Project Lighthouse e-Fuel in Chile

Front-End Engineering Design (FEED)

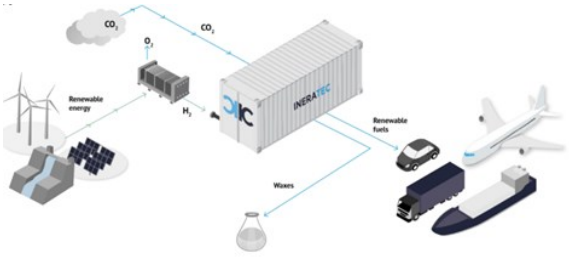
For the realisation of a Power-to-Liquid (PtL) plant

PPP Background

Decarbonization poses a complex challenge requiring diverse strategies such as renewable energy generation, energy efficiency, electrification of transportation and heating, carbon capture, and the development of synthetic fuels from renewables. Chile, with its significant renewable energy potential, sees synthetic fuels as pivotal for reducing greenhouse gas emissions and fossil fuel dependency in transportation.

The National Green Hydrogen Strategy, initiated in 2020 by the Ministry of Energy, aims to entirely replace fossil fuels with Green Hydrogen by 2030, furthering Chile's path towards carbon neutrality.

In this context, a public-private collaboration project was carried out between GIZ and INERATEC. This project involved mapping and qualifying potential sites in Chile for the implementation of a Power to Liquid (PtL) plant, as well as identifying local stakeholders along the value chain. INERATEC specializes in modular chemical plants for Power-to-X applications, leveraging recycled CO2 and green hydrogen. With capacities ranging from 350 to 50,000 tons per annum, their focus includes advancing technological maturity (TRL), optimizing yields, and developing robust thermochemical processes. The goal is to produce ASTM-standard fuels that seamlessly integrate into existing infrastructures.



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Project

The PPP began in mid-2023, with an investment of around 400,000 euros in pre-feasibility studies to analyze a project that contemplates the production of 50,000 ton/year of e-fuels, which will require 170,000 ton of CO_2, 23,000 ton of $H2_2$, 300.000 m_3 of water and an energy supply of 8,000 hours per year. The main objectives of the PPP were, firstly, to identify the most suitable sites for the plant realisation. Secondly, to design the plant in 3D and develop a flow diagram. Thirdly, to consolidate a mapping of local stakeholders, and finally, to conduct a techno-economic analysis of the plant.

These studies were successfully consolidated thanks to the collaboration between INERATEC and the H2Uppp program.

Methodology and Main Results

Regarding the analyses carried out, the optimal location for the plant was determined considering various mandatory criteria necessary for e-Fuel production, such as:

- **CO_2 sources**
  - Identify CO_2 sources with at least 170,000 t/a CO_2 emissions.
  - Exclude coal and natural gas power plants (planned to cease operations by 2024 and with limited operating time).
  - Result: Greater presence of biogenic CO_2 in the Biobío region, while industrial sources are mainly available in the north and the south of the country.
- **H_2 sources**
  - Identify project with a production of at least 23,000 t/a.
  - Close to the CO_2 source (max. 150 km).
  - Mature development (FEL1-3).
  - Result: 4 projects meeting these requirements were found, 3 in the north and 1 in the south.

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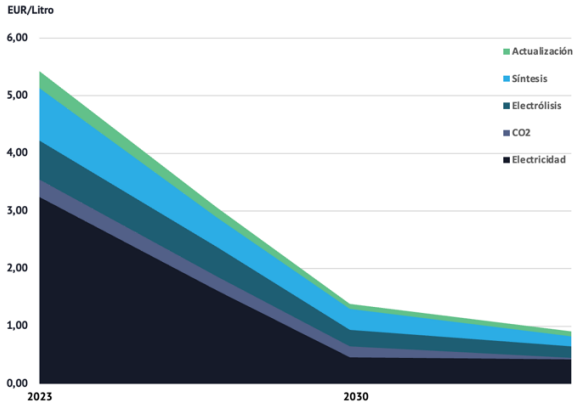
- **Water sources**
  - Nearby desalination plant.
  - Connection to the drinking water network.
  - Feasibility of waterhole.
  - Result: 29 desalination plants were found, of which 24 have a capacity greater than necessary.
- **Electrical system**
  - Nearby substation with a minimum capacity of 220 kV.
  - Grid total capacity of 200 MW per 8,000 h/a
  - Result: The cost of energy considering price, transmission cost, power, among others, ranges between 106 and 119 USD/MWh
- **Syngas**
  - At least 300,000 NM3/a (without inert gases).
  - Result: There is no production or supply of syngas or similar gases in Chile yet.
- **Transportation network**
  - Road and railway.
  - Nearby pipeline.

After a first ranking of 16 potential areas, 10 high-potential sites have been identified and qualified: One (1) in the north, seven (7) in the central-south, and two (2) in the south of the country.

A techno-economic analysis was conducted, resulting in the final cost of e-fuel production. It's important to note that both the economic analysis and the plant design might change based on the chosen installation site, potentially eliminating some facilities and reducing CAPEX costs.



Source : INERATEC ©

A 3D visualization of INERATEC's 50,000 t/a e-Fuel plant was created to offer a comprehensive view of the facility's layout, equipment, and infrastructure. This visualization showcases cutting-edge technology and efficient operation, providing stakeholders with a detailed understanding of its design and functionality. Any modifications to the plant design would also affect this visualization.

Source : INERATEC ©

The Chilean fuel market has been analysed and shows a clear dominancy from COPEC being the main distributor of diesel, holding 60% of the market. Enex follows with 21%, Esmax with 13%, and the remaining 6% are distributed among other actors. Regarding jet fuel consumption, it is observed that the main Chilean airlines, such as LATAM, Sky Airline, and Jetsmart, represent 75% of the total consumption, while the remaining 25% are distributed among international airlines operating in Chile.

By leveraging this information, INERATEC could effectively assess the market size and opportunity for introducing its e-Fuels, develop targeted marketing strategies, and position itself for success in the burgeoning e-Fuels market.

Publications and Dissemination

- Building Value Chains: The market ramp-up of e-Fuels in Chile, event held in Santiago, Chile on March 5th, 2024.
- Carbon Sourcing for Power-to-X: How can we meet the demand for sustainable value chains? Side event of the BETD, March 18, 2024
- Stand at the Green H2 Summit H2LAC, October 25th-26th, 2023.
- Webinar "Ciclo de talleres técnicos H2LAC/H2UPPP, April 3rd, 2024.

Contact:
GIZ Chile
N Javier Ortiz de Zúñiga
E francisco.ortiz@giz.de
I https://www.giz.de/

INERATEC
N Samantha Michaux
E samantha.michaux@ineratec.de
I www.ineratec.de

Author/Responsible/Editor, etc.:
Javier Ortiz, Santiago de Chile
Patricio Barboza, Santiago de Chile
Catalina Orellana, Santiago de Chile

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