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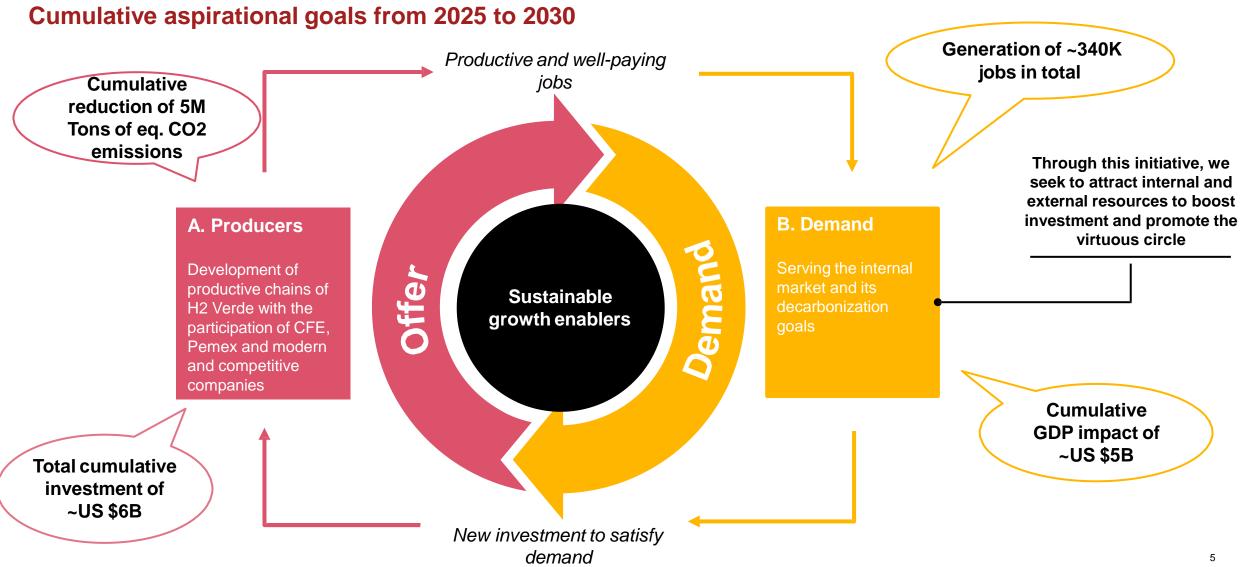






Promote investment on Green H₂ to develop this industry in Mexico in order to grow and decarbonize the Mexican economy

The deployment of 230K Tons of green H2 in Mexico is the basis for strengthening Mexico's climate agenda by 2030



The study is divided into 4 phases that were built from interactions with +50 stakeholders & internal research & analysis

Market study content & main sources used









1 Diagnostic

2 Potential

3 Impact

4 Goals & roadmap

- Introduction to green H2
- Background & tendencies
- Barriers & incentives
- Key stakeholders' perspective

- Applications
- Business opportunities
- Size of the opportunity
- High level costs review across the supply chain

- Requirements to invest along the supply chain
- Potential economic, social
 & environmental impact
- Aspirational goals
- Roadmap for the industry implementation in Mexico

- Surveys & interviews with +50 stakeholders
- Official reports & industry studies
- > New

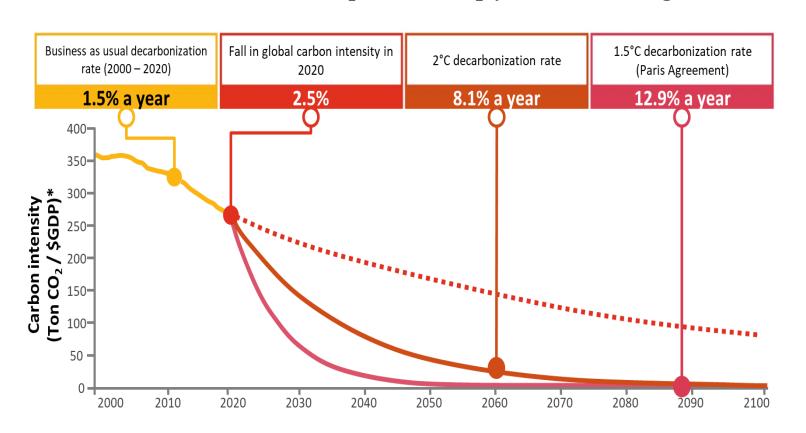
- > Industry reports
- International reference projects
- National utilities reports
- Commodities price projections
- Product-Input Matrix from INEGI & Leontief model
- National GHG emissions inventory
- Macroeconomic data
- Industry reports

- In-person workshop with +20 stakeholders
- Hydrogen strategies in other countries
- Internal discussions regarding the role of green H2 in Mexico

Green H2 can help decarbonize thermal processes in various industries and meet global & national emission reduction goals

Why is Green H₂ so important?

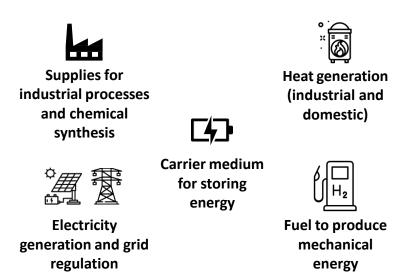
Global decarbonization rate required to comply with the Paris Agreement



What is green H2?

It is the H_2 that is produced through an electrolysis process powered only by energy from renewable sources that does not generate emissions or polluting waste in its production.

What is green H2 used for?



In order to feasibly implement Green H2 in the national economy, it is necessary to overcome the main following challenges

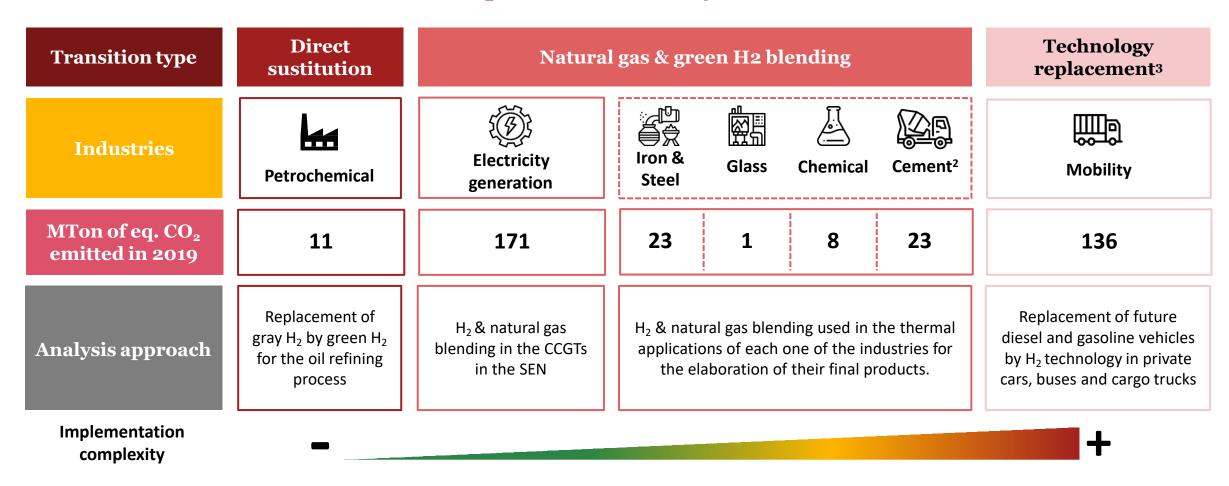
What are the challenges to implement green H_2 in Mexico?





This study focuses on the 7 industries with the highest GHG¹ emissions in Mexico and analyzes 3 types of transition to Green H₂

Which industries can substitute Green H₂ in Mexico in their processes?

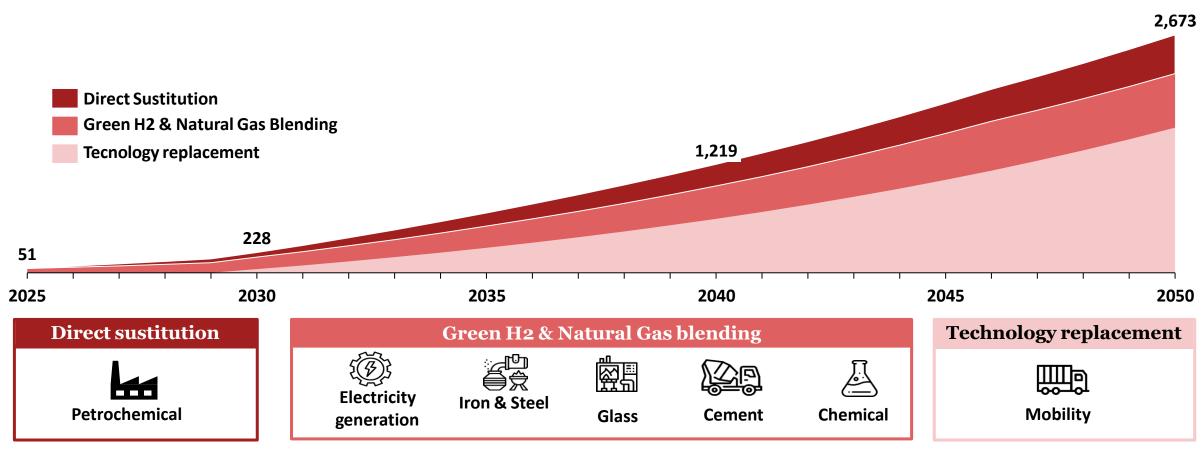


¹⁾ Based on 2019 data. Agricultural, Mining, Aviation, Food and Beverage Processing, Shipping, and Rail industries were excluded. 1) The analysis of the cement industry considers the mix of natural gas currently consumed with H₂ and the mix of future natural gas consumption, when coke is replaced by natural gas. 3) For the type of transition "Technology replacement", this study focuses exclusively on the analysis of the Mobility sector. Sources: National Inventory of Emissions, Gases and Greenhouse Effect Compounds 2019. Internal analysis

It is estimated that demand for Green H_2 in Mexico will start in 2025 & will increase to a total of ~230K Ton in 2030 & ~2,700K Ton in 2050

What is the size of the Green H₂ opportunity in Mexico?

Size of the Green H₂ Opportunity in Mexico (KTon)





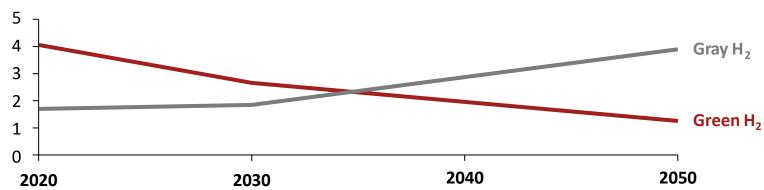
The total costs of Green H₂ for interregional consumption are estimated at \$5.3 USD/kg in 2030 and \$2.4 USD/kg in 2050

What is the cost of green H_2 ?

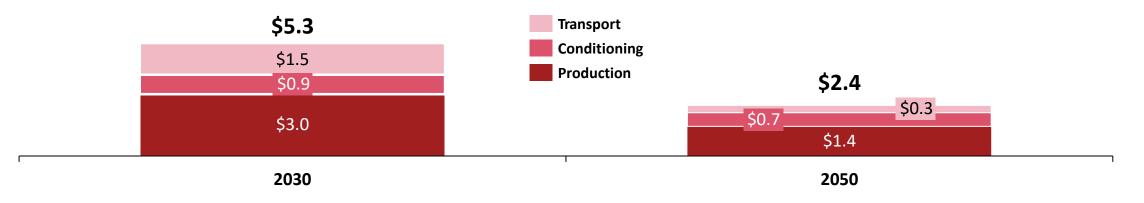
Cost calculation process

Green H₂ projects in the **planning or construction** phase were analyzed and **cost benchmarking** was carried out in different countries

On-site production cost estimate (USD/Kg)



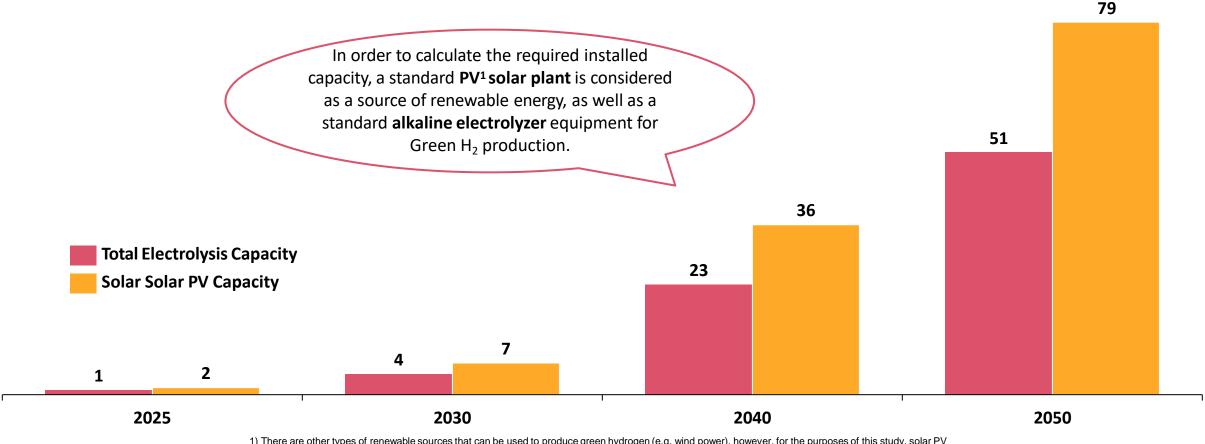
Estimated total cost of green H₂ for interregional consumption (USD/Kg)



In order to supply Green H₂ demand, it is estimated that 79 GW of renewable capacity and 51 GW of electrolysis must be installed by 2050

What is the renewable capacity required to cover the expected Green H₂ demand?

Estimated solar PV and electrolysis capacity requirements (Total GW installed)



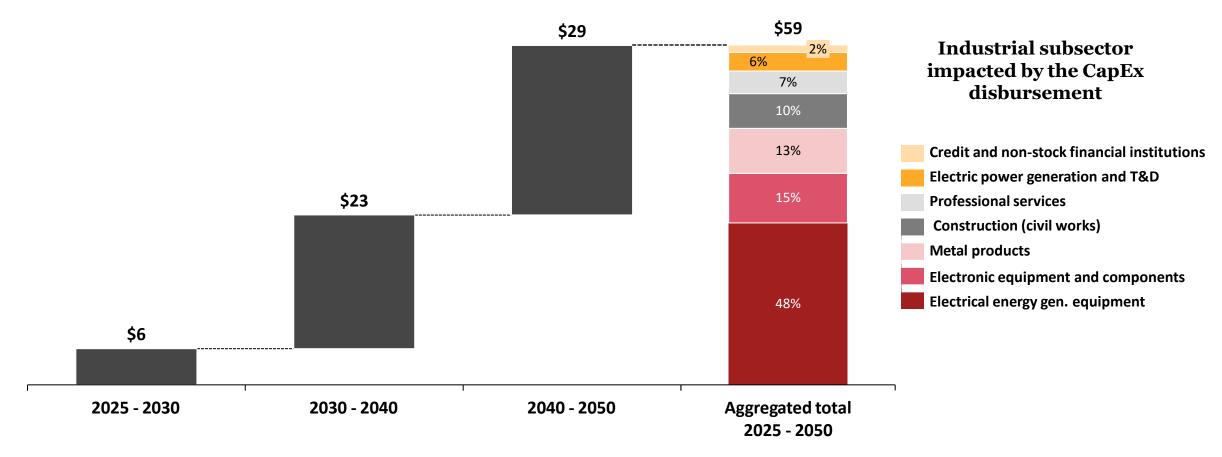
¹⁾ There are other types of renewable sources that can be used to produce green hydrogen (e.g. wind power), however, for the purposes of this study, solar PV technology was considered. Sources: IRENA, CENACE, Internal analysis



The renewable & electrolysis capacity needed to cover the estimated demand, requires a total CapEx of \$59B USD from 2025 - 2050

CapEx required by the Green H₂ industry on each impacted industrial subsector

Estimated total investment required by the Green H₂ industry from 2025-2050 (\$B USD)

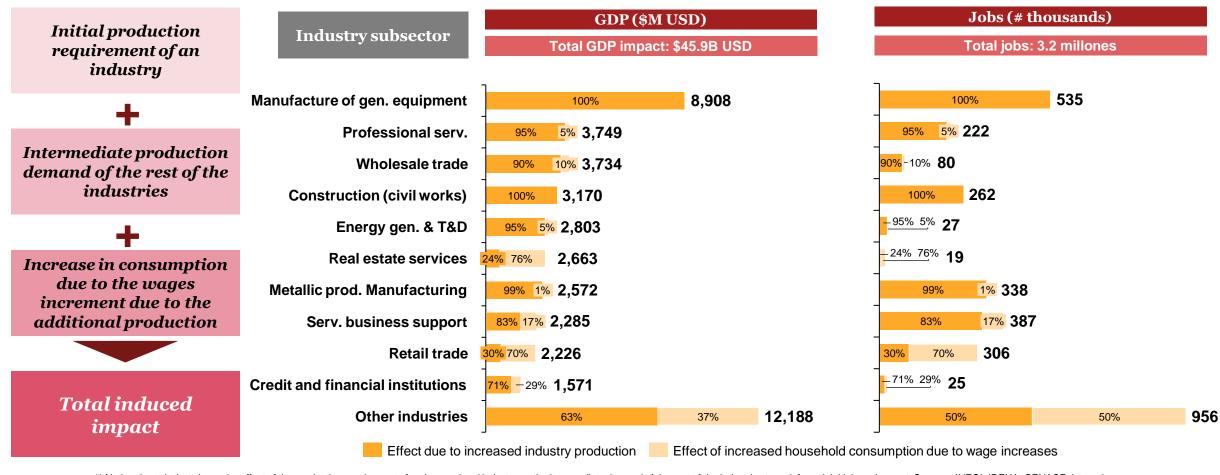


The investment generated by the Green H₂ industry in Mexico will have an impact of \$46B USD on GDP & will produce 3.2M jobs from '25-'50

What is the impact on GDP and new jobs creation?

Inputs considered

Total impact on GDP and jobs by industry of green H2 in Mexico (2025 – 2050)



¹⁾ National matrix that shows the effect of the production requirement of a given national industry on the intermediate demand of the rest of the industries to satisfy such initial requirement. Sources: INEGI, IRENA, CENACE, Internal 17 analysis

It is estimated that the Green H₂ industry will be able to reduce 53M Tons of CO2 by 2050, equivalent to a reduction of 14% compared to the 2019 base year

What is the environmental impact of the Green H₂ industry in Mexico?

Calculation details

National emissions inventories and studies with emission factors by type of fuel were consulted for the calculation of pollutants and their reduction.

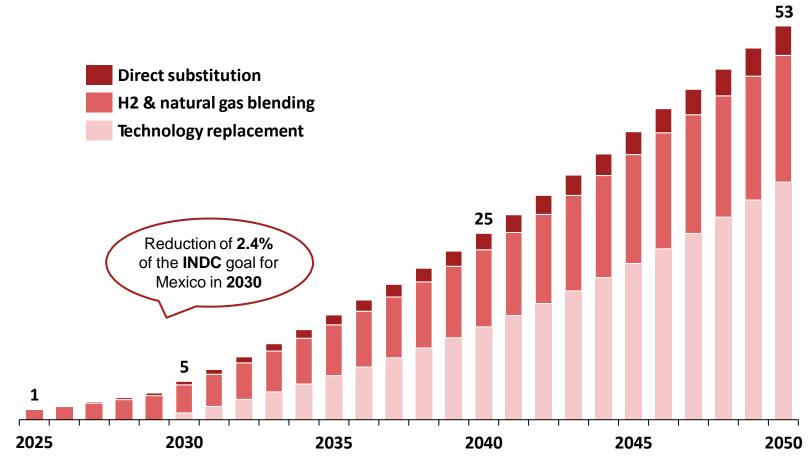
Direct substitution To calculate avoided emissions, a polluting factor for gray H₂ production through the SMR process was used

Natural gas & H2 bleding To calculate the emissions reduced, the volume of natural gas replaced, and a factor of CO₂ emissions were considered

Technology replacement

The volume of emissions by type of vehicle & the number of H₂ vehicles that will replace the current ones were quantified to calculate the emissions reduction

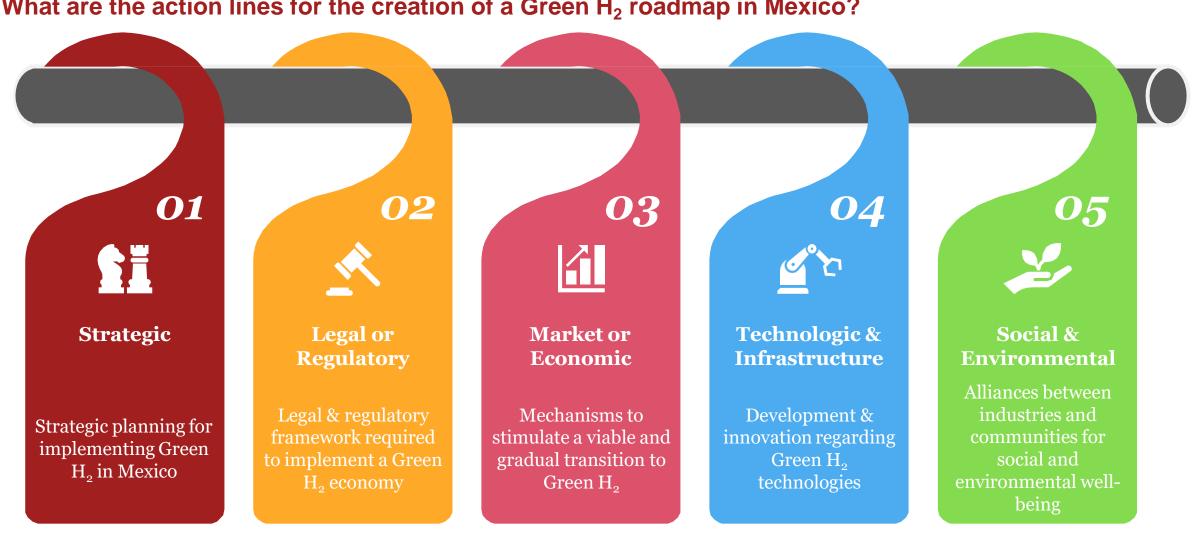
Reduced emissions by type of transition to green H₂ in Mexico (M Tons of CO₂)





5 lines of action were defined to classify the milestones required for the development of a Green H2 Roadmap in Mexico

What are the action lines for the creation of a Green H₂ roadmap in Mexico?



A workshop with +20 stakeholders was held to design the Green H₂ roadmap in Mexico, in which the main milestones were determined

What are the main milestones in the roadmap for the implementation of H₂ Verde in Mexico?

্রু Technologic & Social & **Strategic Regulatory Economic Term** infrastructure environmental Technical studies on the Organize forums to create a Review success in the CO₂ Map success cases Map current regulation competitiveness of green H₂ emissions market operation applicable to Mexico national strategy at the regional level Short Specific regulation on green Promote the formation of Evaluate opportunities for Map key stakeholders & Set decarbonization goals by economies of scale in the H₂ including safety and national manufacturing of create alliances region demand for green H₂ operation standards components and equipment Publication of the National Advise the financial sector Taxonomy for the green H₂ Strategy and Roadmap with and investors on the risks value chain priorities and objectives and opportunities Plan to integrate national Leverage existing Guarantees of Origin system Create inclusion programs utilities to the green H₂ infrastructure minimal Medium Develop CO₂ market for green H₂ for nearby communities CapEx transition to H₂ industry Establish specialized Green H₂ transition manual International forums to map Develop manuals for the Allocate funds to technical careers in the with regs. & minimum export requirements CO₂ market development banking green H₂ value chain investment needs Update goals according to Leverage international Evaluation of the compliance Large-scale production of Develop new applications of the green H₂ industry agreements to export green trajectory with green H₂ green H₂ (Mobility) evolution decarbonization goals

Economies of scale to reduce costs of green H₂



