Public Disclosure Authorized

Project Information Document (PID)

Appraisal Stage | Date Prepared/Updated: 27-Apr-2023 | Report No: PIDA33450

BASIC INFORMATION

A. Basic Project Data

Country	Project ID	Project Name	Parent Project ID (if any)
Chile	P177533	Chile Green Hydrogen Facility to Support a Green, Resilient and Inclusive Economic Development	
Region	**Estimated Appraisal Date**	**Estimated Board Date**	**Practice Area (Lead)**
LATIN AMERICA AND CARIBBEAN	26-Apr-2023	22-Jun-2023	Energy & Extractives
Financing Instrument	**Borrower(s)**	**Implementing Agency**	
Investment Project Financing	Republic of Chile	Corporación de Fomento de la Producción - CORFO	

Proposed Development Objective(s)

The Project Development Objective is to support the development of the green hydrogen industry in Chile.

Components

Component 1: Green Hydrogen Investment Sub-loans and Risk-Mitigation Facility
Component 2: Capacity Building and Project Management

PROJECT FINANCING DATA (US$, Millions)

SUMMARY

Total Project Cost	435.00
Total Financing	435.00
of which IBRD/IDA	150.00
Financing Gap	0.00

DETAILS

World Bank Group Financing

International Bank for Reconstruction and Development (IBRD)	150.00

Non-World Bank Group Financing	
Commercial Financing	285.00
Unguaranteed Commercial Financing	285.00

Environmental and Social Risk Classification

Substantial

Decision

The review did authorize the team to appraise and negotiate

B. Introduction and Context

Country Context

1. **Fueled by a strong fiscal response to the economic impacts of COVID-19 and emergency response measures taken in 2020, Chile's economy rebounded in 2021; but a sharp deceleration in 2022 is expected to continue into 2023.** Chile's economic growth in 2021—among the fastest in the world—was propelled by consumption, large fiscal transfers, and pension fund withdrawals. A remarkably rapid vaccine rollout, which reached over 90 percent of adults, firms' implementation of sanitary operational measures, and an expansionary monetary policy also contributed to the recovery. However, after registering 11.7 percent year-on-year (y/y) growth in 2021, the economy grew only 6.4 percent y/y in the first half of 2022—and only 0.3 percent y/y when compared with just the second half of 2021. Gross domestic product (GDP) grew by 2.1 percent in 2022[1] and is expected to contract by 0.9 percent in 2023, while a gradual acceleration is expected from 2025 onward. At the same time, the country faces significant challenges to increasing total factor productivity and economic diversification, which are needed for long-term, sustainable growth.

2. **Chile is facing significant challenges to its social contract and economic model.** Social unrest in 2019–20 exposed the vulnerability of the socioeconomic system, with protesters demanding several changes to the country's direction, prompting a constitutional reform process. On September 4, 2022, Chile held a referendum on a draft constitution; 62 percent of voters rejected the proposal. Congress approved the "*Acuerdo por Chile*," initiating yet another constitutional reform process, subject to approval in a referendum planned for November 2023. Still, efforts to enhance productivity—and, specifically, human capital, innovation, and female labor force participation—and to improve the allocation of resources across regions and municipalities, will need to further be reinforced.

3. **The Government of Chile's (GoCl's) *Programa de Gobierno Apruebo Dignidad 2022–26* aims to foster inclusive and sustainable economic growth.** The Boric administration has set an ambitious reform agenda centered on tax and pension reform; maintaining fiscal discipline; equitable access to quality education and health services for the vulnerable; gender parity; and economic growth through digital transformation and more sustainable, innovative, and environmentally friendly practices. As part of this vision, Chile is reformulating environmental and energy policies to put local populations at the center, with a special focus on reducing regional inequalities across the country and supporting the transition to a net-zero economy.

[1] Preliminary estimate from World Bank Global Economic Prospects, January 2023.

4. **Chile is strongly committed to decarbonization and to reaching carbon neutrality by 2050.** Chile's economy and the competitiveness of various of its productive sectors are vulnerable to risks associated with the increased intensity and frequency of extreme weather events (as experienced over the past decade). Among the country's efforts to address these challenges, the Climate Change Framework Law (No. 21455) codifies its pledge to reach carbon neutrality by 2050. The law includes (i) the obligation for Chile to comply with its updated Nationally Determined Contribution[2] (NDC) (limit greenhouse gas [GHG] emissions to 95 million tons of carbon dioxide equivalent [$MtCO_2eq$] by 2030[3]); and (ii) a Long-Term Climate Strategy (*Estrategia Climática de Largo Plazo*, ECLP, presented at COP26),[4] which outlines a road map to significantly increase renewable energy generation and green hydrogen production, and reduce emissions from industry and mining, in turn decarbonizing the economy. It specifically acknowledges green hydrogen's potential role in reducing GHG emissions by 21 percent by 2050.

Sectoral and Institutional Context

5. **Chile's energy sector, which is driven by private sector–led investments and market-based principles, relies on imported fossil fuels; clean energy generation needs to be increased to reduce this dependency.** The sector's generation, transmission, and distribution segments are led by private entities, which are regulated by the National Energy Commission (*Comisión Nacional de Energía*, CNE) and overseen by the Superintendency of Electricity and Fuels (*Superintendencia de Electricidad y Combustibles*, SEC). The power grid comprises the National Electric System, (*Sistema Eléctrico Nacional*, SEN) and two other minor power systems located in the southern part of the country.[5] SEN represents more than 99 percent of total installed capacity in the country. Hydrocarbons still account for 65 percent of the total primary energy supply and 77 percent of total GHG emissions. Despite ambitious changes to the power sector's regulatory framework that seek to increase energy supply, foster competition, lower prices, and increase the share of nonconventional renewable energy (NCRE),[6] the sector still relies on imported coal and gas, which fueled 34 and 18 percent of power generation, respectively, in 2021.[7] Although the share of NCRE has increased significantly in recent years—to 33 percent of power generation during 2022[8]—more is needed to reduce fossil fuel dependency, reach carbon neutrality goals – especially in hard-to-abate sectors-, and increase energy security.

6. **Chile relies on imported fuel for approximately 60 percent of its total primary energy consumption; the GoCl acknowledges that reducing this dependence on imported fossil fuels requires tapping into the country's abundant natural resources, scaling up renewable generation, and addressing emissions from economic sectors that are hard to abate or electrify.** Chile has made substantial commitments to phase out coal-powered generation by 2040, including

[2] NDCs are at the heart of the Paris Agreement and the achievement of its long-term goals. By setting NDCs, each country commits to reducing national emissions and adapting to the impacts of climate change (United Nations—Climate Change).
[3] UNDP Global NDC Support Programme, "Chile," United Nations Development Programme, https://www.ndcs.undp.org/content/ndc-support-programme/en/home/our-work/geographic/latin-america-and-caribbean/Chile.html.
[4] 2021 United Nations Climate Change Conference. See Government of Chile, *Estrategia Climática de Largo Plazo de Chile* (Santiago de Chile: Government of Chile, 2021), https://unfccc.int/sites/default/files/resource/CHL_LTS_2021.pdf. The World Bank provided support for the development of the Long-Term Climate Strategy in the Framework of the COP21 Aide Memoire: Ana Bucher, Patricio Bofill, and Carolina Urmeneta, "Chilean Society Builds Its Long-Term Climate Strategy in a Participatory Way," World Bank blogs, November 8, 2021, https://blogs.worldbank.org/latinamerica/chilean-society-builds-its-long-term-climate-strategy-participatory-way.
[5] As of December 2022, the Aysén and Magallanes electricity systems represented 0.23 percent (70 megawatts [MW]) and 0.42 percent (129 MW) of the total installed capacity, respectively. Coordinador Eléctrico Nacional, Energía Abierta, "Capacidad Total Instalada," http://energiaabierta.cl/visualizaciones/capacidad-instalada/.
[6] As defined by Law 20.257, NCRE sources include solar, wind, biomass, geothermal, and small-scale hydroelectricity (up to 20 MW).
[7] As of the end of October 2022, coal and natural gas represented 25 and 19.6 percent of the total power generation, respectively; Coordinador Eléctrico Nacional, Histórico Generación de Energía, "Generación de Energía Renovable No Convencional (en GWh)," https://www.coordinador.cl/wp-content/uploads/2023/01/CEN-hist_gen_de_energia_por_tecnologia.xlsx.
[8] Coordinador Eléctrico Nacional, "Generación de Energía Renovable No Convencional." The share of NCRE in Chile's power grid has constantly increased, from less than 2 percent in 2010, to almost 10 percent by the end of 2016, to approximately 27 percent by the end of 2021.

through the public-private agreement, "*Plan de Retiro del Carbón*."[9] Carbon pricing instruments, such as the country's carbon tax, promote a level playing field across technologies to support decarbonization. However, an innovative and versatile energy carrier such as green hydrogen is required to help tackle emissions in hard-to-abate sectors, including the extractives (e.g., mining, lithium), industrial (e.g., steel, cement, refineries, chemical, and fertilizer), and heavy and long-distance transport sectors. Green hydrogen can also significantly increase the integration of larger shares of NCRE by providing long-term energy storage that can better balance the power grid while increasing Chile's energy security.

7. **Moreover, green hydrogen can provide an opportunity for a just transition as established under the Boric administration and Chile's latest Energy Agenda (*Agenda Energía 2022–26*).** The shift to low-carbon technologies also brings a workforce transition process. The Boric administration is focused on ensuring it is well managed in order to prevent increasing social inequality, and is beneficial for the Chilean population, especially for women and the vulnerable. The Energy Zero Carbon Agreement[10] has established the closure of 5 gigawatts (GW) of coal-fired generation by 2040, which will affect nearly 14,000 related jobs,[23] pointing toward training- and education-based reskilling and upskilling of the workforce in innovative and green technologies, which often offer higher-quality jobs.[11] In particular, it will be important for the country to invest in equipping the workforce with the skills required to develop green hydrogen.

8. **In 2020, Chile launched an ambitious National Green Hydrogen Strategy (NGHS)[12] to become a global leader in green hydrogen production and leverage Chile's abundant and low-cost renewable energy potential.** The primary objectives of the NGHS include (i) having 5 GW of electrolysis capacity under construction by 2025, (ii) producing the lowest-cost hydrogen in the world by 2030, and (iii) being among the top three global hydrogen exporters by 2040. Key domestic offtaker sectors identified by the NGHS include oil refineries and chemical industries (including ammonia and methanol), mining haul trucks (*camión de extracción, CAEX*), heavy-duty transport, and long-range buses. According to the NGHS, developing a green hydrogen industry could unlock US$330 billion in private investment opportunities and exports of about US$30 billion, representing 10 percent of GDP by 2050.[13]

9. **Chile has the potential to produce the world's lowest-cost green hydrogen by leveraging its excellent solar and wind resources and the competitive cost of investments in the energy sector.**[14] The most recent electricity auction saw a record low price of US$13.32/megawatt-hour (MWh) for solar generation,[15] and the country has renewable potential equivalent to 70 times its current demand.[16] This translates to low costs for green hydrogen production, even when considering the costs of transport to overseas offtakers.[17] Chile's competitive levelized cost of energy is backed by high

[9] Summary available at: MoE (Ministry of Energy), *Plan de Retiro y/o Reconversión de Unidades a Carbón* (Santiago de Chile: Ministry of Energy, Government of Chile, 2020), https://energia.gob.cl/sites/default/files/plan_de_retiro_y_o_reconversion_centrales_carbon.pdf. Further updates accelerating the phase-out process have been announced since the launch of the original plan.

[10] In June 2019, the MoE signed the Energy Zero Carbon agreement with Aes Gener, Colbún, Enel y Engie to close 5 GW of coal-fired generation by 2040.

[11] ILO (International Labour Organization), *Skills for a Greener Future: A Global Overview* (Geneva: ILO, 2019), https://www.ilo.org/wcmsp5/groups/public/---ed_emp/documents/publication/wcms_732214.pdf.

[12] MoE, *National Green Hydrogen Strategy* (Santiago de Chile: Ministry of Energy, Government of Chile, 2020), https://energia.gob.cl/sites/default/files/national_green_hydrogen_strategy_-_chile.pdf.

[13] MoE, *National Green Hydrogen Strategy*.

[14] IRENA (International Renewable Energy Agency), *Global Hydrogen Trade to Meet the 1.5°C Climate Goal: Part III—Green Hydrogen Cost and Potential* (Abu Dhabi: IRENA, 2022), p. 25, https://www.irena.org/publications/2022/May/Global-hydrogen-trade-Cost.

[15] Government of Chile, "Gobierno Y Empresas Logran Precio Promedio De 23,78 USD/MWh Con Energías Renovables Y Almacenamiento," CNE (Comisión Nacional de Energía), Ministry of Energy, Santiago de Chile, September 7, 2021, https://www.cne.cl/prensa/prensa-2021/09-septiembre-2021/gobierno-y-empresas-logran-precio-promedio-de-2378-usd-mwh-con-energias-renovables-y-almacenamiento/.

[16] MoE, *National Green Hydrogen Strategy*, 13.

[17] The estimated low costs of green hydrogen production in Chile make it competitive with other producers closer to import markets. The cost of shipping hydrogen as green methanol to Germany or Japan is estimated at about 5 percent of the total cost. See Energy Partnership Chile

capacity factors.[18] For instance, the Atacama region boasts a 38 percent capacity factor for solar power, and the Magallanes region reaches 60 percent for onshore wind. This compares favorably to an estimated average capacity factor of 25 percent for solar power in Saudi Arabia and 55 percent for offshore wind in the North Sea.

10. **Supporting green hydrogen can help Chile diversify its economy through the creation of green value chains, allowing it to remain competitive while adapting to the challenges of low-carbon export markets, while also help it advance towards a just transition.** The development of green hydrogen and its derivatives can help in decarbonization and foster the creation of green value chains in key productive areas such as green copper, green steelmaking, green lithium, and other chemical production. Green fertilizers can also help create value chains in important export agribusinesses such as fruits, vegetables, salmon, and/or wines. This will help the country to remain competitive, particularly in European Union (EU) markets, given the introduction of the Carbon Border Adjustment Mechanism (CBAM).[19] Using green hydrogen, Chile can produce new green ammonia or green hydrogen commodities that could be consumed locally or internationally. This can help Chile to further diversify its economy. While these are emerging commodity markets, they are expected to grow significantly in the coming decade.[20] Moreover, many of the green hydrogen projects will be located in regions with the highest renewable energy capacity factors primarily in the northern region of Antofagasta, and the southern regions of Magallanes and Bio-Bio. These hydrogen hubs or hydrogen valleys can help stimulate the economy by capitalizing on economies of scale to develop local demand and capacity (in terms of new green local employment opportunities), especially in the regions with more vulnerable and marginalized people. Analytical work has shown that the development of green hydrogen can lead to the generation of an estimated 22,000 new green employment opportunities by 2030, 87,000 by 2040, and 94,000 by 2050 in Chile.[21]

11. **There is strong institutional support from key government agencies to advance the green hydrogen industry and help create market conditions that support private investment.** The NGHS enjoys broad support across the political spectrum. The GoCl has formed alliances with potential global offtakers (such as the Port of Rotterdam, the Government of Singapore, and the Government of Japan), has reached out to potential foreign investors in the industry, and is supporting the development of local regulations. The Boric administration has recognized that green hydrogen promises economic, environmental, and social benefits for local communities. Securing the participation of local companies in the value chain would help create a sustainable industry that will generate new jobs and skills for workers.[22] President Boric launched the Committee for the Development of the Green Hydrogen Industry (*Comité de Desarrollo de la Industria del*

Alemania, "Conditions and Opportunities to Trade Green Hydrogen from Chile to Germany and Japan" [in Spanish], 2021, https://www.energypartnership.cl/fileadmin/user_upload/chile/media_elements/Studies/Abstract_Hydrogen_Export_from_Chile_to_GER_EP_CHL_2_2021_01.pdf.

[18] The LCOE is substantially affected by the weighted average cost of capital (WACC). In Chile, the WACC ranges between 4 and 10 percent, whereas it is 7–12 percent in African countries. IRENA reports that a WACC increase from 4 percent to 6 percent would cause the LCOE to increase from US$8.7/MWh to US$25.5/MWh (a 37 percent increase). Hence, Chile's competitiveness in hydrogen production also derives from its competitive business environment.

[19] In the first transition stage of CBAM, which will enter into force in October 2023, the following products will have to declare their carbon footprints: cement, aluminum, fertilizers, electric energy production, iron, and steel. However, by January 2026, all importers will need to declare the embedded GHG emissions for all goods imported into the European Union and surrender the corresponding number of CBAM certificates. The price of the goods will be calculated based on the weekly average auction price of EU Emissions Trading System (ETS) allowances. See European Council, "Council Agrees on the Carbon Border Adjustment Mechanism (CBAM)," March 15, 2022, https://www.consilium.europa.eu/en/press/press-releases/2022/03/15/carbon-border-adjustment-mechanism-cbam-council-agrees-its-negotiating-mandate/.

[20] Hydrogen Europe, "Hydrogen—A Carbon-Free Energy Carrier and Commodity," November 2021, https://hydrogeneurope.eu/wp-content/uploads/2021/11/2021.11_Hydrogen-as-a-carbon-free-energy-carrier-and-commodity_clean.pdf.

[21] 4e (Programa de Energías Renovables y Eficiencia Energética en Chile), *Cuantificación del encadenamiento industrial y laboral para el desarrollo del hidrógeno en Chile* (Santiago de Chile: Ministry of Energy, 2020), https://www.4echile.cl/publicaciones/cuantificacion-del-encadenamiento-industrial-y-laboral-para-el-desarrollo-del-hidrogeno-en-chile/.

[22] Inter-American Dialogue, "Online Event: Low-Carbon Hydrogen in LAC—Prospects and Pathways," June 28, 2022, https://www.thedialogue.org/events/online-event-low-carbon-hydrogen-in-lac-prospects-and-pathways/.

Hidrógeno Verde, also known as *Comité de Hidrógeno Verde de CORFO*)[23] with the objective of coordinating related initiatives of the ministries of finance, economy, development and tourism, energy, foreign affairs, social development, public works, transportation, environment, sciences, agriculture, and national assets, as well as of CORFO.[24]

12. **The hydrogen ecosystem is still at a nascent stage; public intervention through blended finance and risk-mitigation instruments is required to help mobilize investments in order to reach financial closure and help overcome the initial phase that every new technology faces (the so-called valley of death) until it becomes commercially self-sustainable.** The Hydrogen Council[25] states that despite the announcement of US$240 billion of investments globally, only about 10 percent have reached the Final Investment Decision (FID), mostly in advanced economies. To overcome the funding gap and convert pilots into larger-scale projects, governments across the world are providing public incentives. Many countries have already enacted public funding to develop their industries, including members of the Organisation for Economic Co-operation and Development (OECD), such as the United States, the United Kingdom, Germany, Australia, and Spain. Resource mobilization and overcoming the funding gap are more difficult in emerging economies, since governments face fiscal deficits, and the cost of capital tends to be higher as the private sector perceive risks related to investments in green hydrogen projects.[26] Therefore, emerging economies could only compete if they have abundant and competitive resources and can provide adequate concessional financing to be blended with commercial lending and risk-mitigation mechanisms to reduce hydrogen production costs.

13. **A robust market sounding undertaken by the World Bank (WB) has identified key risks to developing green hydrogen projects in Chile as perceived by developers, financial institutions, and other stakeholders.**[27] The market sounding concluded that key risks in the nascent technology include: (i) high cost of electrolyzers that are expected to decline and could deter investors and lenders to finance green hydrogen projects; (ii) relative uncertainty regarding the technical performance of green hydrogen production and/or its derivatives due to the limited track record of the technology; (iii) novelty of the industry due to limited track record of large-scale projects; (iv) high cost of transportation infrastructure and logistics; and (v) scarcity of specialized personnel and cost of international experts.

14. **Green hydrogen can mobilize significant private capital (estimated at US$8 billion by 2025 and US$330 billion by 2050)[28] provided the risks perceived by financiers are addressed appropriately.** Nascent industries are initially developed by large and strategic equity investors, which use their own financial resources to conduct prefeasibility and feasibility studies, as well as initial construct small testing pilot projects. However, industrial development at scale can

[23] The Committee for the Development of the Green Hydrogen Industry was launched on July 5, 2022.
[24] CORFO launched the Committee for Green Hydrogen Development on July 5, 2022. CORFO, "Chile cuenta con nueva institucionalidad para el desarrollo sustentable de la industria de Hidrógeno Verde," https://www.corfo.cl/sites/cpp/sala_de_prensa/nacional/05_07_2022_comite_hidrogeno_verde;jsessionid=GXfPlX4oQLmpGCNmXqLVqiYMIQ_5B4VjJrTTrSGSDkFZpcNzsXWM!-23838105!-635010659.
[25] Hydrogen Council, "New Hydrogen Projects Achieve Record Numbers Globally with Even Greater Urgency for Final Investment Decisions to Attain Net Zero," September 20, 2022, https://hydrogencouncil.com/en/new-hydrogen-projects-achieve-record-numbers-globally-with-even-greater-urgency-for-final-investment-decisions-to-attain-net-zero/. About 680 large-scale project proposals (worth about US$240 billion) have been put forward, but only about 10 percent have reached a final investment decision. While Europe leads in proposed investments (~30 percent), China is slightly ahead on the actual deployment of electrolyzers (200 MW). Meanwhile, Japan and South Korea are leading in fuel cells (with more than half the world's 11 GW of manufacturing capacity).
[26] IEA (International Energy Agency), *The Breakthrough Agenda Report 2022* (Paris: IEA, 2022), https://iea.blob.core.windows.net/assets/49ae4839-90a9-4d88-92bc-371e2b24546a/THEBREAKTHROUGHAGENDAREPORT2022.pdf.
[27] (i) Private sector—Indura (AIR PRODUCTS Group), HY24, ARUP, Infrata, AES Andes, HDF (Hydrogene de France), Porsche, Engie, Geostock/Vinci group, Siemens; (ii) financial institutions—BNP Paribas, Société General, Hudson Bankers, Natixis, Infrared Capital Partners, Brookfield, Aberdeen, Sumitomo, MUFG; (iii) hydrogen associations—Hydrogen Council of Australia, California Hydrogen Business Council; (iv) government representatives—Delegation of EU Brussels and Chile, Ministry of Energy in Germany, Ministry of Energy in the United Kingdom; (v) development agencies—GIZ, KfW, the United Nations Industrial Development Organization; and (vi) Chilean institutions—Desarrollo País, CORFO, Fundación Chile, CNE, Univ. Santa Maria.
[28] MoE, *National Green Hydrogen Strategy*, 12.

only be achieved with the participation of debt investors (e.g., commercial banks) that have the required resources to accelerate the transition from pilot projects to medium- and large-scale industrial projects capable of having a meaningful impact on the development of a new industry. Therefore, it is crucial to create an investment environment that attracts not only equity but also debt investors as early as possible. Commercial banks charge interest rates that reflect the risks they are taking along with all their costs, including those of their regulatory capital requirements in cases where they are direct lenders. When assessing whether to finance a green hydrogen project, risks related to the lack of a track record of the technology, the large financing amounts involved, and the long tenors required are likely to result in high interest rates with standard grace periods and tenors, which are far from the soft financing terms that are critical to achieve competitiveness and industry development. The ability to provide lending to green hydrogen projects as close to International Bank for Reconstruction and Development's (IBRD) financing terms is thus essential to achieving the objective of reducing financing costs, and thus lowering the cost of the green hydrogen produced, and becoming competitive.

15. **A Green Hydrogen Facility (GHF) is a strategic public intervention that fosters green hydrogen development as it crowds in private capital, mitigates risks, and reduces the costs mentioned above.** Devoting targeted amounts of public resources to mitigate perceived risks and finance key capital goods for green hydrogen production can create a multiplying effect on private investments. Scaling up green hydrogen projects from a pilot phase to a commercial scale would reduce the costs of producing a kilogram of green hydrogen, thereby increasing the technology's competitiveness.[29] Leveraging Chile's comparative advantages and tailored public interventions could accelerate the transition to industrial-scale green hydrogen projects by: (i) providing the catalytic capital to attract private financing; (ii) acting as an anchor investor to attract interest; (iii) supporting the construction of an initial portfolio of attractive green hydrogen projects; thus spearheading industry development; and (iv) fostering the country's enabling environment by supporting capacity building and local demand.

16. **The proposed Project can become a reference of a global public good (GPG) to other countries in the Latin American and the Caribbean region and globally, since it can boost positive externalities and spillovers on decarbonizing hard-to-abate sectors, energy security, food security, productivity diversification, and innovative financing.** In terms of climate change, (i) green hydrogen is a zero-carbon energy carrier, just like electricity, but it has an edge when it comes to decarbonizing sectors that are hard to electrify (e.g., heavy industry or long-haul transportation), and (ii) it can be stored for long periods, which facilitates greater integration of variable renewable energy and increases countries' energy security. Moreover, green hydrogen also has positive externalities in terms of producing green ammonia and green fertilizers locally, which can increase energy security. It has important spillovers in diversifying productivity through the creation of green value chains in the extractives (e.g., mining, lithium), industrial (e.g., steelmaking, cement), and agrobusiness sectors (e.g., agriculture products and wine), so that countries are better prepared to remain competitive in the growing context of CBAM. Finally, it proposes an innovative financing product to be able to mitigate the risks associated with a new technology, thereby increasing commercial lenders and financiers' confidence to provide blended finance to spur technological shifts, which will be needed globally to support the energy transition.

C. Proposed Development Objective(s)

Development Objective(s) (From PAD)

[29] Hydrogen Council, *Path to Hydrogen Competitiveness: A Cost Perspective* (Belgium: Hydrogen Council, 2020), https://hydrogencouncil.com/wp-content/uploads/2020/01/Path-to-Hydrogen-Competitiveness_Full-Study-1.pdf.

17. **The Project Development Objective (PDO) is to support the development of the green hydrogen industry in Chile.**

Key Results

18. **The proposed PDO-level indicators are as follows:**

- Total capacity of electrolyzers supported under the GHF
- Establishment of a new credit and environmental and social (E&S) risk units within CORFO

D. Project Description

19. **The proposed Project will support the early deployment of green hydrogen supply investments in Chile through the creation of a GHF.** The Project will consist of an Investment Project Financing (IPF) loan for US$150 million to the GoCl to be implemented through CORFO over a five-year period. The Project will comprise two components aimed at reducing the cost of producing a kilogram of green hydrogen: (i) green hydrogen investment sub-loans and risk-mitigation instruments; and (ii) capacity building and project management. Both components will support the establishment of the GHF and help develop the enabling environment. The components are described below.

20. **Component 1: Green Hydrogen Investment Sub-loans and Risk-Mitigation Facility (US$143 million, IBRD).** Under this Component, the Project will provide sub-loans on a preferential but cost-covering basis to partially finance green hydrogen (renewable energy powered electrolysis) sub-projects in Chile and risk-mitigation reserve accounts. The sub-loans help mitigate the financial and early-stage constraints currently faced by the green hydrogen industry. Component 1 will finance credit lines that will comprise: (i) preferential but cost-covering sub-loans to finance up to 40 percent of electrolyzer system costs, and (ii) risk-mitigation instruments through a debt service reserve account (DSRA) and a liquidity reserve account (LRA) to mitigate payment and performance risk respectively to developers, lenders, and financiers. The specific sub-components are described below.

- **Sub-component 1a: Green Hydrogen Investment Sub-loans (estimated US$122 million, IBRD).** The sub-component will provide sub-loans to financial intermediaries (and, eventually, directly to green hydrogen sub-projects) for up to 40 percent of the investment costs (capital expenditures, CAPEX) of electrolysis systems. The IBRD loan resources will only finance investment costs associated with the production of green hydrogen, including, *inter alia*, the capital cost of the electrolyzer, compressor, storage, and dispenser equipment, as well as related installation, engineering, transport, and civil works—items that can represent between 60 and 80 percent of the total costs of a green hydrogen production plant.
- **Sub-component 1b: Risk-Mitigation Reserve Accounts (estimated US$21 million, IBRD).** The component will finance reserve accounts, a typical instrument used in project finance, to mitigate the payment and operational risk associated to the green hydrogen production sub-projects. Sub-component 1b would complement the sub-loans if the retail financial intermediaries (RFI)/sub-project requests so. However, reserve accounts would not be able to be requested without a sub-loan. In its sub-project assessment, CORFO will determine the size of the reserve accounts. Specific characteristics of the reserve accounts are described below:
    i. *Debt service reserve account (DSRA)*: The DSRA will be created to mitigate the risks arising from the uncertainty related to unexpected or untimely cash needs for commercial debt repayment related to the financing of electrolysis systems of green hydrogen generation plant. The DSRA will be available to cover up to 12 months of interest and principal, to reduce the risks to the RFI related to potential payment default by sub-projects. The DSRA will be triggered in the event of a shortfall of cashflows

that jeopardizes debt payment to RFIs based on the agreed debt service coverage ratio. Activation of the DSRA, the steps, and the processes will be detailed in the Project Operational Manual (POM).

ii. *Liquidity reserve account (LRA)*: The LRA will be created to cover unexpected short-term technical underperformance in the green hydrogen generation plant and provide liquidity to the sub-project. This risk-mitigation instrument is intended to reduce the cost of engineering, procurement and construction (EPC) performance guarantees and will strengthen confidence among EPC firms', financiers', or lenders' in the operational performance of the green hydrogen sub-project. The LRA would be calculated based on a percentage (of about 25 percent) of a green hydrogen sub-project's revenue for the initial five years. The LRA's triggering could be requested solely when sub-projects face nonstructural technical challenges (especially early on) that could arise due to the early development stage of the green hydrogen industry. The triggers will be further detailed in the POM based on these indicative concepts and others to be further defined with CORFO.

21. **Component 2: Capacity Building and Project Management (US$6.625 million, IBRD)**. This component will finance technical assistance, capacity-building activities, and overall Project management activities to strengthen the enabling environment for green hydrogen through the development of necessary professional, financial, and technical skills. Component 2 will support producing knowledge and evidence for further developing the nascent industry in priority areas. Knowledge products and studies supported by Component 2 would focus on: (i) assessments to help inform ways to foster demand for green; (ii) promoting the use and access of public infrastructure, particularly ports; and (iii) analyses of the expected hydrogen international commodities markets. Overall project management support will include, among other, the following: (i) independent third-party consultants to assess the risks and support the technical, financial, legal, and E&S evaluation of sub-projects under Component 1; (ii) capacity training in the technical, financial, and E&S assessment of green hydrogen sub-projects; (iii) project fiduciary coordinator for the adequate financial management and procurement aspects as well as monitoring of component 1 and 2; (iv) project management to strengthen CORFO and its role as a one-stop shop to facilitate sub-projects' access to new and existing financial instruments (e.g., R&D Law subsidies, sub-loans, reserve accounts, guarantees, and coverage); and (v) project monitoring and evaluation activities.

Legal Operational Policies

	Triggered?
Projects on International Waterways OP 7.50	No
Projects in Disputed Areas OP 7.60	No

Summary of Assessment of Environmental and Social Risks and Impacts

22. **The proposed Environmental and Social Risk Classification (ESRC) for the Project is Substantial under the WB's Environmental and Social Framework (ESF).** The classification corresponds to potential environmental, social, health, and safety risks and impacts stemming from the production of green hydrogen, and the operation of green hydrogen plants, by eligible sub-projects to be financed under the GHF, and includes, among other considerations, the following:

i. The wide range of potential environmental, health, and safety (EHS) risks and the expected adverse impacts, considering that the types, scope, components, and technology of the green hydrogen sub-projects could involve one or more stages of the green hydrogen value chain and the vast array of end-use sectors that could

be targeted (the types, scope, components, and technology of the sub-projects to be financed and the final uses of the produced green hydrogen and/or its derivatives will be known only during Project execution);

ii. The potential E&S sensitivity of the specific locations where the sub-projects will be implemented and their potential to extend over large areas;

iii. The potential negative impacts to the surrounding communities due to the use of water in the development of the green hydrogen sub-project.

iv. The expected complex interinstitutional arrangements necessary to ensure appropriate management, monitoring, and oversight of the sub-projects' EHS aspects;

v. The participation of eligible RFIs, for which the institutional E&S capacity is currently unknown;

vi. The novelty of the green hydrogen industry in Chile;

vii. The high vulnerability of the project area to natural disasters;

viii. The need to address a variety of labor management issues, beyond occupational health and safety;

ix. The potential for land acquisition for civil works, even if this is expected to be done through voluntary means such as land leasing;

x. Possible cases of sexual exploitation and abuse and/or gender-based violence toward community members;

xi. Possible inadequate attention to sub-project-specific stakeholder engagement as per Environmental and Social Standard ESS10; and

xii. Possible discrimination toward indigenous people and/or migrants due to language barriers.

23. Additionally, (i) current capacity within CORFO and RFIs to assess and follow up on the E&S instruments of the green hydrogen sub-projects requires strengthening, and (ii) even though the current national regulatory framework already includes norms and regulations on the safe use of hydrogen, the MoE is drafting norms (expected to be promulgated in the next two years) to further regulate hydrogen's production, storage, transportation.

24. **Specific environmental, social, health, and safety risks and impacts will be managed through:**

i. An ESMS to be developed, implemented, and maintained by CORFO–GIF. The ESMS must be in place and operational in CORFO as a disbursement condition for Component 1. Eligible RFIs would have to comply with CORFO's ESMS, as will be reflected in the corresponding agreements between CORFO and the RFIs.

ii. An Exclusion List for WB–supported RFI sub-projects, which covers all necessary exclusions to be consistent with a Substantial risk rating, and which will aim to avoid high E&S risks and impacts based on the scale, location, and characteristics of green hydrogen sub-projects.

iii. Eligibility criteria of the sub-projects financed directly by CORFO–GIF and/or RFIs.

iv. Criteria for identifying and selecting RFIs.

v. A Stakeholder Engagement Plan (SEP) including the results of the different participatory activities that were taken into consideration to develop the final National Green Hydrogen Strategy and were used by CORFO to develop the draft SEP for the proposed project. As part of project preparation and prior to Appraisal, CORFO carried out high-level consultations in the form of a hybrid event that it held on 30th March 2023. The final SEP is a condition of effectiveness.

vi. A Labor Management Procedures (LMP) will be prepared as effectiveness condition for the Project and will be integrated into the CORFO's ESMS.

vii. The E&S instruments that will be developed for each sub-project by the proponents in compliance with the ESMS requirements and procedures. The ESMS will include templates for developing the necessary E&S instruments.

viii. The establishment of an E&S unit within CORFO, responsible for the E&S management of the GHF and the operation of its ESMS, and comprised by a full-time senior social specialist and a full-time senior EHS specialist. The participant RFIs will be requested to designate personnel responsible for the day-to-day implementation of the CORFO ESMS requirements.

ix. Third-party monitoring. Given the importance of assessing and monitoring the ESMS's implementation, Component 2 will fund an independent third party to support CORFO in these activities. CORFO will be responsible for supervising and monitoring the E&S aspects of the sub-projects financed directly by the entity as well as the sub-projects financed through participant RFIs.

x. The definition of other necessary institutional arrangements to manage the Project's E&S risks in accordance with the ESF.

E. Implementation

Institutional and Implementation Arrangements

25. The proposed Project will be implemented by CORFO, which will assume overall responsibility for the Project and implement Components 1 and 2. CORFO is a decentralized public service with its own legal person and its own assets[30] for fostering productive activities, innovation, entrepreneurship, investment and financing, and capacity building in the country. It carries out several financing programs, the most important being those that enable micro, small, and medium enterprises to access finance by providing guarantees and funding that operate through RFIs CORFO will receive budgetary approval from the Budget Law approved by Congress each year to use its resources for the implementation of the Project and from the Budget Office (*Dirección de Presupuesto*, DIPRES)[31] to be able to request the reimbursement of funds to the WB. Within CORFO, the Investment and Financing Management Unit (*Gerencia de Inversión y Financiamiento*, GIF) will be responsible for all Project activities under both Project components, specifically, through its Department of Studies and Management Control (*Subdirección de Estudios y Control de Gestión*) with extensive support from its Department of Risk Management and Financing and Educational Rights (*Subdirección de Gestión de Riesgos y de Financiamiento y Derecho Educacional*) and its Department of Administration and Finance (*Gerencia de Administracion y Financiera*, GAF). Some activities under Component 2 will be developed in coordination with the CORFO Green Hydrogen Committee.

26. For the implementation of Component 1, CORFO–GIF will be the wholesale financial intermediary managing the process to provide sub-loans and reserve accounts to other RFIs on a rolling basis and on a sub-project to sub-project basis. The financial risk assessment unit and the environmental and social risk assessment unit of the Department of Risk Management and Financing and Educational Rights of CORFO–GIF will assess the RFIs requests for sub-loans and reserve accounts. It will do so with support from a pool of third-party independent consultant firms with technical, financial, legal, and socioenvironmental expertise. CORFO's risk assessment units, with support from the third-party experts, will assess the sub-projects technical, financial, legal, and environmental and social risks, propose mitigation measures, and provide recommendations on the sub-project's allocation for sub-loans and reserve accounts in a draft Financing Agreement. The draft Financing Agreement would be presented to CORFO's GHF Credit Committee for the final approval or rejection of the proposed sub-project. The GHF Credit Committee will include external technical experts with experience in

[30] CORFO is managed by a Board of Directors presided by the Minister of Economy, Development, and Tourism, and comprising the Minister of Finance; the Minister of Agriculture; the Minister of Foreign Affairs; the Minister of Social Development and Family; the Minister of Science, Technology, Knowledge, and Innovation; the Executive Vice President of CORFO; and two counselors appointed by the President of the Republic.
[31] CORFO (Production Development Corporation), "What is CORFO," https://www.corfo.cl/sites/cpp/webingles.

infrastructure project finance and green hydrogen, as detailed in the POM. If approved, sub-projects would sign financing agreements detailing all conditions and requirements of the Project's financial and risk-sharing instruments.

27. CORFO will eventually directly provide sub-loans and reserve accounts to green hydrogen sub-projects, once the project finance unit is established and other requirements are in place under GIF's Department of Risk Management and Financing and Educational Rights. CORFO will require to build capacity in direct lending to green hydrogen sub-projects, particularly in project finance, risk assessment, monitoring and overseeing of construction and operation phases, and payment collection, and liquidity management among other. Therefore, CORFO will only be able to provide direct lending once it has: (i) designed and prepared a business plan for a unit dedicated to provide direct financing to green hydrogen sub-projects (which can be later expanded to other green energy investments); (ii) established such a unit with adequate governance and the required technical, legal, and financial expertise to assess, design, approve, and monitor project finance arrangements; and (iii) developed the required policies, procedures, and systems in a manner satisfactory to the WB.

28. At all times, CORFO–GIF will ensure the WB loan resources are managed appropriately, through its Department of Studies and Management Control and its Department of Risk Management and Financing and Educational Rights for due diligence of sub-projects and RFIs, monitoring, and activation of reserve accounts, as well as to supervise sub-projects' compliance with the Project's ESMS.

29. CORFO-GIF will also be responsible for the implementation of Component 2 which will support activities to improving the enabling environment for the development of green hydrogen, as well as an appropriate Project implementation. The component will use Chile's own procurement procedures (ChileCompra), and also when needing international expertise, for which the WB's Procurement Regulation Policy will be used as established in the Project's procurement strategy prepared by CORFO.

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