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Energy Transition and Entrepreneurship

*Opportunities for Startups in the framework of
Chilean – German Cooperation*



Imprint

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Executive Summary

One of the main challenges we are facing as humanity is to face and mitigate climate change, which requires us to promote the transition to a sustainable development model. An energy transition is one of the most effective tools in this context, where the replacement of fossil and nuclear fuels with renewable energies combined with energy efficiency has the potential to significantly reduce CO₂ emissions globally and thereby limit the increase in global temperature to a maximum of 1.5°C compared to pre-industrial temperature levels.

Building on the consensus achieved in the framework of the groundbreaking Paris Agreement adopted during the COP21 in 2015, Germany and Chile formalized during the following years the commitments made by committing to achieve carbon neutrality by 2050. The Energy Partnership between Chile and Germany, officially launched in April 2019, a cooperation that supports high-level intergovernmental dialogue on energy issues and enables an active exchange on how to achieve the goals of the energy transition, seeks, among others, to foster energy entrepreneurship through binational collaboration.

Entrepreneurship: A Key Factor for Energy Transition

Entrepreneurship has become crucial for the sustained growth and development of companies in all industries and in view of the challenges faced by Chile and Germany to achieve the national goals as defined in the framework of the energy transition, innovative technology-based entrepreneurship is presented as a fundamental element to develop the new technologies, services and business models required.

Germany's Energiewende and the goal of carbon neutrality by 2050 that Germany and Chile have set themselves to achieve, for which the energy transition is a fundamental pillar, a series of opportunities arise for startups to develop and test technologies and business models in emerging markets that in many other countries will only be developed in a few more years. Ventures categorized as 'startups' have a higher rate of innovation than established companies and therefore play an important role in the development of new technologies and solutions for the economy of the future as it seeks to move towards circularity.

There are some key aspects that differentiate energy startups: On the one hand, they require a well-defined and stable political and regulatory framework for the promotion of variable renewable energies and energy efficiency, in order to give the market strong signals. In many cases, startups in the energy field are involved in the development of high-tech hardware, which requires higher investment amounts than software investments, in addition to having longer pilot cycles, for which it is essential to have a robust infrastructure for R&D activities. For the same reason, they also require investors and first customers who are open to taking risks and agile in their decision-making. The profile of the energy entrepreneur is characterized by a high educational level and faces the challenge of often requiring highly specialized personnel with specific technological knowledge to develop their product/service, which is difficult for a startup to afford.

Entrepreneurial Ecosystem in Germany and Chile

As Daniel Isenberg of Babson College has argued, a strong entrepreneurial ecosystem is essential for the promotion of entrepreneurship and, according to his approach, it consists of six areas: a conducive culture, enabling public policies and leadership, availability of adequate financing, quality human capital, risk-friendly markets for products and a range of institutional supports. This study analyzed the strengths and weaknesses of the entrepreneurship ecosystems of both countries, considering the described specificities of energy entrepreneurship, in order to identify possible lines of action for collaboration between Germany and Chile to increase the rate of entrepreneurship in the energy field.

Germany's ecosystem for energy entrepreneurship is characterized by the German Federal Government's consistent research and innovation policy, whereby favorable framework conditions have been created for a synergistic interaction between science, startups, and industry. Germany is characterized as an “innovation-driven” economy, which refers to its ability to produce innovative new products through sophisticated processes. The public sector and industry have consistently increased their R&D spending to more than 3% of GDP, which makes Germany one of the international leaders in innovation, thanks to the availability of a highly skilled workforce for technological innovation. The recruitment of highly specialized human resources also entails higher costs, which once again highlights the fact that cleantech startups are faced with a more complex financial situation. Currently, the recruitment of IT staff is a particular challenge for all startups.

Over the past few years, an R&D+i funding program has been implemented under the umbrella of the High Technology Strategy, thus filling the innovation “pipeline”, and providing a good basis for promoting the creation of companies from R&D processes in a more targeted and efficient manner.

Such an innovative and R&D-based profile goes hand in hand with Germany's energy policy. This synergy leads to the seventh Energy Research Program (Energieforschungsprogramm) called “Innovations for the Energy Transition” (Innovationen für die Energiewende), in pursuit of a strategy that focuses on technology transfer and innovation. Germany emphasizes the importance of future-oriented technologies to achieve an energy transition and its programs are geared to achieve the fundamental objectives of Germany's energy policy.

For startups, closeness to universities and networking with other startups are the most valued aspects of the German entrepreneurship ecosystem. Further, there is a large number and variety of support instruments, both at national and regional level, coupled with technically experienced mentors, a good supply of incubators, hubs and accelerators with international networks and an excellent infrastructure for R&D pilots.

While early-stage funding does not turn out to be a major problem for a large share of startups, the lack of adequate funds for the growth phase (including venture capital) is noted as one of the main weaknesses of the German innovation system. Whereas venture capital investments in Germany more than doubled between 2015 and 2019, they are still very low when compared internationally. Technology-based companies typically require 10 to 50 million euros per funding round for growth, which is a capital that companies of this size are unlikely to find among German and/or European investors. By way of comparison and according to 2017 data: total venture capital investments are 300 percent higher in Asia and the United States than in Europe. And it is precisely in the later stages of growth that the “venture capital gap” in Europe becomes apparent in comparison to Asia and the United States.

Large companies are an important player in the German entrepreneurial ecosystem, acting as a first customer as well as an investor, because their innovative capacity is increasingly linked to their ability to cooperate with startups. Startups frequently develop new products or supplementary services together with companies. However, only a few German companies have invested significant sums in startups as potential investors, including major corporations such as BASF, Bosch, Siemens, Evonik, Innogy, BMW and E.ON:agile. This latter supports up to ten projects in the energy field per semester. However, investments in excess of 100 million euros are still the exception.

Germany's entrepreneurial culture is still characterized by risk aversion and low tolerance for failure.

In contrast, the Chilean entrepreneurial ecosystem is developing within an economy currently still classified as 'efficiency driven', that is, driven by improvements in the efficiency of production processes where most of the technology is imported from developed countries. The Global Competitiveness Report 2019 shows that the innovation indicator is the lowest of all the indicators analyzed. Chile's main weaknesses are low innovation capacity, low R&D spending reaching only 0.35 % of the GDP in 2018 with very little participation of the private sector and little collaboration in R&D between academia and industry. However, this contrasts with the availability of well qualified human resources for the technological innovation processes.

The Global Entrepreneurship Monitor 2019 data shows that the 'financial support' dimension ranked the worst among the dimensions of the entrepreneurship ecosystem in Chile by the experts surveyed in the framework of the GEM. Consensus exists that there is a sufficient supply of public subsidies especially for the early funding stages articulated mainly through CORFO, however, the lack of private funding opportunities that manage to support the business growth processes is identified as a major shortcoming. In relation to venture capital, there are currently around 50 venture capital funds operating in Chile, albeit with a rather conservative and risk-averse culture.

The infrastructure for R&D activities and piloting of new technologies in Chile is still very poorly developed and difficult to access for startups compared to Germany, although this is currently being changed through the efforts of different stakeholders under the auspices of CORFO and the National Agency for Research and Development (ANID). Ultimately, within the Latin American context, Chile stands out in terms of entrepreneurial culture, however, it is an entrepreneurial culture that is not very innovative, which is why it is necessary to promote a culture that encourages innovation, creativity, and experimentation so that more ventures that can be classified as startups can be launched.

Technologies for Energy Transition

An understanding of the differences, strengths and weaknesses of both ecosystems provides the basis for collaborative work to increase the number of energy startups in Germany and Chile so as to generate the necessary innovations in the different technological areas that are important to achieve the energy transition and the associated challenges in order to harness the potential of each area.

The following technological challenges that require innovation can be outlined in Chile. As for renewable energies, there is a need to expand energy solutions related to biomass, other than firewood, for heating processes, in addition to the implementation of district heating networks, for which there are different possibilities concerning the energy source, one of them being "waste to energy".

With regards to electricity generation, the Ministry of Energy expects to have an installed capacity of more than 20,000 MW of photovoltaic energy by 2050. Increase the efficiency of the panels is an important measure to achieve this goal. New technologies are already being developed and/or tested in Chile – such as two-sided panels or the technology that aligns the panels always towards the sun. New technological developments are also required to better use footprint to achieve the integration of photovoltaic energy in buildings, in agricultural activities and on water with floating solar panels, as well as in the field of control and maintenance of photovoltaic plants, for instance, technologies to deal with local problems such as fouling of the panels.

The enactment of the Extended Producer Responsibility Law (REP Law) in Chile and with an overall lifespan of solar panels of 20–30 years, there is a need to recycle solar panels after use. The solar panels currently in use in Chile contain about 250,000 tons of glass, about 30,000 tons of aluminum and 4,000 tons of silicon. Therefore, recycling solutions for the panels will need to be developed in the coming years, especially considering that Chile currently has only one recycling plant for solar panels.

As for wind and wave energy, there are also several technological challenges to be solved, such as offshore wind energy installation costs, extreme conditions for the material to withstand the weather at sea and, in the case of wave energy, the extreme fluctuation of the generation due to waves, among others.

Transmission infrastructure is another major challenge associated with the energy transition, where transmission is currently in the process of developing superconductivity cables, where further research is needed to develop cables that can withstand higher temperatures, as well as the implementation of smart grids that allow demand to be adapted to power generation. Moreover, different large- and small-scale electrical and thermal energy storage systems should support this, where decentralized home batteries, for example, can play an important role.

The development of a hydrogen economy in Chile is also very important in this context: Given the great potential for low-cost renewable energy generation, Chile has the opportunity to not only produce green hydrogen for the domestic market, but also for export. For a hydrogen economy to develop, Chile will need technology for hydrogen storage such as tanks, hydrogen purification, compressors for feed-in, synthetic fuel production technology, increasing the efficiency of methanation processes, and the construction of hydrogen fuel pumps for buses and trucks with all the accompanying infrastructure such as compressors, storage, and transport of hydrogen, to name a few.

Electromobility is another important pillar in the transportation sector, where the Chilean government seeks to achieve the goal that 100% of urban public transportation will be electric by 2040 and that by 2050 electric vehicles will make up 40% of the automotive base. Investment in R&D for the development of innovative batteries and battery management systems is necessary to achieve this goal.

Chile still has a very low standard of energy efficiency in the building sector and the development of new insulating materials plays an important role in this regard, especially the development of bio-based thermal insulators. Lastly, significant developments in the field of information and communication technologies are essential to enable controllable systems, automate and manage.

Collaboration Opportunities between Germany and Chile

A comparison between Germany and Chile concerning the implementation of energy technologies shows that in some fields, such as district heating, home batteries and energy efficiency in buildings, among others, Germany is already well on its way, while in other areas, startups from both countries are making their contribution to develop new technologies and services, with the understanding that the political goals defined in Germany and Chile are the ones that will trigger the demand from the market. There are interesting opportunities for collaboration between the two entrepreneurship ecosystems to support the development of startups in both countries.

While the entrepreneurship ecosystem in Germany and Chile is supported by government, public and private stakeholders, this study shows that there is still room for improvement, and that these ecosystems could benefit from the exchange of best practices and collaborative working models at the national and international level. To this end, the following courses of action are proposed:

- Development of a bilateral work agenda for public policy on R&D+i+e, including the implementation of a communication channel for the exchange of best practices among those responsible for the promotion of energy entrepreneurship by the ministries and public agencies involved, the implementation of binational working groups on best practices in public policy for the systematic elimination of barriers and bureaucracy, as well as the improvement of the energy entrepreneurship ecosystem and a public-private board for a long-term binational strategy.
- Creation of Chilean-German funding networks through the networking of Venture Capital and Corporate Venture Capital funds in Germany and Chile, also encouraging state-owned companies to invest a percentage of their profits in the high-tech energy industry and creating a directory of energy startups to generate a performance profile for each one in order to attract national and international investors.
- Strengthening innovation culture through the implementation of a collaboration platform between the main stakeholders of the two entrepreneurship ecosystems, including internship programs hosted by technology business incubators and accelerators in Germany and Chile, the creation of two pilot hubs in both countries to generate a collaboration network between Chilean and German startups, and the implementation of a Chilean-German network of energy mentors to support energy startups in both countries.

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- *Diversification of support instruments for energy startups by promoting a public infrastructure for energy startups in Germany and Chile, creating a public information platform for energy startups in both countries as an instrument for the dissemination of knowledge and new technologies, which will enable the measuring of progress of innovations, and supporting co-works that work with the energy entrepreneurship ecosystem to offer consulting services.*
 - *Diversification and training of human capital through entrepreneurship summer schools at universities in Germany and Chile, a binational dual education and continuing education program, energy training and the creation of alliances with incubators in Germany and Chile to enable entrepreneurship-specific training in energy.*
 - *Market sophistication for energy startups in Germany and Chile through support for binational R&D+i+e projects that meet the guidelines for funding research on strategic topics for the Energy Transition, the creation of regional energy R&D+i+e clusters that offer systematic collaborative activities to a multi-stakeholder ecosystem, and the creation of a pilot R&D+i+e zone in both countries to generate scalable experiences and best practices inspired by free trade zones to attract investors and specialized human capital, among others.*

There is great potential for binational collaboration in the field of energy entrepreneurship to accelerate innovation within the energy industry with the help of startups and to support energy startups that need a reasonable market size, which only the Latin American continent or large markets such as Europe can offer. The key to the innovation strategy in the energy sector is to support the development of innovative startups that not only add value, but also have a positive social and environmental impact.

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