fuel cell forklift with green hydrogen in its .

This pilot is the first approach to the use of green hydrogen in order to build skills and standards to expand the use of hydrogen to a variety of mobility solutions within the value chain and thus achieve its goal of being carbon neutral by 2040.

HOW IT WORKS



Solar Energy | Recycled mining water | Electrolysis | Green hydrogen | Refueling station | Applications

PRODUCTION

Solar energy is used to generate green hydrogen from mining recycled water. The hydrogen is poured through a refueling station to power a forklift. In addition, a stationary fuel cell will produce energy from surplus green hydrogen to reinject into the local power grid.

PROJECT OWNER

PROJECT OWNER

AngloAmerican

Anglo American is a leading global mining company and its products are the essential ingredients in almost every aspect of modern life.

Their portfolio of world-class competitive operations, with a broad range of future development options, provides many of the future-enabling metals and minerals for a cleaner, greener, more sustainable world and that meet the fast growing every day demands of billions of consumers.

STATUS

The implementation of the Pilot Project costed

$890,000 USD

and started its operation in

2021

PROJECT DETAILS

5 kW
Fuel cell forklift

2 Kg H_2
Kilograms green hydrogen consumption per day

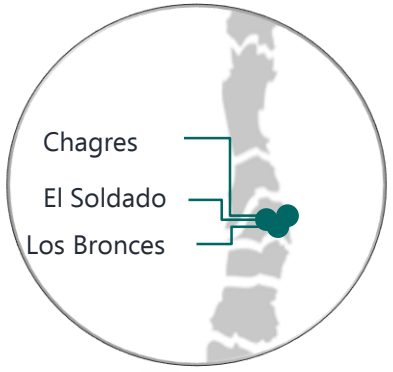
10 kW
Fuel cell for power generation

GOALS

Anglo has an ambitious Sustainable Mining Plan, which aims to achieve carbon neutrality in all its operations by 2040.

In Chile, they operate Los Bronces and El Soldado mines as well as the Chagres smelter. The company also has a stake in the Collahuasi mine.

LOCATION



Operations in Chile

Worldwide operations

POWER TO AMMONIA

Pauna Greener Future PROJECT

Contact details: Benjamín Page D.
Environmental manager, Statkraft Chile
benjamin.page@statkraft.com

GREEN HYDROGEN PROJECT SHEET

Using renewable energy from the Pauna Solar photovoltaic plant, Statkraft aims to generate green hydrogen to supply the Chilean domestic market and for export.

PRODUCTION

Solar energy from the "Pauna Solar" photovoltaic and energy storage power plant will be used to split water through an electrolysis process, obtaining oxygen and green hydrogen. The hydrogen will be destined to supply the domestic market and alternatively will be used for the production of green ammonia for export.

PROJECT OWNER

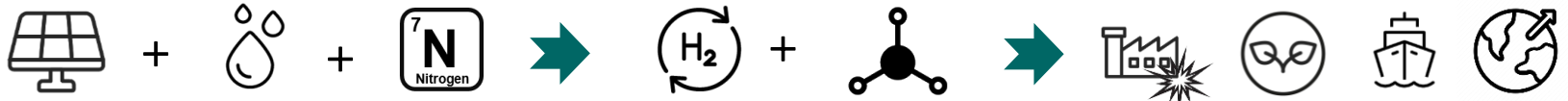
PROJECT OWNER

Statkraft

Statkraft is a global company in energy market operations. It is a leading company in hydropower and Europe's largest generator of renewable energy. The group produces hydropower, wind power, solar power, gas-fired power and supplies district heating.

Statkraft was awarded funding from the "Chile-European Union Bilateral Fund for Transitional Development" co-financed by the European Union and the Chilean Agency for International Cooperation for Development (AGCID), to conduct a pre-feasibility study for the project.

HOW IT WORKS



Pauna Solar photovoltaic plant | Water | Nitrogen captured from the air | Green hydrogen | Green ammonia | Applications

STATUS

The project is in a prefeasibility stage.

Two scenarios are under evaluation:
I) Green hydrogen production
II) Green ammonia production

Operation should start in

2025

PROJECTIONS

Scenario I

- **8,500** Tonnes green hydrogen per year
- **540 million** USD investment for the green hydrogen plant
- **100 MW** Electrolyzer
- **500 million** USD investment for the photovoltaic plant

Scenario II

- **170,000** Tonnes green ammonia per year
- **1,040 million** USD investment for the green ammonia plant
- **400 MW** Electrolyzer
- **500 million** USD investment for the photovoltaic plant

LAND AND RESOURCE

The 671 MWp photovoltaic plant called **Pauna Solar** is under environmental assessment.

The project owns a concession over 800 hectares public property for the plant.

OFFTAKE

The project is looking out for partners to establish offtake agreements to provide both the domestic market, replacing ammonia imports, and for export, as a Renewable Fuel of Non Biological Origin for the Norwegian maritime sector for example.

LOCATION

POWER TO X

H_2 Genesis PROJECT

Contact details: Anthon Miers
Lead Project Manager, Antuko
anthon.miers@antuko.com

GREEN HYDROGEN PROJECT SHEET

Thanks to the high penetration of renewable energy in the north of Chile and the low electricity prices, Genesis aims to produce, store and distribute green hydrogen and oxygen both for energy generation and industrial heat.

PRODUCTION

Using energy from the grid or from renewable PPA's and demineralized water, H2 Genesis will produce green hydrogen and oxygen through electrolysis. The green hydrogen will be transported through tube trailers, existing gas infrastructure, and probably to other countries depending on the offtake agreements. The project contemplates scaling up gradually.

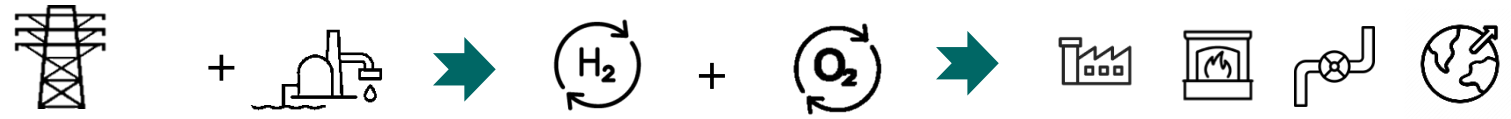
PROJECT OWNER

antuko

Antuko is an energy consultant and project developer located in Chile, with offices in Spain and Mexico. Over the past 10 years, the company has participated in over 200 consulting projects, has over 400 MW of assets under management and more than 500 GWh in energy trading activity.

In the last few years, **Antuko** has redirected its focus to the study and development of renewable projects, specializing on hydrogen and storage solutions for NCRE's.

HOW IT WORKS



Renewable energy from the grid | **Desal. water** | **Green hydrogen** | **Oxygen** | **Applications**

STATUS

The pilot project will start with 4 MW and will scale up to 100 MW within 5 years. H2 Genesis is currently in a pre-feasibility stage. The environmental assessment will be completed in 2022.

80 million USD

Total investment divided in several phases, starting operation in **2025**

PROJECTIONS

100 MW
Electrolyzer installed capacity

6,200 H_2
Tonnes green hydrogen per year

50,000 O_2
Tonnes oxygen per year

OFFTAKE

The project is currently in discussions with potential offtakers from the mining, energy, cement and metallurgical industries.

LOCATION

POWER TO X

H_2 CSP+PV PROJECT

Contact details Oscar Alvarez Gonzalez
Head of Business Development, Cerro Dominador
oscar.alvarez@cerrodominador.com

GREEN HYDROGEN PROJECT SHEET

The Project aims to produce 100% green hydrogen and its derivatives, using low cost energy from Cerro Dominador's 210 MW Concentrated Solar Power and PV complex, as well as from future CSP and PV projects developed by Cerro Dominador.

PRODUCTION

Cerro Dominador CSP and PV plant provides Chile with low-cost, manageable and all-year-round solar renewable energy, which will also be used to generate green hydrogen and its derivatives, supporting Chile's energy transition towards sustainability. The Pilot contemplates a 6MW electrolyzer to produce green hydrogen at a maximum rate of 2,600 kg per day.

PROJECT OWNER

CERRO DOMINADOR
CONCENTRATED SOLAR POWER

Cerro Dominador is dedicated to the generation of flexible, manageable and 100% green and sustainable renewable energy, using innovation to drive the transformation of the Chilean energy matrix.

CEA-Liten will conduct a pre-feasibility study co-financed by EIG and the "Chile-European Union Bilateral Fund for Transitional Development", a fund co-financed by the European Union and the Chilean Agency for International Cooperation for Development (AGCID).

HOW IT WORKS

Concentrated Solar Power · **PV Project** · **Water** → **Green hydrogen** → **Hydrogen & derivatives storage** → **Applications**

STATUS

The Pilot project is under development. A pre-feasibility study is currently being conducted.

6 million USD

Estimated investment on the electrolyzer for the pilot phase, which is expected to start operations in

2024

PILOT PHASE PROJECTIONS

210 MW
CSP +PV installed capacity

6 MW
Electrolyzer installed capacity

950 H_2
Tonnes of green hydrogen per year

RESOURCE

The Cerro Dominador 100 MW photovoltaic plant and the 110 MW CSP plant are in operation and have been delivering electricity to the National Electric System since June 2017 and May 2021, respectively.

OFFTAKE

The **H2 CSP+PV** Project seeks to establish partnerships with companies interested in using green hydrogen for a variety of applications, such as transportation, mining, industrial machinery and ammonia, among others, in order to scale production.

LOCATION

GREEN HYDROGEN PROJECT SHEET

POWER TO LIQUIDS

H2 Magallanes PROJECT

Contact details: Antoine Liane
Managing Director
H2Magallanes@total-eren.com

Located in the most austral region of continental Chile, H2 Magallanes is expected to be the country's first giga-scale green ammonia project, harnessing the rapid winds of this remote area.

PRODUCTION

Wind power is used to split water obtained from sea water desalinization through an electrolysis process to obtain green hydrogen. Most hydrogen will then be combined with nitrogen captured from the air through the *Haber-Bosch process,* to produce green ammonia

PROJECT OWNER

TOTAL eren

Total Eren is a France-based Independent Power Producer (IPP) which develops, finances, invests in, builds and operates renewable energy power plants (solar, wind, hydro) worldwide over the long-term. The company is present in Chile since 2013 and has executed over 400 MW of renewable energy projects.

Since December 2017, **TotalEnergies**, a key player in the energy sector, has been participating as a shareholder of Total Eren. TotalEnergies is investing massively in solar and wind power to become one of the top five producers of renewable energy by 2030.

HOW IT WORKS

Wind energy | Desal. water | Green hydrogen | Nitrogen captured from the air | Green ammonia | Applications

STATUS

Project engineering ongoing and environmental baselines are being defined.

Up to **20 Billion USD**
Total investment
starting construction in **2025**

MAX CAPACITY PROJECTIONS

10 GW
Wind energy installed capacity

4.4 MT NH_3
Million tonnes green ammonia per year

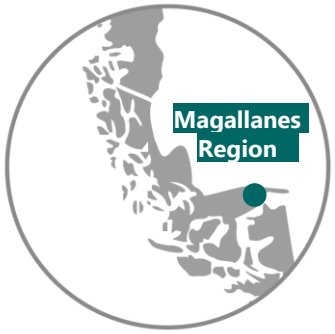
800 T H_2
Thousand tonnes of green hydrogen per year

OFFTAKE

Mainly for industrial processes and fertilizer production.

Offtakers prospection starting in 2022.

LOCATION



GREEN HYDROGEN PROJECT SHEET

POWER TO POWER

SAN PEDRO MINING PROJECT

Contact details: Cristian Opazo
copazo@pilotaje.cl

The project aims to decarbonize the San Pedro Mine processes by developing a Hydrogen Center.

THE PROJECT

Create a center that provides the capacity to execute tests, pilots and validations of technologies that generate, store, transport and consume hydrogen in their processes. In addition, it will allow decarbonizing transportation processes and energy backup in MSP.

PROJECT OWNER AND PARTNERS

PROJECT OWNER

CENTRO NACIONAL DE PILOTAJE DE TECNOLOGÍAS PARA LA MINERÍA

MSP MINERA SAN PEDRO

PARTNER COMPANIES

Busso group

Centro UC Energía

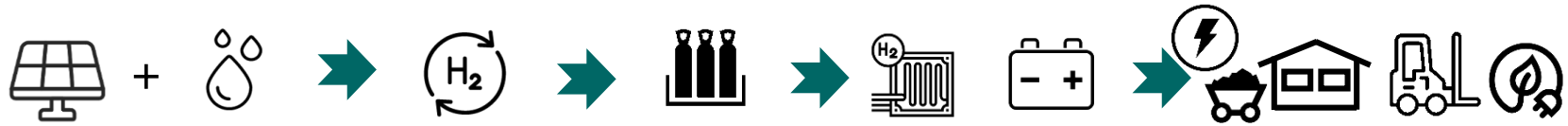
CNP is an organization that provides piloting and industrial validation services of mining technologies.

MSP is an underground minig operation which produces polymetallic concentrates such as copper and silver.

TRA SpA. (Busso group) is a holding that seeks to contribute to society through technologies for environmental care and other aspects.

Centro de Energía UC (UC Energy Center) promotes R&D, technology develop and public policies.

HOW IT WORKS



Solar energy | **Water** | **Green hydrogen** | **Hydrogen Storage and transport** | **Fuel cell** | **LiFePo Battery** | **Applications in mining environment**

STATUS

The project already has conceptual engineering, prefeasibility, feasibility and basic engineering studies, and detailed engineering is under development.

1,330 million USD

Total investment.

PROJECT IMPLEMENTATION

Pilot Phase

Enabling facilities for the generation, storage, and conditioning of hydrogen. Subsequently, integration of hydrogen transport and consumption systems for energy backup in the off-grid mining camp.

Industrial Phase

Escalation in generation and diversification in hydrogen consumption, considering equipment such as stationary and mobile fuel cells in vehicles, blending and others.

OFFTAKE

The hydrogen will be used in a mining camp at Minera San Pedro (MSP) in Til-Til, Metropolitan region

LOCATION

GREN HYDROGEN PROJECT SHEET

POWER TO X

Pionero PROJECT

Contact details: Pedro Aguilar
paguilar@eolico.cl

Located in the southern most region of Chile, Pionero project aims to take advantage of the region's favorable conditions for wind energy project development, with capacity factors up to 60% and a geography that allows effective design of big scale wind plants.

PRODUCTION

Wind power is used to split water obtained from sea water desalinization through an electrolysis process to obtain green hydrogen. Most hydrogen will then be combined with nitrogen captured from the air to produce green ammonia

The objective of Pionero Project is to produce green ammonia with high environmental standards to export with a competitive pricing model.

PROJECT OWNER

consorcio eólico

Consorcio Eólico is a Chilean project developer based in the south of Chile, having developed over 400 MW of wind energy which are currently under construction or operating, and with over 8,500 MW in either under feasibility evaluation or currently under development.

HOW IT WORKS

Wind energy + **Desal. water** → **Green hydrogen** + **Nitrogen captured from the air** → **Green ammonia** → **Applications**

STATUS

Environmental assessment and feasibility study are currently under development.

Up to **4,500 million USD**
Total investment, starting first phase operation in **2028**

PROJECTIONS

2,000 MW
Wind energy installed capacity

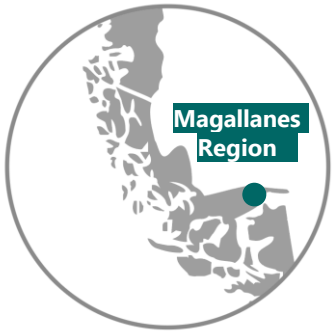
700,000 NH_3
Tonnes green ammonia per year

120,000 H_2
Tonnes green hydrogen per year for **ammonia production**

OFFTAKE

Ammonia will be exported to be used for fertilizers, mining products, as a fuel and other ammonia-based processes in the chemical and petrochemical industry. Alternatively, ammonia could be sold to be used as a carrier for long distance transport of green hydrogen.

LOCATION



POWER TO X

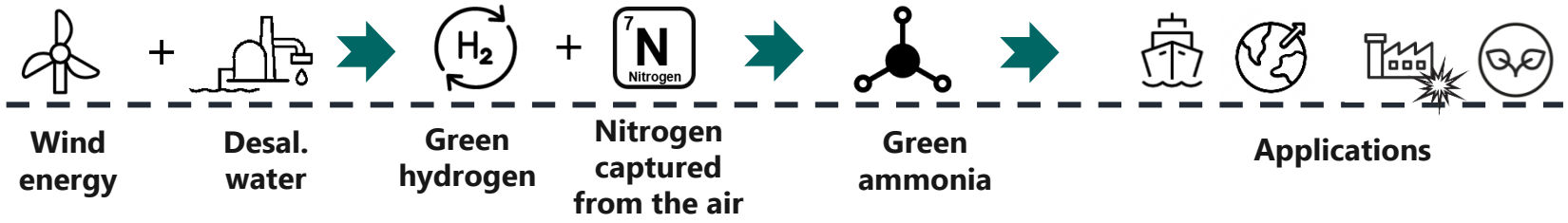
Gente Grande PROJECT

Contact details: Tim Adams
Managing Director
tim.adams@t-e-g.uk

GREEN HYDROGEN PROJECT SHEET

The "Gente Grande" project aims to produce green hydrogen and ammonia on a large scale in Magallanes for export, taking advantage of the abundant wind resources present in the region.

HOW IT WORKS



PRODUCTION

Wind energy is used to power an electrolysis plant, which uses desalinated water to obtain oxygen and hydrogen. Hydrogen will then be combined with nitrogen captured from the air, to produce green ammonia. The project also contemplates the construction of port infrastructure for export.

PROJECT OWNER

PROJECT OWNER

TEG is a privately owned group of companies with offices in London, Santiago and Toronto set up specifically to facilitate early market entry into world leading hydrogen related projects for offtakers, financiers, constructors and operators.

HAURA Energy is the strategic partner in Chile for the development of this project. Is a Chilean-Swiss company with a long history of its partners in the renewable industry.

STATUS

The projects is currently in its **first phase,** feasibility studies are being executed, as well as environmental screening and wind resource assessment on selected potential sites.

Expected year operation start

2028-2030

PROJECTIONS

Phase 1
2021
Project design and permit application for the green hydrogen production. every effort to achieve **"ready-to-build"** status and to be as environmentally friendly as possible.

Phase 2
2025
Construction begins, including a minimum of **1GW** of wind power, storage, desalination unit, large-scale electrolyzer, ammonia synthesis plant and deepwater port.

Phase 3
2028
Large-scale operation of the project.

3 GW
250 kTpa H2
1250 kTpa NH3

OFFTAKE

TEG and its consortium is also the buyer or "offtaker" of the hydrogen produced in the project.

LOCATION

POWER TO AMMONIA

TANGO PROJECT

Contact details: Sergio Raballo
Project Director, HyNewGen
sergio.raballo@hynewgen.com

GREEN HYDROGEN PROJECT SHEET

TANGO Project is a large-scale green hydrogen and ammonia development in the Antofagasta Region, Chile. With one of the strongest solar radiations in the world, the Project can deliver a highly competitive green ammonia to both domestic and international markets.

THE PROJECT

The project will fit into the local ecosystem in an integrated manner with the industry, communities, academia, and social environment.

CONSORTIUM PARTNERS

HyNewGen · gasco · Linde · Vopak · Port of Rotterdam

Gasco has been providing energy solutions across the country for over 165 years, with one of the largest gas supply and commercialization networks in Chile.

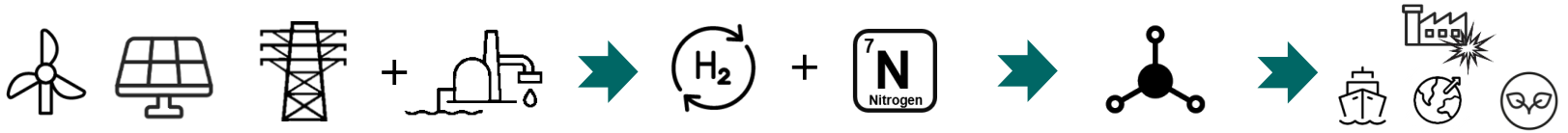
HyNewGen´s highly experienced team developed, in 2009, one of the first hydrogen pilot projects in the world, located in Argentina.

Linde has the technologies, expertise, and reach to unlock the massive potential of hydrogen, with around 260 hydrogen projects around the world.

Port of Rotterdam operates the largest energy port in Europe, handling over 13% of the energy that is being used in Europe annually.

Vopak, with six ammonia terminals around the world, has extensive experience in the safe storage of ammonia. Together with HES International and Gasunie, Vopak is developing an import terminal (ACE Terminal) for green ammonia in the Port of Rotterdam.

HOW IT WORKS



Wind energy · **Solar energy** · **Energy from the grid** · **Desal. water** → **Green hydrogen** + **Nitrogen captured from the air** → **Green ammonia** → **Applications**

STATUS

Feasibility studies will be completed in 2022 and concept selection will begin. The construction phase is expected in 2025-2026.

Start of **2027.**

Electrolizer Capacity:
Initial Phase: **200 MW**
Final Phase: **500 MW**

PROJECTIONS 2027

600 MW — **Renewable energy** installed capacity

172,000 NH_3 — **Tonnes green ammonia** per year

30,200 H_2 — **Tonnes of green hydrogen** per year for **ammonia production**

OFFTAKE

Green ammonia production will be shipped to the Port of Rotterdam to meet the future demand of Northwest Europe. The Project may also be leveraged by developing potential local demand for ammonia.

Open to receiving Expressions of Interest.

LOCATION

GREEN HYDROGEN PROJECT SHEET

POWER TO AMMONIA

H_2V Cabeza del Mar PROJECT

Contact details: Juan Guillermo Walker
Founder & CEO, Free Power
juan.walker@freepowergroup.com

Kenneth Maclean
Founder & CEO, GH Energy
kmaclean@lmabogados.cl

The project consist of the development of a green ammonia production plant in the Otway bay, involving local players and integrating mature technologies.

PRODUCTION

Integrating a 1 GW wind farm with a back up consisting in batteries and a natural gas/hydrogen turbine, the project aims to generate green hydrogen and green ammonia, which will be exported to developed countries through an existing port located 20 km from the plant.

PROJECT OWNERS

PROJECT OWNERS

Free Power SpA is a renewable energy developer, which holds a pipeline of more than 2 GW of wind and solar projects under development in Chile and Argentina.

GH Energy S.A. is a company based in the Magallanes region with extensive experience in land management, corporate and community relations and legal affairs.

Consultant company **Wood PLC** conducted a feasibility study of the project, financed by Project partners and "Chile-European Union Bilateral Fund for Transitional Development" (AGCID).

HOW IT WORKS

Wind energy | **Gas turbine** | **Desal. water** | **Green hydrogen** | **Nitrogen captured from the air** | **Green ammonia** | **Applications**

STATUS

The project is in a conceptual engineering development stage, currently undergoing wind measurements, and environmental permits are expected to be used in Sept. 2022. Port use agreement is closed.

2,850 million USD
Total investment, starting construction in **2027**

PROJECTIONS

1,000 MW
Wind energy installed capacity

750,000 NH_3
Tons green ammonia per year

130,000 H_2
Tonnes green hydrogen for ammonia production per year

OFFTAKE

Green ammonia will be commercialized to different offtakers for different applications such as fertilizers, synthetic surfaces, explosives, colling processes, among others. In the near future, green ammonia will be used to blend with coal for power generation (Japan) and fuel big vessels for global transport.

LOCATION