

Solar NH₃-Pool Chile: Concepts for the development of a sustainable green hydrogen / ammonia industrial park in Antofagasta (Chile)

Background

The objective of Chile's Green Hydrogen Strategy (November 2020) is to position the country as a pioneer in the production, local use and exportation of green hydrogen and its derivatives, in order to become a "zero emissions country" by 2050. With this objective, Chile pretends to strength the competitiveness and productivity of its economy in a sustainably manner.

In particular, Antofagasta region, in the north of Chile, it is an important development hub for the production and export of green hydrogen and its derivatives. Due to the huge solar and wind energy potential, the region is home of numerous renewable energy companies, especially in solar photovoltaic technology, but also concentrating solar power (CSP). With a current photovoltaic installed capacity of 1.7 GW and 108 MW of CSP. Additionally, in this early stage, the region already has several public and private actors working on the development of a hydrogen economy. However, at the moment, small and medium-sized companies (SME's) have few chances to be part of the hydrogen market if they act alone, due to economies of scale to achieve competitive prices.



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However, total cost of projects can be reduced using shared infrastructure and avoiding construction of redundant infrastructure. Additionally, shared infrastructure let the projects take advantage of synergies, optimize land and costal uses, and use technologies efficiently, minimizing the environmental and social impacts of projects.

The concept of shared infrastructure would facilitate the entrance of SME's companies into the hydrogen economy, as the initial investment (CAPEX) of each project can be lower. Antofagasta offers a favorable opportunity to take advantage of this potential, to increase competitiveness of projects, create synergies and add aggregate value for the region through collaboration between companies.

The solution

It is proposed to develop a green hydrogen and derivatives industrial park composed by plants of different sizes, combining their generation capacities to produce ammonia and other derivatives on a large scale.

By combining infrastructure and productive capacity, a group of companies can join forces for the competitive production and commercialization of ammonia for export and local use. This business model is based on scale-up the production of ammonia through Harber-Bosch process, whose economic efficiency is reached when the production is more than 350.000 tons/year.

The industrial park will make possible to take advantage of economies of scope by concentrating in the same space a group of companies that benefits each other from their physical proximity, exchanging more efficiently the products, services and required information for the processes. Adequate territorial and infrastructure planning, with a long-term view, will help to overcome coordination failures between public and private actors, promoting collaboration between them, a key aspect in this initial stage of development.

How it will be done

Developing different studies for the design of a sustainable industrial park of green hydrogen and derivatives in the region of Antofagasta, optimizing regional infrastructure with a techno-economic and structural analysis for the design of facilities.

Shared infrastructure has three main pillars: water supply, renewable energy supply & electricity transmission grids, and logistics for the transportation and storage of products:

- The high-quality water supply is a major challenge, especially in the extremely dry Antofagasta region. For this, different alternative should be evaluated, such as project-owned seawater desalination plant, water long-term contracts with local suppliers, among others.
- Identification and optimization of a renewable energy supply mix (solar PV, CSP and wind) and, if it's necessary, supplementary energy storage to achieve the highest possible annual contribution margins for continuous operation of the production plants plays a decisive role. Additionally, different cooperation models and contracts with the regional electricity producers are going to be analyzed.
- A major challenge for the development of the industrial park is the improvement of the logistical infrastructure. In order to transport big quantities of H₂ & NH₃, relevant investments in export ports, storage facilities, rail infrastructure (loading stations, rail network & trains) and pipelines are necessary.

Impacts and results

- Proposal of a Mater Plan for the development of the Industrial Park, considering the necessary improvements in the regional logistics and the sustainability of the communities involved.
- Proposal of a sustainable solution for the water and energy supply for green hydrogen & ammonia production, in order to take advantage of synergies and other stakeholders.
- Optimized predesign of a green ammonia plant, as part of the industrial park.
- Engagement and capacity building of stakeholders from academia, research institutions, authorities and represents of public and private sectors.

At a glance	
Duration	November 2022 to December 2023
Country	Chile
Objetive	Series of studies for the design of a sustainable industrial park of green hydrogen & ammonia in Antofagasta region, based on an optimized analysis of regional infrastructure that includes a technical-economic and structural analysis for the plants design.
Partners	GIZ, Soventix Chile Spa, SI Solar Investments GmnH y Pabetin GmbH.
Expected Results	<ul style="list-style-type: none"> • Master Plan for the development of an industrial park of green hydrogen & ammonia. • Infrastructure and logistics analysis. • Pre-design of a green ammonia plant. Public relations, dissemination and participation of different stakeholders.



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Published by:
Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices
Bonn and Eschbor, Germany

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Design/layout, etc.:
peppermint werbung berlin GmbH, Berlin.

Photo credits/sources:
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