

TECHNICAL GUIDE ¹

“Technological Program to strengthen local manufacturing capacities of enabling components for the Hydrogen industry in Chile”

TECHNOLOGICAL CAPABILITIES DIVISION
CORFO

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¹The function of this technical guide is to guide applicants in the preparation of their application for this call, providing context and relevant information to be used in the formulation of the proposals.

To all intents and purposes, the original Spanish version of this form is the only valid document, and the English version is just a reference to ease the understanding of the Technical Guide for non-Spanish speakers.

1 GENERAL BACKGROUND

The global transition towards a greener and more sustainable economy brings significant changes also in the manufacturing industry. The need for mass production of green technologies, which require both critical minerals and economic sources of renewable energy, has positioned countries like Chile at the center of attention for their deployment. Thus, the global economy of energy transition is a phenomenon that undoubtedly directly impacts the Chilean manufacturing industry.

Trade openness and integration into international markets allowed broader access to technologies and knowledge, but also exposed local companies to more intense global competition ². In this context, it is urgent to facilitate the access of our productive fabric to technologies (licenses/property, industrial secrecy/technological agreements), associated with critical infrastructure and specialized manufacturing capacities of components widely in demand in the context of the local energy transition and global. To do this, it is necessary to technologically transform part of the national manufacturing industry, linking directly with demand, in order to address the new challenges and opportunities of highly sophisticated productive sectors.

Specifically, a study published in 2022 by the Chilean Ministry of Energy and the IDB ¹⁴ estimates that only considering the two main “hydrogen valleys” of Chile, and assuming a conservative scenario between the Antofagasta Region and the Magallanes Region, In Chilean Antarctica, approximately 12.8 GW of electrolyzers capacity will be installed by 2030.

Even considering a conservative scenario, it can be seen that there is a potential market for giga-scale electrolysis installed in Chile by the end of this decade, which creates the opportunity for the country to take an active role in promoting initiatives for the manufacturing, assembly, marketing and, especially, the generation of added value and productive chain around the electrolysis, storage and transportation systems of H₂, renewable energies or other components that enable the **GREEN HYDROGEN INDUSTRY**, both to supply demand internally as well as globally.

In this context, having local manufacturing of these pieces and parts would allow, in principle, not only to increase investment, but also to accelerate the development of green hydrogen production plants and derivatives by reducing the deployment times of this new industry in Chile, but also, generate jobs and add economic and social value to the territories.

Within Corfo's Strategic Focuses for the period 2022-2026, it was determined that the institution will contribute to the task of a new model of sustainable productive development, towards a new way of creating and distributing wealth, promoting a productive transformation that, based on knowledge and talent of people, take charge of the great social and productive challenges of the country and ensure greater sustainability and equity. **The guiding challenges are fair decarbonization; adaptation to the climate crisis and its socio-environmental consequences; and Productive diversification, seeking this call, “Technological Programs to strengthen local manufacturing capacities of enabling components for the Hydrogen industry in Chile”, to contribute with all of them.**

² https://www.scielo.cl/scielo.php?script=sci_arttext&pid=S0250-71611999007600002

With respect to the challenge of “Fair Decarbonization” , we seek to promote the process of fair energy transition in the productive sphere to achieve carbon neutrality goals by 2050 by promoting the development of a local industry through the adoption of clean technologies that contribute to mitigation and adaptation to climate change ; **Likewise, it is expected to contribute to developing a competitive H2V industry with the development of local components, diversifying our productive fabric**, with a territorial focus and giving continuity to a State Strategy.

Thus, based on the different sources of green energy and inputs available in Chile, there is an opportunity to promote the decarbonization of the country's activities, diversify the national energy matrix and generate new local development industries.

As a country, it is possible to achieve the transition from an industry based on the extraction of natural resources to one that produces and uses renewable, zero-emission and low-cost fuels and inputs. Furthermore, our country has the necessary conditions to generate a competitive hydrogen industry, to satisfy the local market and export, which can have a great impact on the GDP, adding value to the products created in Chile, reducing its carbon footprint. transport carbon and offering our renewable energy to those who need it. In this way we see that we have the opportunity to generate spaces for innovation, enhance local growth and employment, as well as create new companies with local and global impact ³.

Likewise, it is essential to promote business innovation, strengthening its processes and capabilities, and intentionally updating and scaling them, in addition to strengthening the innovative ecosystem that allows improving the productivity and/or competitiveness of the country.

To advance these challenges, Corfo, within the framework of its mission and objective, has the financing instrument called “Technological Programs” whose focus is to increase the rate of technological innovation in products and processes of companies in specific productive and/or economic sectors. , through an inter-institutional cooperative dynamic and collaboration between companies and other entities, of a portfolio of technological development projects that make it possible to reduce and/or close the gaps detected, improve the productivity of the sector and contribute to its diversification and/or sophistication.

Regarding the challenge of the **“Technological Program to strengthen local manufacturing capabilities of enabling components for the Hydrogen industry in Chile”**, the aim is to promote the transformation of the national manufacturing industry to achieve high technological sophistication and linkage with the chain. value of the hydrogen industry, developing knowledge, adopting technologies and production processes and contributing to the productive transformation of the country.

This call, which will contribute to the strengthening of the Chilean manufacturing industry in tune with the requirements of international green technology deployments, will focus on all innovative manufacturing companies that are willing to invest in technologies, improving and transforming their production processes, and to work associatively between companies and with a driving company that ensures the demand for pieces and parts and at the same time defines the production standard of these components, favoring the insertion of these companies in the value chains of the hydrogen industry (from renewable energies to the transportation of and post-processes of H2).

³ <https://energia.gob.cl/h2/Estrategia-nacional-de-hidrogeno->

2 MAIN TECHNOLOGICAL GAPS AND/OR CHALLENGES TO ADDRESS:

The proposals that apply to this instrument must address at least the following challenges and/or gaps:

1. Promote the transformation of companies in the Chilean manufacturing industry, to achieve the technological sophistication necessary to associate with the value chains of the hydrogen industry at a local and global level.
2. Promote the linking of national manufacturing companies, and companies belonging to the hydrogen value chain, such as manufacturers of electrolysis, H2 storage and transportation systems, renewable energies or other components that enable the green hydrogen industry.
3. Close technological gaps in companies in the national manufacturing industry of parts and parts of the value chain that enables the Green H2 industry in Chile.

The development(s) must be inserted in the value chain of the hydrogen industry, which ensures the use of technologies during the execution of the technological program; therefore, the market to be served must be resolved, among other factors.

3 SCOPES:

- a) In accordance with the provisions of the last paragraph of section 4.1 of the bases, legal entities incorporated in Chile, under private law, with or without profit purposes, may apply as beneficiaries.
- b) The technological adaptations and/or developments carried out within the framework of this program must respond to real needs of the national industry, through the use and strengthening of the largely local capacities of the manufacturing sector that can serve the Hydrogen enabling industry. green in Chile.
- c) The proposals must address developments and/or adaptations of manufacturing processes of parts and pieces, so that these are integrated into the production chain associated with the hydrogen industry in Chile, before the end of the program. Therefore, those technological developments that can be implemented in hydrogen industry value chains should be considered in a period of no more than 3 years, in order to achieve and ensure final integration into the industry (TRL 8/9) in a maximum period of 4 to 5 years.
- d) The proposal must explain any other public funds to which companies and other participants may be applying (universities, technology centre's, etc.), justifying the additionality and complementarity of the proposal and ensuring that there is no other project with public and private financing that have the same objectives or expected results.
- e) The Program must manage and measure the economic, social and environmental impact that its developments (products and services) generate, also incorporating its contribution to the SDGs.
- f) The National Hydrogen Strategy and other public policy documents ⁴should be considered, as well as the diversity of information associated with technological gaps and/or challenges to be addressed.

⁴Referential compilation of analysis and strategies associated with the gaps in the call.

4 OBJECTIVES

The objective of this call is the selection of programs that promote the development and/or technological adaptation in national companies, which enable the production of parts, pieces and/or assembly of electrolysis systems, storage and transportation of H₂, renewable energies or other components. that enable the green hydrogen industry.

Specific objectives:

- a) Develop technological solutions that accelerate the process of productive transformation, of national companies, towards the manufacturing of parts, pieces and/or assembly of electrolysis systems, storage and transportation of hydrogen, renewable energies or other components that enable the hydrogen industry.
- b) Demonstrate the technical and economic feasibility of the proposed solutions, which comply with all security protocols for subsequent packaging and commercial scaling.
- c) Establish a business model that ensures the company(s) the production of developments.
- d) Generate and strengthen alliances between national and international industry actors, establishing their contribution to the project portfolio and/or the expected results of the proposal.

5 EXPECTED RESULTS AND INDICATORS

5.1. Consider at least the following results:

- a) Insertion of national manufacturing companies in the value chain of manufacturing electrolysis systems, H₂ storage and transportation, renewable energies or other components that enable the green hydrogen industry.
- b) Transformed production chains aimed at the adaptation and/or development of technological solutions, including procedures to comply with safety standards and testing protocols and certification of results, which make the proposed developments viable.
- c) Linking national manufacturing companies and supplier companies in the hydrogen value chain, such as manufacturers of electrolysis, H₂ storage and transportation systems, renewable energies or other components that enable the green hydrogen industry.
- d) Transfer and business model operating for the different technological developments, which enable the manufacturing of pieces and parts associated with the value chain of the hydrogen industry in Chile.

5.2. Consider at least the following indicators:

- a) Investment amounts materialized by the companies participating in the program
- b) No. of supplier companies (agreement or purchase commitment) of new productive developments and/or industrial processes due to the intervention of the technological program

- c) Plan and strategy for effective and efficient technology transfers from alliances with the companies that demand the manufactured technological products.
- d) Sale of components developed through the technological program.
- e) Direct jobs linked to the resulting technological developments and projections.
- f) Sustainable Development Goals (SDG)⁵ to which the program pays taxes.

6 PROPOSAL REQUIREMENTS

In structuring the work plan, the postulated proposals must contemplate at least the following lines of work associated with the projects in the portfolio:

6.1 Based on the main needs and technological solutions facilitated by the deployment of technological systems to address the productive challenges of the manufacturing of enabling components for the Hydrogen industry, the following should be done:

1. Deliver a diagnosis of the opportunities associated with the challenges of manufacturing enabling components for the Hydrogen industry in companies in the sector, estimating the impact of the deployment of the proposed technological program to address these challenges from a productive perspective.
2. Provide a detailed description of the proposed technological solutions, including the parameters and critical factors for their performance, under the regulations and standards of the industry in which it is intended to be applied.
3. Deliver the technological strategies and existing models of the following aspects: (1) the management of productive systems associated with the manufacturing of enabling components for the Hydrogen industry, (2) the suppliers and/or manufacturers of parts or components (OEMs) and, (3) the technical and methodological trends associated with the validation of product development and/or technological packages directly related to the guidelines of this Technical Guide.
4. Establish a baseline of the initial situation of each project in the portfolio consistent with the detected needs of the manufacturing companies to be transformed, in order to know the contribution of each project in the defined production lines, and to reduce or solve the identified gaps. in this Technical Guide.
5. Identification of regional, national and international technological partners, establishing their validation and providing viable technological solutions to solve the challenges of companies linked to the chosen sector.

6.2 Portfolio of projects that will address the gaps and/or challenges of Technologies ⁶for the manufacturing of enabling components for the Hydrogen industry, hereinafter “ TMCHI - H2”, and available processes

1. Define and establish strategies and action plans to adapt and/or develop solutions with TMCHI-H2 in those areas where, effectively and in a proven manner, there are technologies available to date,

⁵ <https://www.undp.org/es/sustainable-development-goals>

⁶ Set of industrial instruments and procedures of a certain sector or product

pointing out and justifying the gaps and challenges that will be addressed. and the technological milestones that would allow progress towards the productive transformation phase of the proposal.

2. Define a portfolio of projects that as a whole can resolve the gaps and/or challenges, associated with the sector or sectors of the proposal, declared in the previous point.
3. Determine the technological development and/or adaptation projects that will make up the portfolio, as well as their objectives, based on the background information raised in section 6.1. and 6.2.1. above, defining starting points (**minimum TRL 6**) and end, through TRL level definition
4. Establish the main activities ⁷to be carried out to achieve the objectives of each project, in addition to their results and deadlines, among other aspects.
5. Define modeling systems, measurement of parameters and critical factors for the evaluation of the performance of the TMCHI-H2 based on the challenges currently presented by companies in the chosen sector and companies linked to the Technology Program.

6.3 Development of conditions and capacities that allow scaling-up of results

1. Develop and implement an effective and efficient linking methodology with companies (national and/or international) belonging to the chosen sector, in such a way as to promote the advantages offered by the integration of the TMCHI-H2 for productive transformation in order to reduce technological gaps and encourage the adoption of technology.
2. Design and implement a strategic plan for productive transformation that involves national manufacturing companies, and companies belonging to the hydrogen value chain, the technological development of specific products for the hydrogen industry at the national level and the installed innovation infrastructure at the national level. national to ensure the arrival of the final product to the defined market.

6.4 Strengthening the technological program management, through the following components:

6.4.1 Governance Model:

The Governance Model must describe the decision-making mechanisms and the organization established for the management of the Program, explaining the coordination mechanisms. In particular, emphasis should be placed on:

- Seek a composition that provides interests between the sector/industry, and other interest groups, in particular the competent authority.
- Consider operation models based on collaborative innovation.
- Clear definition of roles of the managing entity, the board of directors or board of directors, and the committees that are formed.
- Ensure transparency in administrative and financial aspects.
- Establish mechanisms for resolving possible conflicts.

⁷ Take into consideration section 7. Financing Activities (with subsidy and/or contributions)), of the Bases of the Technological Programs instrument.

- Seek the active incorporation of women in the governance of the program and in the executing team of the program projects.

The direction of the Consortium will fall to a Director /Manager of the same, proposed by the Technology Manager in conjunction with the Strategic Council, who must have leadership, negotiation and management skills, market knowledge with experience in the industry, knowledge in technological transfer and coordination skills of public-private actors and technical knowledge to link with the executors of the initiatives. Likewise, the Program must consider governance with at least the following bodies:

- **Strategic Council:** in addition to what is indicated in the bases of the technological programs instrument, this council must consider 1 representative of the Undersecretary of Economy, Development and Tourism, and 1 representative of the Hydrogen Committee. After 50% of the execution period has advanced, the incorporation of a representative of an investment fund or sector specialist should be considered for a temporary participation to guide the work team in developing capabilities for the negotiation process with investment funds. investment for productive and commercial scaling. In particular, it will be the subject of this council to control the measurement of the progress of scalable and marketable products, in accordance with the information collected by the Technical Council, and thus accelerate the obtaining of products that have been determined as competitive with commercial attractiveness.
- **Technical Council:** in addition to what is indicated in the bases of the technological programs instrument, this council must consider 1 representative of the Undersecretary of Economy, Development and Tourism, and 1 representative of the Hydrogen Committee. It is the subject of this council to be able to control and verify that the results with the greatest marketing potential can be obtained within the stipulated period and/or to identify the critical factors for obtaining these.

6.4.2 Policy of Intellectual property rights and technology transfer

- Definition of the ownership of all valuable results derived or produced with direct or indirect resources of this Technological Program to address the challenges for the manufacturing of enabling components for the Hydrogen industry, that is, all patent applications or registrations, creations, tangible or intangible developments and/or any other form of Intellectual Property that exists or comes to exist and is developed in the Technological Program to address the challenges for the manufacturing of enabling components for the Hydrogen industry.
- The rules on co-ownership must be determined among the participants, taking into consideration previous contributions and those made during the Technology Program to address the challenges for the manufacturing of enabling components for the Hydrogen industry. In cases where there are two or more owners, a person responsible for the protection of intellectual property rights, as well as their transfer or commercialization, must be defined.
- Management of information and knowledge developed in each project, through various mechanisms, for example: labeling of information by degree of criticality, custody by physical, digital and legal means; Implement confidentiality clauses; Require written authorization for publications or presentations, so as not to violate future protection by industrial property rights;

Incorporate the obligation to disclose project results; Maintain a registry or repository of valuable intangible assets, in order to facilitate their management, valuation, protection and subsequent transfer.

- Observance of intellectual property rights, which involves verifying the legitimate use of resources protected by third parties within the project through the corresponding operating freedoms or other similar analysis, to ensure the future transfer of the results derived from it.
- Responsible for the management, protection and transfer of knowledge and technologies that enable the development of TMCHI-H2.
- Develop and implement protection strategies for the deployment of TMCHI-H2, based on the following elements: State-of-the-art report on the promotion of TMCHI-H2 (patents, market and information, scientific, etc.); Competing technologies and their competitiveness; Market potential.
- Define conflict of interest rules in which all participants are committed to prioritizing the objectives of the project over the particular interests or of the organizations that develop it.
- Consider a technological surveillance model, specifying and deepening its scope both at the project and Technological Program level to address the challenges for the manufacturing of enabling components for the Hydrogen industry, clearly indicating its indicators and the productive sector in which this will be applied. model.

The property associated with the components of the TMCHI-H2 development of products and services developed must be at the absolute disposal of the Technological Program to address the challenges of the manufacturing of enabling components for the Hydrogen industry, ensuring that the future incorporation of new modules during the execution of the projects in the Technology Program portfolio is in no case captured by the developer, as is the information that is generated.

6.4.3 Quality Management System and regulatory frameworks associated with productive/environmental transformation activities through the deployment of TMCHI-H2 systems for productive purposes

- Description of the preliminary strategy to install a quality management system for the management of the technological development activities of TMCHI-H2 for the productive purposes of the Program, considering international best practices and the specificities of the technologies/services to be developed and to the clients/ destination markets, including any accreditations or certifications that must be implemented.
- The above is required so that the developments generated can meet the current market demands to which it aims, simultaneously complying with the current regulatory framework, so that it is possible to scale them to replicable and reproducible innovations in an efficient and effective way.

6.4.4 Risk Management Plan

- Development of a risk matrix in obtaining results and/or activities (linked to objectives and results), identified risks, probability of occurrence, impact on the program, control mechanism and periodicity, mitigation actions, among others.

6.4.5 Communication Strategy and Dissemination of results to companies in the chosen economic sector

- Develop diffusion material.
- Presentation of the results of the Portfolio of technological Projects to companies in the targeted sector.
- Presentation and dissemination of TMCHI-H2 products/services for the implementation of productive transformation developed by the Technological Program to address the challenges for the manufacturing of enabling components for the Hydrogen industry.

6.4.6 Establish a measuring model of results and economic, ethical, social and environmental impact of the products and services developed, which considers at least

- Develop and establish a methodology for defining causality around the planned developments of productive transformation technology within the framework of the Technological Program to address the challenges for the manufacturing of enabling components for the Hydrogen industry.
- Describe and define indicators, means of verification and goals associated with the portfolio projects and/or the products developed for productive transformation through the deployment of the TMCHI-H2.
- Identification and definition of data collection techniques, units of measurement, analysis, among other relevant aspects, for the measurement of results and impacts of the products developed within the framework of the Technological Program to address the challenges for the manufacturing of enabling components the Hydrogen industry.
- Specify the analysis techniques (metrics) to be used to define the results and impacts of the developed products.
- Consider a baseline survey to be provided by CORFO for the companies linked to the awarded proposal(s). This will be done both at the beginning of its execution and during the progress and completion of each stage.

The previous points must be organized in accordance with the traditional program measurement schemes, which corresponds to the definition of the baseline (according to the characteristics defined in this technical guide), progress measurements of the program and its portfolio, final and ex post (considering at least the results indicated in this technical guide).

For the follow-up and monitoring of the program and its results and impacts, in addition to the model proposed by the proposal, the Technological Capabilities Management will apply a support model based on the logical framework of the initiative (program objectives and projects), with the corresponding indicators that compromise the proposal and others that the Corporation requests to add. This, in accordance with what is described in section 11 of the General Administrative Bases.

7 FINANCING AND DEADLINES

Corfo will co-finance up to **60.00%** of the total cost of the Technology Program, with a limit of up to **\$3,500,000,000** (three billion five hundred million Chilean pesos). Regarding the contribution of the participants:

Nature Contribution	Percentage
Minimum contribution from participating entities (includes pecuniary and non-pecuniary contributions)	At least 40 % of the total cost of the Technology Program
Minimum financial contribution of participating entities	At least 20 % of the total cost of the Technology Program.

The duration of the Technological Program may be **up to 5 (five) years**, considering at least 2 stages.

In accordance with section 7. Financing Activities, from the bases of the Technological Programs instrument, those activities necessary and relevant for the compliance of the general objective and the specific objectives of the Program may be financed (with a subsidy and/or contributions), as well as also, to achieve the expected results and impacts, which allow the execution of the portfolio of projects included in it ⁸.

The activities and/or expenses of the Program, financed with subsidies and/or contributions, must be budgeted in accordance with the "Human Resources", "Operation Expenses", "Administration Expenses" and "Investment Expenses" accounts, described in section 4.6.1 of the General Administrative Bases.

⁸ Review in detail the classification of financeable activities in the technological program bases, section 7.