Implications of the Energy Transition on Employment

Energy Division

Today's Results, Tomorrow's Needs

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Executive Summary

Countries in Latin America and the rest of the world have made considerable efforts to engage in an energy transition, reduce their net greenhouse gas emissions, and align themselves with the Paris Agreement. These efforts at decarbonization have been mostly directed at increasing their share of renewable energy sources in electricity generation, but not only. New activities that take part in the transition have started gaining increasing attention and attracting investment. We refer to these activities as "emerging". They include electric mobility, battery, storage, energy efficiency, hydrogen, and demand management, to name a few.

As the definition of the energy sector expands, we find ourselves in a post-pandemic recovery phase, new opportunities emerge for economic development and growth, including employment creation. The question is how the benefits of this transition at this moment in time can be better ripped. The present work explores the potential employment implications of the energy transition in Latin America as we enter the third decade of the 21st century. Will and can employment be created? Are some technologies more labor-intensive than others? What types of jobs will be most needed, and are labor markets ready to meet the demand requirements?

To answer these questions, firm-level surveys were carried in three Latin American countries in order to achieve a single common database. This report summarizes the results of the first stage of this research, which includes Bolivia, Chile, and Uruguay. The survey was harmonized as much as possible between the countries and covered firms in the electricity generation field, engineering and construction, and emerging sectors. The main evidence found in the present work are the following**.**

- Emerging activities have the highest employment creation potential. Results show that investing one million USD in these can create between 11 and 36 direct jobs.
- The emerging sector can create local, permanent and direct employment by hiring a qualified labor force. Based on the experiences of some countries, we found that the most traditional generation also created employment opportunities. Still, the jobs' positions were mainly temporary in the pre-operational phase and were mostly filled by outsourced workers. Furthermore, most of these jobs could not be classified as quality employment opportunities, as few of them had working hours regulation, social protection benefits, and so on (ILO, 2012).
- Gender imbalances are considerable in the energy sector, though emerging firms and some generation technologies relative to others seem to create a potential for better gender inclusion. Although women amongst STEM (Science, Technology, Engineering, Mathematics) workers are still under-represented, they are not the most unqualified workers either. As such, emerging activities have the potential to create employment and overcome gender disparities.
- There is a gap between labor demand and supply in technical competencies, as firms report obstacles to recruiting. The reporting of this issue by firms calls for the incorporation of future training of employees**,** as new technologies that accompany the energy transition are developing fast.
- There is considerable heterogeneity in outcomes between neighboring countries. This heterogeneity emphasizes the importance of carrying out case-by-case studies instead of using aggregate data whenever possible. Those studies can highlight that a given

electricity generation technology might be more successful at hiring women than another, depending on the country and its national incentives or labor market.

These findings reiterate the importance of carrying out case-by-case studies instead of using aggregate data. Moreover, they motivate the question about what kind of policies can generate the right condition to maximize job creation while keeping the efficiency of the industry. This represents a first step in providing a set of policy recommendations that should be explored by policy-makers aiming to respond to future labor demand requirements for the energy transition towards net zero emission. To fully benefit from the energy transition for the economic recovery in Latin America, it is key to think policies holistically: including energy, value chains and skills.

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1. AN OPPORTUNITY FOR EMPLOYMENT CREATION

Countries in Latin America and the rest of the world have made considerable efforts to engage in an energy transition to reduce their net greenhouse gases emissions and align themselves with the Paris Agreement. These efforts at decarbonization have been mostly directed at increasing their share of renewable energy sources in electricity generation, but not only. New activities that take part in the transition have also started gaining increasing attention and attracting investment. These emerging activities include electric mobility, battery storage, energy efficiency, hydrogen, and demand management, amongst others.

These new investments create opportunities for employment creation, which is an important aspect that deserves to be further explored and has important policy impacts worldwide. It is expected that the energy sector will create 122 million jobs by 2050, including 43 million in renewables only (IRENA, 2021). This is particularly relevant in present times, as countries engage in recovery policies and agendas in the post-Covid-19 era (Vogt-Schilb, 2021), commit to decarbonization plans, and work together to mitigate climate change. But which type of firms will take part in this energy transition and create new jobs, and which type of jobs will these be, and for whom? How can the different estimations resulting from the energy transition be considered given the diverse technological transformations, such as the convergence of the energy industries, telecommunications, digitalization, and transportation? And what are the existing capacities to be exploited, and those that still need to be developed, so that we can take full advantage of this transition? This document seeks to provide answers to all these questions.

The topic of employment generation in the energy transition is not new. Recently, the International Energy Agency (IEA, 2020) published a report on a sustainable recovery from the sanitary crisis. The report estimates the number of employments that could be created in the energy transition process for each million United States Dollars (USD) invested in construction and manufacturing. Another study recently published by the Inter-American Development Bank (IDB) and the International Labor Organization (ILO) also estimated employment creation under different projections of case scenarios of decarbonization for 2030 and 2050 in LAC. On average, related studies found that one million USD invested by a firm that takes part in the energy transition can lead to the creation of between 2 and 45 direct jobs, depending on the technology, sector, and country (IEA, 2020; ACEEE, 2011; Garrett-Peliter, 2017; Pollin and Garrett-Peltier, 2009; Janssen and Staniaszek, 2012).

The present work, based on surveys, seeks to complement the existing literature with a microeconomic analysis. On the one hand, this allows to redefine the ecosystem of firms associated with the energy transition in each country, as the newly emerging and less traditional firms now become included. On the other hand, it reveals the importance of links between existing employment and future one to identify training needs.

The heart of the present research lies in estimating the employment implications and the future needs of the labor market in, Bolivia, Chile, and Uruguay. Two aspects are underlined in this analysis: (1) the employment creation opportunities generated by investments in the energy transition and (2) the expected transformation in the gender

balance. As such, it should provide a better understanding of the firms related to the energy transition technologies, which include **renewable energy** (hydroelectric, wind, solar, biomass, tidal, biogas, biofuel, waste, etc.), **energy efficiency**, **demand management**, **hydrogen**, **battery storage**, and **electric mobility**, amongst others. This understanding is relevant for designing public policies and selecting direct investments, incentives, and training programs.

To answer the underlying question of this research, a survey was designed and carried out in these three South American countries, targeting firms associated with the energy transition. These three countries are the first to be considered. Still, additional countries will be surveyed in the region in the second part of this study. The choice of these countries is associated with their proximity, diversity of resources, and energy transition paths selected, as well as the access to firm information and the possibility to carry out the fieldwork and collect survey data in times of a global pandemic.

The rest of this document is organized as follows. First, it provides a comprehensive review of the literature on the employment implications of the energy transition by differentiating between sectors and technologies and looking at case studies. Then, it highlights the data collection methods, as well as some of the challenges faced in the process. Section four and five present the results on labor force characteristics in the energy transition and employment creation potential of investments, respectively. This research concludes by summarizing our findings, making some policy recommendations on future actions in terms of skills training programs, investment opportunities, and future research.

2. EVIDENCE OF THE IMPACT OF THE ENERGY TRANSITION ON EMPLOYMENT

Given that the decrease of green technologies costs and the leading role of the energy sector in facing climate change issues are quite recent phenomena, the study of employment generation in the energy sector is relatively recent in the literature. Some of the oldest articles in the field that we will refer to are Blanco and Rodrigues (2009) and the U.S. Department of Energy (2004). Still, in general, most of them have been published during the 2010s.

As mentioned in the introduction, the term 'energy transition' involves several sectors. The most traditional one is electricity generation from renewable sources, such as solar and wind. Other sectors that also contribute to the transition are energy efficiency, demand management, smart metering, electric mobility, and hydrogen. **When we speak about the energy transition, we mean moving towards net-zero emissions of greenhouse gases tackling climate change. This implies moving away from traditional fossil fuels for energy generation and using energy as efficiently as possible.**

All sectors are concerned, whether residential, industrial or transport. The firms that we consider to be contributing to the energy transition are those that engage in activities that generate electricity through non-fossil fuel sources (i.e., renewables or hydrogen), that promote the efficient use of energy (i.e., energy efficiency, demand management), or that seek to become less reliant on fossil fuel in daily life (i.e., electric mobility, storage). The selected sectors in the present study are relevant in all our case studies despite some sectors being more relevant than others in some selected countries. In general, most articles and reports tend to agree on those sectors' leading role in job creation, even when compared to fossil technologies. Firms that rely on fossil fuels were also included to compare fossil and green technologies in the present work.

From a geographical perspective, some studies have a global focus and assess the potential impact of transitioning to 100% renewable energies scenarios by 2050. Most of the studies that focus on defined geographic areas look at North America and the European Union. Very few focus on Latin America, despite some articles pointing to a greater positive impact of green energy on job creation for developing countries (REN21, 2020). For instance, the Renewables 2020 Global Status Report of REN21 shows that renewable distributed generation to improve energy access generates almost as many jobs as the traditional utility-scale power sector in India and Kenya (i.e., about 95,000 direct jobs generated in India, and 10,000 jobs generated in Kenya). This evidences the important role that renewables can represent to stimulate the economy of isolated or less developed regions.

Due to the methodological differences of each study, it is not possible to make a straight results' comparison between countries or technologies. This is precisely one of the gaps that this article plans to fill in the case of Latin American countries, starting with Chile, Uruguay, and Bolivia.

The countries were selected based on the availability of information on characteristics of the energy sector and access to companies in the sector, as well as aiming to represent different stages of the energy transition process. Considering the sanitary crisis that brought most countries into lockdown from March 2020 onwards, these countries were also chosen because they had the means to realize surveys and collect data despite the lockdown. These case studies are part of a broader project that includes more regional countries and continued to be carried out in 2021.

Among the factors that differentiate each study that analyzes employment creation in green energies, Lambert and Silva (2012) highlight the following: (1) the definition and characteristics of the jobs, for example, distinguishing between permanent and non-permanent jobs, the quality of the job created and the type of skills necessary to perform those jobs, (2) the importance of gross employment versus net employment, where the latter takes into consideration the job losses related to the energy transition, and (3) the methodology used to estimate the effects, mainly, input-output models (I-O) or analytical methods. We return to this last factor in the next section of the present work. Annex I presents a table with the main characteristics of the articles in terms of countries, sectors within the energy transition, methodological aspects, and the findings concerning the number of jobs per million USD of investment or per MW of installed capacity, when applicable.

The rest of this section is organized as follows. First, we consider studies that assess job creation from the energy transition relative to an unchanged energy matrix. Second, the focus shifts to employment creation within each sector that is associated with the energy transition. The third part describes the employment characteristics rather than just direct or indirect jobs or the project phase that can also be captured in data collection under certain methods. Fourth, studies focusing on Latin America are covered, summarizing the studies already done in the region. We conclude by highlighting our contribution to the existing literature and areas to be further explored.

2.1 Employment in the energy transition compared to ‘business-as-usual’ scenarios

A reasonable way to approximate the generation of employment from green energies compared to traditional sectors is through a direct comparison between electricity generation from renewable technologies and fossil fuels’ generation for determined amounts of investment in money or generated capacity.

In this case, we find works such as that by Garrett-Peltier (2017), who uses an Input-Output approach to compare clean industries with existing fossil fuel industries. Her main results show that investing 1 million dollars in fossil fuel industries yields on average 2.65 full-time jobs. In contrast, the same investment in renewables would yield 7.49 full-time jobs. Thus, investing in renewable energy creates a net of 5 full-time jobs.

Even greater results are found by International Energy Agency (2020) that designed a sustainable recovery plan to be implemented between 2021 and 2023, and that arises in response to the impacts generated by Covid-19 and lockdowns. If implemented, the IEA estimates a creation of about 9 million jobs over those three years. The plan contemplates the sustainable development goals and is estimated at 1 trillion USD per year over the next three years globally. The plan is focused on six sectors: electricity, transport, industry, buildings, fuels, and emerging low-carbon technologies. The highest employment creation in energy generation would occur in the Solar PV sector, with about 12 jobs per 1 million USD invested.

In comparison, energy efficiency projects for buildings and the industry would create between 10 and 15 jobs per 1 million invested. The study also notes that for the equivalent amount of spending in sectors such as new vehicles, appliances, batteries, biofuels, and recycling, “advanced economies” would create fewer jobs than the “rest of the world” (IEA, 2020:40). Interestingly, in the latter, investing one million dollars can generate as many as 45 jobs and close to 30 jobs in recycling and biofuels, respectively. The authors note that this is due to the labor intensity of feedstocks processing and the large informal economy of developing markets (Ibid.).

Alternatively, an indirect comparison can be obtained by analyzing the potential effects of a 100% renewable scenario concerning the business-as-usual case scenario. In this sense, as previously mentioned, some studies try to estimate the effect on global employment through 2050. Two of them are Ram et al. (2020) and Jacobson et al. (2017). In the first case, the authors use an employment factor approach to estimate that full-time jobs would increase by 14 million, from 21 million in 2015 to 35 million in 2050. Solar PV, storage, and wind energy would be the areas where most jobs would be concentrated.

Unlike Ram et al. (2020), Jacobson et al. (2017) consider the green economy as a whole, including transport, heating, cooling, etc. According to their estimates, the transition would create 52 million permanent full-time jobs. Suppose we consider its estimated job loss of 27.7 million due to the transition. In that case, the net effect is a gain of 24.3 million full-time jobs. However, neither study considers indirect and induced jobs, suggesting higher positive net effects.

It was already mentioned that, although most studies find positive net effects on employment, there are also negative effects in the literature. One of them is Almutairi et al. (2018), whose results show an overall 4.45 million job loss. Unlike previous studies that consider transitions towards 100% renewable, in this case the authors study the effects of achieving the renewable energy targets set by 2030 compared to the results when the current electricity generation mix remains constant.

Other studies also analyze the effects of having a 100% green economy by 2050 in a more concentrated area. For example, in the case of California, Jacobson et al. (2014) forecast the creation of about 632,800 direct full-time jobs, 88% concentrated in solar PV energy and off-shore wind energy, and a loss of about 413,000 full-time jobs in fossil and nuclear industries, which yield a positive net effect of 219,800 full-time jobs. It is important to highlight that the analysis only considers direct full-time jobs during the construction and operation periods, excluding other important sections of the value chain, such as development and manufacturing. Another example follows from The Netherlands' ambitions to reach 100% renewable energy by 2030. In this case, Bulavskaya and Reynes (2018) find that the country would benefit by generating about 50,000 full-time direct jobs. These results are also calculated relative to a business-as-usual scenario, where the energy mix would remain unchanged until 2030.

2.2 Employment creation within the energy transition sector

From the previous subsection, it could be concluded that, in general, the transition to renewable generation has the potential to generate positive effects on employment compared to 'business-as-usual' scenarios, in which current electricity generation technologies continue to prevail.

This subsection will present the contributions to employment within the sectors that make up the transition. These sectors are renewable energies (including solar, wind, biomass, hydropower, and geothermal), energy efficiency, demand management, smart metering, electro-mobility, and energy storage.

2.2.1 Renewables

Considering spill-over effects in the case of the European Union, the shift transition to a less carbon-intensive economy with greener technologies (including natural gas) has implied 530,000 jobs between 1995 and 2009, according to Markandya et al. (2016). The authors used an I-O model to calculate the results. The estimated impacts have heterogeneous effects. Some countries have had positive net effects (e.g., Polar, Germany, and Hungary). In contrast, others had negative net effects (e.g., Ireland, Lithuania, and France). A discussion about why some countries might have different employment outcomes than others is offered at the end of this section reviewing the literature.

More geographically focused case studies show that Germany's renewable energy sector (wind, solar, biomass, hydropower, and geothermal) has generated about 278,000 jobs in 2008 (Frondel et al., 2010). In contrast, in Spain, renewable energies create more than 188,000 direct and indirect jobs in 2012 (Sooriyaarachchi et al., 2015). Also, for the case of Spain, the article of Sustainlabour and Fundación Biodiversidad (2012) show that in 2010, the renewable energy sector generated 11,327 direct jobs and 83,410 indirect jobs, which represents an increase of slightly more than 3,000% from the year 1998. In addition, the authors find that green energy as a whole created 319,942 direct full-time jobs and 91,342 indirect jobs.

For the specific case of wind energy, it is estimated that 104,350 direct jobs can be created in the 30 European countries studied by Blanco and Rodrigues (2009). According to the authors, evidence shows a growth of 226% between 2003 and 2007. The results on two of the leading EU countries, Germany and Spain, are similar to those found in other literature (for Spain, refer to AEE, 2009; and for Germany, see Hillebrand et al., 2006). Manufacturing and developers are the sectors where most jobs were concentrated, with 59% and 16%, respectively.

In the case of solar energy, the 10th annual national solar jobs census in the U.S. reports that almost 250,000 workers spent the majority of their work time on solar-related duties in 2019 (The Solar Foundation, 2020). The number of jobs increases to 344,532, accounting for workers that spent some portion of their time in solar-related tasks (i.e., indirect jobs).

Regarding geothermal energy, the U.S. Department of Energy published in 2004 that in 1996, the geothermal power industry generated approximately 12,300 direct full-time jobs and 27,700 indirect jobs. A more recent study shows that in 2010, including only construction and manufacturing jobs associated with geothermal energy in the U.S., about 5,200 direct full-time jobs were created and 13,100 indirect full-time jobs (Shortall et al., 2015). In addition, IRENA (2019a) uses its database to report that in the world, during 2018, geothermal energy created around 94,000 direct and indirect jobs. Most jobs were concentrated in the United States, the European Union, and China (35,000 jobs, 23,000 jobs, and 2,500 jobs, respectively).

There is important heterogeneity among these numbers, which raises questions about how these results could interpret job creation potential in other countries. Based on the references, the differences between methodologies and data analysis can partially explain the heterogeneity, rendering country comparative analysis challenging. Moreover, the renewable energy source industry's productivity and heterogeneity levels also impact the potential of job creation in each country. For instance, Germany and Spain have exported different services associated with wind generation, and China is the biggest exporter of PV solar modules.

Moreover, it is important to remember that a complete picture of the energy transition requires a more comprehensive analysis of sectors, including electricity generation and other sectors like energy efficiency, electric mobility, and energy storage.

2.2.2 Energy efficiency

In the case of energy efficiency, ECO Canada (2019) calculates that the provision of energy efficiency products and services created about 436,000 permanent jobs in 2018. This estimate is based on a survey of 1,853 establishments across six industries: construction, manufacturing, wholesale trade, professional and business services, and utilities and other services. Similarly, for the same year in the U.S., energy efficiency accounted for two out of four jobs in the green economy, adding up to 2.25 million full-time jobs, according to E2 and E4thefuture (2018). In the study for Canada, 66% of total employment in energy efficiency comes from construction. Other main initiatives are household and buildings insulation, smart monitoring systems, high-efficiency appliances (efficiency labeling), etc. (E2 and E4thefuture, 2018).

There are other studies focused on analyzing employment levels in energy efficiency for the renovation of buildings. For example, one by the ILO (2012) shows that the renovation program of buildings created about 300,000 direct jobs a year in Germany. Based on the experience of small-scale energy efficiency programs in different states of the U.S., Hendricks et al. (2010) argue that a national program to retrofit households in the U.S. could create around 625,000 direct and indirect full-time jobs over a decade. In a similar analysis, the Rockefeller Foundation and Deutsche Bank Group published in 2012 a report that estimated the creation of 3.3 million cumulative (direct and indirect) jobs due to increased building retrofits.

For comparison purposes, these numbers have been studied in terms of monetary investments. The report published by the American Council for an Energy-Efficient Economy (ACEEE, 2011) estimated 45 full-time jobs (direct, indirect, and induced) created in the first year of energy efficiency initiatives per million invested. Additionally, they estimate that 21 net jobs per year per million invested are added to the economy over the investment's life cycle. For the European Union, the Energy Efficiency Industrial Forum suggests that investing 1 million euros in energy efficiency projects creates 19 direct full-time jobs during the construction stage (Janssen and Staniaszek, 2012). In other words, and according to both studies, investing 1 million USD in energy efficiency would roughly create 20 direct jobs.

2.2.3 Electromobility

Concerning electric vehicles, an early work by Becker and Sidhu (2009) forecasts that the adoption of electromobility could generate between 130,000 and 250,000 net new jobs by 2030 in the United States. Similarly, Melaina et al. (2016) show a net growth of approximately 140,000 direct jobs in the US under a scenario of high oil prices and around 1,000 jobs in an extreme scenario with very low oil prices. In both studies, jobs are primarily concentrated in the construction of charging stations.

Mönnig et al. (2020) study the effects of the electrification of passenger trains in Germany by 2030. The results show a positive effect in the short run, but it turns negative in the long run. By 2030, about 114,000 full-time jobs would be lost by the electrification of passenger trains, and there would be a 0.6% loss in GDP. That is mainly due to the effects in other sectors, like the car industry. Using electrified trains for daily commute might become more attractive for consumers. However, if the government incentivizes the domestic production of cars and batteries, there could be positive net effects. These results highlight the crucial role of the government during the electromobility transition, as well as understanding the behavior of consumers (Rehák, 2018).

2.2.4 Demand management and smart metering

Regarding demand management, Pollin and Garrett-Peltier (2009) analyze the employment effects of two investment agendas for green energy investments in Ontario, Canada, using I-O models. It is calculated that for the first agenda (Integrated Power System Plan), conservation and demand management generate nine direct jobs per million spent and 5.2 indirect jobs. In addition, smart grid technology would create 7 and 7.1 direct and indirect jobs per million spent. Moreover, the authors show that about 9,400 jobs are created in conservation and demand management over ten years of a project. Around 6,000 are direct jobs, and around 3,400 are indirect. For the second investment agenda (Expanded Green Energy Act Alliance), the job creation regarding conservation and demand management is almost 19,800 jobs (12,570 direct jobs and 7,224 indirect jobs). Likewise, it is estimated that smart grid technology would create about 7,050 jobs in total (3,490 direct jobs and 3,560 indirect jobs).

Due to data limitations, the authors cannot provide a reliable, comprehensive breakdown of all the jobs created. However, the main categories for energy conservation and demand management are: (1) construction, (2) professional and technical services, (3) appliance manufacturing, and (4) information and advertising. In the case of smart grid technology: (1) construction, (2) machinery manufacturing, (3) electronics manufacturing, and (4) electrical equipment and component production. The authors highlight the importance of developing local content activities to promote local employment. They note that 35% and 75% of activities from energy conservation, demand management, and smart grid technology are import-competitive, respectively. In the former case, this applies to activities (3) and (4), while in the latter to activities (2) to (4).

Continuing with smart grid technology, Atkinson et al. (2009) estimate, for the United States, that a $50 billion investment in smart grid technology over five years would create around 239,000 jobs on average for each of the five years, for a total of 1,195,000 new jobs. To perform the estimation, the authors use I-O multipliers and industry-specific data on employee compensation. In another early study, KEMA (2008) shows that disbursement of $16 billion in Smart Grid incentives would create the incentives for developing Smart Grid projects worth $64 billion. The impact of these projects would result in the direct creation of around 280,000 new positions across various categories (17% in utility smart grid, 7% in contractors for installation and service providers, 40% in utility suppliers, 27% in indirect utility supply chain for the suppliers of suppliers, and 9% in new utility or ESCO jobs). In their calculations of direct job creation, the authors considered the number of jobs that would transition to other roles, as meter reading is no longer needed. They estimate these to be 11,000. This is less than 4% of the total jobs that would be created.

2.2.5 Energy storage

The last subsector is energy storage, a less studied topic in the literature due to its recent evolution. In this case, a study by Ram et al. (2020) predicts that battery storage will start to play an important role around 2040, creating around 58,000 jobs in Eurasia, for example. This scenario is assuming an energy transition towards a 100% renewable power system by 2050. On average, the global effect of energy storage on job creation would be a generation of 4.55 million jobs in 2050 (or about 13% of total jobs created by the green economy).

For the U.S., the 2020 U.S. Energy and Employment Report (NASEO and EFI, 2020) shows that energy storage (including battery storage, pumped hydro, and other types of storage) employed 84,301 people at the beginning of 2019. The majority of the jobs are concentrated in construction, manufacturing, and professional services, with 39,708 jobs, 18,109 jobs, and 15,262 jobs, respectively. The study is based on surveys, interviews, and secondary data collection.

Except for electromobility (Mönnig et al. 2020) and one study in renewable energy Almutairi et al. (2018), most studies show a positive effect of these green technologies on job creation. In the case of electromobility, the effects depend on what part of the industry is being analyzed: public electromobility (e.g., passenger trains and buses) might have negative net effects on job creation, while private electromobility (e.g., electric vehicles) shows in general positive effects. In the study of Almutairi et al. (2018), the main reason for the negative effects could be that the study focuses on direct and indirect jobs per megawatt installed created during the operation and maintenance phases of the projects. According to the evidence, the authors ignore the job creation regarding development, manufacturing, and construction of renewable energy projects, which concentrate most of the job creation.

As in generation from renewables, we observe a general tendency of positive effects in the findings and an important heterogeneity among the results. When analyzing the potential of job creation in a concrete country or region, the study must consider the specificities of the industry and the job market in the country/region. We return to these below.

2.3 Other characteristics of employment in the energy transition

Some of the advantages of the analytical methodologies are that more information on the profile of the jobs created can be captured. They usually involve surveys and/or interviews with more disaggregated information on the labor forces' characteristics. These characteristics can include gender, profile or function performed, and ethnicity, amongst others.

Information on these labor characteristics is not included in all studies. They depend on the purpose of the overall project, the resources available, and access to such information. They, however, complement any analysis on employment creation that is limited to estimations of direct or indirect employment or of the construction versus the operational phase. They allow to identify trends in the labor market specific to the energy sector, and more specifically, to the green energy sector. They can also contribute to understanding where the gender or skills gaps lie in this sector, informing key policy-making to overcome these gaps.

For instance, in a study on renewable energy and gender by IRENA (2019b), renewable energy is found to mitigate gender imbalances. Using an online survey covering 144 countries, the report finds that the share of the female labor force in renewable energy is 32% (or 3.5 million jobs worldwide). Although this percentage is still low, it represents an improvement of 22% of the female workforce in the oil and gas industry for the same year (IRENA, 2019b). That improvement was similar to the one verified in the female workforce reported for wind energy in Europe in 2008 (Blanco and Rodrigues, 2009). In addition, the document points out that female laborers tend to work more in administrative jobs instead of areas related to engineering, math, or other sciences. To cite a few, this might be driven by entry barriers, such as cultural and social norms, perception of gender roles and/or the prevailing hiring practices.

In addition to the last study, the already mentioned 10^{th} annual national solar jobs census in the U.S. reported about 250,000 direct workers on solar-related duties in 2019 (The Solar Foundation, 2020). The census also showed that women, Latins, Asians, and African Americans represent, respectively, 26% (65,000 direct jobs), 17% (42,500 direct jobs), 9% (22,500 direct jobs), and 8% (20,000 direct jobs) of the total solar workforce. Finally, out of total solar jobs, about 65% (162,500 direct jobs) are related to installation and project development, from which 56% go to the residential sector, 25% to the non-residential sector, and 19% are utility-scale. Relative to the installed capacity, 38.7 jobs, 21.9 jobs, and 3.3 jobs per MW installed are created in the residential sector, non-residential sector, and for the utility-scale, respectively. These findings are relevant for our subsequent analysis, as they reflect that smaller-scale solar generation creates more employment than at the utility-scale. We include the activity of solar panel installation, residential and non-residential, as one of our subsectors, under the category of "Emerging".

Regarding the level and type of education, the study by Parrilla (2017) analyzes the case of Uruguay making a division between permanent jobs (associated with the O&M phase and other management) and non-permanent jobs (associated with the phase of construction and assembly). Concerning permanent jobs in wind farms, for every 100MW, eight professional jobs are created (engineering, architecture, and finance), 14 technical jobs (electrical or mechanical), and 12 unskilled jobs (security and administrative). Also, 198 non-permanent jobs are added for every 100 MW installed, of which 90% are construction workers, 7% engineers, and 3% administrative personnel. Regarding solar PV, Parrilla (2017) estimates 119 permanent jobs for every 100MW: 46 in O&M and 73 in manufacturing inputs and other corporate functions. Likewise, 396 non-permanent jobs are created: 93% construction personnel, 5% engineers, and 2% administrative personnel.

2.4 Employment in Latin America's energy transition

When looking at South America, we find that different studies have estimated the job creation for specific projects. As mentioned above, there are not many studies on the energy transition impact on job creation in Latin America, which is a void this study tries to fill.

Looking at the energy sector as a whole, a recent study of the Inter-American Development Bank reported that an average of 50 direct jobs were created for every US $ 1 million invested in energy projects. This is the highest value within the general infrastructure sector since water and transportation infrastructure projects create, on average, 18 and 11 direct jobs for every US $ 1 million invested, respectively[1].

As in the previous sections, the effect on employment can also be analyzed by comparing the decarbonization scenario to the business-as-usual scenario (with high emissions). In this way, Saget et al. (2020) projected, for Latin-American and the Caribbean, a reduction of about 60,000 jobs in fossil fuel power plants, but a creation of 100,000 additional jobs in renewable electricity, 540,000 in the construction sector linked to energy efficiency, and another 120,000 manufacturing employments to support low-carbon technologies.

So far, more specific country-level case study evidence of job creation linked to the energy transition has been found and reported in Brazil, Argentina, Uruguay, and Chile.

In Brazil, Simas and Pacca (2014) focus on the employment effects of wind power. Using an analytical approach with reviews and interviews, the authors estimate that per each MW produced, wind power in Brazil employs between 13.5 and 14.1 persons per year (including direct and indirect jobs). Consequently, the total wind capacity installed would result in a total of about 170,000 jobs a year. About 48% of these jobs are in construction, 37% in manufacturing, and 15% in operation and maintenance.

In Argentina, RenovAr and MATER programs are among the most important government initiatives to promote renewable energy. In 2018, the Ministry of Energy published a document to assess the creation of jobs in these two programs (Rijter, 2018). The analysis focuses on direct jobs created during the construction and maintenance stages, ignoring the development of the projects and the effects on industries related to inputs. According to the RenovAr program

[1] In the original work, the number of jobs created are estimated per US$ billion. For the sake of comparison, these are now expressed per US$ million, assuming linearity. The respective numbers are 49,893, 18,112 and 11,722 jobs per US$ billion invested.

surveys, biogas is the source that generates the biggest number of jobs (30.6 full-time jobs per MW installed), while wind and solar only generate 4.4 and 5.5 full-time jobs per MW, respectively. However, when analyzing the jobs generated by total installed capacity, wind energy leads with 2,670 full-time jobs, and solar is second with 1,840 jobs. Due to the small capacity installed of biogas, the total job creation of this source of energy is 79 jobs up to the year 2018.

Also, for Argentina, Rojo et al. (2020) study the employment effects of biofuel in three regions: Santa Fe, Salta, and Misiones. The authors study specific projects promoted by the Food and Agriculture Organization (FAO) and the International Labor Organization (ILO). The main results show that in Santa Fe, the projects created 833 direct jobs. In the case of Salta, bioenergy created around 345 direct jobs. And, in the case of Misiones, the authors do not report their estimate for direct job creation.

For Uruguay, the ILO published in Parrilla (2017) estimates jobs generation in investments in renewable energy. This document shows that solar PV is the energy source that creates more permanent direct full-time jobs (133 jobs per 100 MW installed). Biomass generates 73 permanent full-time direct jobs per 100 MW installed, and wind energy only generates 34. However, considering the installed capacity, wind power creates 503 full-time permanent direct jobs, while hydro, solar, and biomass generate 492, 316, and 300 full-time permanent direct jobs, respectively. In the case of non-permanent jobs, solar energy creates 396 full-time jobs per year, while biomass and wind energy create 373 and 198 full-time jobs per year.

The Inter-American Development Bank developed a study to investigate the impact of replacing coal with renewable power in Chile as part of the country's coal phase-out plan. The study concluded that it was possible to create a total of between 2,000 and 8,000 net jobs by 2030 (Vogt-Schilb and Feng, 2019). These estimates include job losses in the coal power sector, estimated to be between 400 and 4,000 in 2030. As the authors argue, while these numbers are insignificant when put in the perspective of the whole Chilean labor market, they are relevant compared to current employment in the generation sector, where jobs were estimated at 48,000 in 2017 (Saget et al., 2020:39)

Some of the main findings of the studies just reviewed that are worth noting are that most of the job creation occurs in the construction or manufacturing phases. There is a clear difference between direct and indirect job creation. Reinvesting in other sectors or implementing complementary policies directed at other sectors that could be negatively affected by the transition seems essential to have an overall positive net effect. In addition, there is great variation in the number of direct jobs created by investing 1 million USD in one technology or another, and sometimes even in the same technology. So far, we note that this variation goes from 2 direct jobs to 45 direct jobs created by 1 million USD invested in generation and emerging activities, respectively. In terms of job creation by MW of capacity installed, the variation is from 0.5 to 31 direct jobs created in Uruguay and Argentina (including biogas), respectively. That shows that the renewable energy source and country matter.

2.5 Filling gaps

As mentioned above, few articles exist to date that study job creation due to the energy transition in Latin America. When they do, they focus on a specific country, region, program, or subsector. limits the overview of employment dynamics and trends in the sector and the scope of the analysis, the formulation of policies, and especially comparative work. For this reason, this document aims to broaden the understanding of this matter. This present study aims to allow calculating the employment generation due to the energy transition by looking at the average for each firm, but also aggregate numbers at the sectoral level, for a list of sectors associated with the energy transition, starting with case studies in Chile, Uruguay, and Bolivia. The surveys were designed in such a way that cross-country comparison is possible.

The approach to the research is analytical, with surveys addressing the main actors in the subsectors of generation, transmission, distribution, construction, services, energy efficiency, and others related to the energy transition. Key sectors that are included that are less well-documented are those of storage, hydrogen, and electromobility, to cite a few. These sectors shape the future path of the development of the energy sector in Latin America. They are key to the transition. Latin America is increasingly turning to these new ways of generating and storing energy instead of other renewable sources. **The potential of the region for a sustainable and rapid transition to green energy is considerable.** To ripe the benefits of this transition, **a thorough understanding of the sector's labor market, composition, challenges, and gaps is needed**. This helps shed some light on **what the jobs of today are and what those of tomorrow will be** in this sector**.**

The present work acknowledges that estimating the job creation potential by energy transition requires understanding its drivers, which will vary by country and sector and affect the overall results. These include the different labor markets' composition, flexibility, mobility, industrial policies, education, etc. For instance, in a paper on the phase-out of coal mines in Chile, Viteri Andrade (2019) highlights how closing down coal mines has affected local employment and growth. The success of energy transition policies in creating employment will depend on how the government has responded to these socio-economic outcomes and how quickly it could reconvert or relocate the local workforce to respond to labor demand. While these are important in understanding and explaining different outcomes, their analysis is beyond the scope of this paper. Future research on the employment implications of the energy transition across different countries might want to address these.

Finally, the application of the survey methodology allows the analysis of specific characteristics of employment such as quality, gender focus, its transitory or permanent nature, the levels of education, and types of skills most required. Therefore, this information will guide governmental decision-makers in technical qualification strategies, gender policies, and job quality to help streamline the transition while creating opportunities for society.

In this way, the present work intends to illustrate the opportunities offered by the sector as an employment accelerator and mitigator of climate changes for the region in times of post-pandemic. However, the different contexts of each country are expected to generate heterogeneous effects. Applying a similar methodological strategy in different countries with heterogeneous energy transition pathways will help to identify which sectors bring more opportunities to each country.

3. A MICROECONOMIC APPROACH TO A GLOBAL ISSUE

This section presents the methodology by first describing the firm-level survey and its different components. Then, it discusses the sample size and its representativeness, as well as some of its limitations. Finally, the samples are detailed by country, sector, and technology.

Our methodology differs from the input-output (I-O) analysis methodology that normally considers aggregate data to describe the interdependencies between different economic sectors. The methodology used in the present work is descriptive statistics based on analytical data collected through phone and online surveys. These were carried out in Chile, Uruguay, and Bolivia at the firm level, based on 2019 records of firms. This methodology has been inspired by comparable work on the energy transition's employment implications, using analytical survey methods to collect information.

Out of the work that inspired the present one, the most relevant is the handbook about the methodology "How to estimate green jobs in bioenergy" by the International Labor Organization (ILO) and the Food and Agriculture Organization of the United Nations (FAO) (Rojo et al., 2020). This handbook presents tools for investigating the effects of bioenergy production on employment at the provincial level. On top of providing a detailed account of the bioenergy sector and its value chain and applying the suggested methodology to the case study of Argentina, strategic advice is given on how to prepare the data collection process, carry it out and later analyze the results, both for enterprise and worker surveys. In our case, we focused on the enterprise survey.

Other important references on data collection methods, that also look at employment generation in the case of renewables, were Rijter (2018) about Argentina, Parrilla (2017) about Uruguay, and The Solar Foundation (2020) about the USA. In the studies on Argentina and Uruguay, the focus of employment creation lies in the value chain levels of construction, operations, and maintenance (O&M) and look at direct employment creation. For Argentina (Rijter, 2018), employment is estimated over the project's first three years for the construction period and relative to 1 MW of installed capacity for each renewable technology directed at electricity generation. It is therefore measured in jobs per MW. Employment projections for both construction and O&M are also provided. In the case of Uruguay, the phases of construction and O&M are also considered. Still, employment creation is estimated relative to the size of the wind turbine or solar park, based on a national average. The Solar Jobs Census, for its part, considers direct and indirect permanent employment and the installed capacity in MW, as well as the occupational category of the workforce. The present work presents an additional dimension of employment creation, which is the qualification level of the labor force. Full-time employment, both permanent and temporary, are estimated.

In this section, we present the structure of our survey and the methodology that we relied on to collect data, drawn on the studies just presented. These vary depending on the case study, as adjustments were made accordingly with the specificities of each energy sector. Novelties include additional information on the characterization of the labor force, investment costs, labor costs, recruiting challenges, and future needs for skills and training. The rest of this section is organized as follows. First, we introduce the baseline survey. Second, methodological obstacles encountered in the realization of the fieldwork and how these were overcome are covered. The third section presents the universe of firms and the survey samples by country, their distribution across the different energy transition sectors, and some limitations of the sampling methods. We conclude by showing the distribution of our samples by country, sector, and technology.

3.1 Baseline survey

The baseline survey of this research project was designed with the support of the Chilean consulting firm *Ekhos*. The initial version was designed for the generation sector in the case study of Chile. This research has classified firms taking part in the energy transition into five sectors: 1) generation, 2) transmission, 3) distribution, 4) engineering and construction[2], and 5) emerging. This categorization has been done based on the types of firms that contribute to the energy transition to facilitate comparison and analysis. The original survey is in Spanish and can be found in Annex II. It starts with an introduction about the project, the survey duration (approximately half an hour). In addition, it highlights that all data will be kept secret and anonymous so that the firm cannot be identified.

The survey is then divided into ten parts, running from letters A to J. **The first one asks general questions (A). The second part is about the production and provision of supplies (B). The third part enquires about clean energy certificates (C). Part four looks at the employment structure (D). Part 5 investigates workers' profiles and their qualifications (E). The sixth part captures the quality of employment (F). Part 7 is about demands and required training (G). Investment and costs are in part 8 (H). The second to last part is about linkages and outsourcing (I). Finally, the survey concludes with questions about investment and employment projections (J).** We review each of these parts below and discuss how it varied depending on the sector and the country.

For each case study, adjustments were made to the survey. The single version is used in the case of Uruguay in Annex III. Details of all adjustments made are described in Annex IV.

Part (A) of the survey asks general questions about the identity of interviwee. Those questions are key to the success rate of responses. Only someone with access and/or knowledge to key employee information can answer the survey accurately. Those questions are followed by questions to identify the firm, such as its name, unique identification number, which sector(s) it belongs to, depending on its principal activity when the project was approved when it started being built, the date it became operational, whether it is nationally- or foreign-owned and by how much, where the parent firm and the surveyed firm are located. The total investment associated with the main project is also asked, which allows us to later estimate the number of jobs potentially created by the amount invested. Additional information on other top projects and the amount invested in these is also requested.

When the survey is addressed to transmission companies, questions on the company's characteristics focus on the type of transmission infrastructure, the number of sub-stations, the number and kilometers of transmission lines nationally, internationally, locally, dedicated, and of the substations. For distribution companies, these questions are replaced by questions on the

[2] This sector's name has been abbreviated to Engineering and Construction, but it also includes installation and maintenance.

number of households and the number of industrial clients that the company has. The equivalent questions for companies considered to fall under the category of engineering and construction are about the number of past and actual clients, the number of projects over the past five years that were either the firm's own or required, and whether the firm has projects that are signed in the environmental evaluation service, and if so how many, and whether these are the firm's own projects or those of customers. Finally, the part on the characterization of the firm that is considered to be emerging is shorter and only asks the number of projects the firm has that are its own, and those that are for third parties, on top of the standard questions highlighted above (i.e., name, identification number, sector, activity type, project name, client name, amount invested, parent company location, own location).

In part (B) of the survey on production and provision of supplies, firms are asked about the exact technology they use as a renewable source, as listed in Table 1 below. This table compares for each sector and country the possible subsectors of the firms surveyed. The sectors of transmission and distribution do not have subsectors and are hence excluded from the table. These two sectors are also mostly dropped later in the analysis of results, either because of no or little responses or because of a monopoly in these sectors. All these circumstances challenge the anonymity of firms that then become easily identifiable.

	Chile	**Uruguay**	**Bolivia**
Generation	Run-of-river mini-hydro (turbines) Run-of-river hydroelectric (turbines) Hydroelectric dam (freshwater) Ocean hydroelectric (pump storage) Tidal Solar photovoltaic (panels) Thermic solar (panels) Wind (aerogenerators) Biomass Biogas Liquid biofuel Geothermic Waste energy Natural gas thermoelectric (turbines) Coal thermoelectric (turbines) Diesel (thermoelectric)	Solar Wind Biomass Hydroelectric dam (freshwater) Biogas Liquid biofuel Geothermic Ocean hydroelectric (pumped storage) Tidal Waste energy	Run-of-river mini-hydro (turbines) < 10MW Run-of-river hydroelectric (turbines) > 10MW Hydroelectric dam (turbines) Solar photovoltaic (panels) Wind (aerogenerator) Biomass Geothermic Waste energy Natural gas thermoelectric (turbines) Diesel thermoelectric (motors)

Engineering and Construction	Electrical engineering project development Construction services Installation services Maintenance and repair services Studies associated with engineering projects Other	Electrical engineering project development Construction services Installation services Maintenance and repair services Studies associated with engineering projects Other	Electrical engineering project development Construction services Installation services Maintenance and repair services Studies associated with engineering projects Other
Emerging	EV Hydrogen Storage Solar panels installation Energy efficiency Consultancy for independent clients Renewable energy consultancy Other	EV Hydrogen Storage Solar panels installation Energy efficiency Consultancy for independent clients Renewable energy consultancy Other	EV Hydrogen Storage Solar panels installation Energy efficiency Consultancy for independent clients Renewable energy consultancy

Table 1. Sectors and subsectors of the energy transition by country surveyed

Part (C) is concerned with whether the firm has a clean energy certificate of its footprint of carbon or other non-conventional renewable energy. While not directly linked to the core of the study, this question has the advantage of indicating whether the firm is engaged or not in the energy transition and whether some sectors or countries are more committed than others.

The part on the employment structure that is part (D) is the most relevant for the present study, along with that on workers' profiles and their qualifications. It is one of the biggest added values of this research. It asks the total number of workers employed, out of them how many are women, whether there are any foreign workers hired, and if any has a disability. All employees are considered, regardless of their contract type, except those who are outsourced. The purpose is then to distinguish between workers who were hired during the construction period (in the case of a generation firm) and those that were directly hired after, and then enquire about the service or task they were hired for. These are divided between construction, machinery or technology installation, maintenance, input and technology purchase, research and development, repairs, general services such as cleaning and security, transportation, and recycling waste or residual removal.

Workers' profiles and their qualifications in part (E) look at three key dimensions: the level of education, qualifications, and profiles depending on responsibilities or the services provided by the workers. The dimension that varies across countries is the level of education, as countries have different educational systems. The selection of the levels of education for each case study was made following consultation with national experts. Broadly speaking, these are divided between workers with no formal education, those with secondary school education, technical education, or unfinished tertiary, and then finalized tertiary education.

Regarding qualifications, the literature increasingly refers to them as STEM, non-STEM, and not qualified (IRENA, 2019b). STEM stands for Science, Technology, Engineering or Mathematics[3], non-STEM for those who have other qualifications that do not fall into this category, and not qualified for those that do not have any qualification, which would mean no other studies beyond schooling. This classification is particularly relevant to the energy sector, as this sector particularly relies on workers with technical skills in STEM. It is also helpful to better understand gaps in these skills and also gaps in gender in terms of qualifications in the energy sector, as empirically, more men would have degrees in STEM compared to women. In each case, the distribution between men and women is asked, as well as the qualifications depending on the profiles of the workers.

The profiles of the workers have to do with the position they occupy within the firm. These can be either in the directory or management, professionals or technicians, part of the construction process, or services, which include cleaning and security guards. With respect to non-STEM professionals and technicians, these would correspond to administration, finance, lawyers, and architects, amongst others. These profiles' distinctions are useful inasmuch as they are relevant to all five sub-sectors of the energy sector, which are generation, transmission, distribution, engineering and construction, and emerging firms.

Two additional sets of questions close this part. The first one has to do with the average number of workers contracted in the previous year, this year (2020), and the amount that has been dismissed since 2020, each time for all workers and then just female workers. This set of questions seeks to identify whether the sanitary crisis caused by Covid-19 might have led to dismissals, and if so, which gender was most affected. No question on the cause of the dismissal was asked, and hence no causality is being established here, only suppositions.

The second and last set of questions is concerned with whether the firm has had difficulties hiring workers, and if so, which profiles or positions were most affected and why. The second part's responses are open-ended.

Some questions on the quality of employment were included in part (F), as per ILO recommendations and guidelines (Eurofound and ILO, 2019), though the list is not exhaustive. Only some of them were brought up in the survey due to the fact that they could be sensitive for some employers to answer. These included whether any work accident had taken place and how many, whether workers were entitled to monthly payments through a contract, or whether they were paid honorarily, whether the firm offered complementary health insurance, and if so, how many workers were entitled to it.

Demands and required training is also a key part (G) of the survey, as it allows to identify where future jobs might be most needed, in addition to those that are already filled (which is estimated with the previous part of the survey). The first question asked is about whether the firm collaborates with universities or technological centers to hire or capacitate staff. Then, a grid on different reasons why capacitation is needed is presented, and the surveyed have the option

[3] This includes profiles such as engineers, electrical/electronic/electromechanics/mechanical/other technicians, physicist, chemists, programmers, system analysts, mathematicians, meteorologists, geologists, environmental scientists and architects.

to select whether this reason is not important at all or very important, with a scale of five echelons. The reasons are reducing gaps in technical competencies, incorporating new technologies, career growing programs, behavioral capacities development, and satisfying safety standards. The part closes by giving the firm the opportunity to comment on the themes and the profiles or occupations that it judges require further capacitation.

For part (H) on investment and costs, firms were asked whether they benefited from any support or financing from the State, or any other international financing institutions, in their project design, construction, operation, or maintenance phases, and if so, which. Then, additional questions were asked about the different costs the firms face and, for salaries, more specifically, how much men and women are paid, respectively.

As many firms in the energy sector outsource workers, to capture the bigger picture, **part (I) looked at linkages and outsourcing.** Questions ask whether the firm outsources any services, and if so, how many workers and of which gender, and for which service.

The survey concludes with part (J) on projections of investment and employment. Answers for this part might need to be taken in hindsight, as they can be rough estimations or reflecting hypothetical situations. The questions ask about the main motivation behind the firm's incentive to use renewable energy sources for generation (and therefore only applies to generation firms in all cases). Possible answers have to do with State programs that require these measures, increasing demand for this type of energy, or an agreement on the environment. Then, a follow-up question asks whether the firm plans on building new projects, or extending existing ones, in the next ten years, as well as the estimated time duration building the new project or extending existing ones, might take.

The survey concludes by asking firms to estimate how many workers they think they might need to hire in the future, whether directly or through outsourcing, for the list of services, as mentioned in part (D) above. To recall, these are construction and repairs, machinery installation, the purchase of inputs and technology, research and development, maintenance, general services (e.g., cleaning, security), transportation, and waste recycling.

3.2 The sample and its representativeness

The processes of firm identification and data collection required several preparation steps and encountered many obstacles, all of which can be found in detail in Annex V. The result of this process can be found in Table 6 below, which shows the universe of firms (i.e., the total number of firms identified per sector) and the sample size for each country and sector.

There are five sectors that are part of the energy transition. Within these sectors, in Uruguay, a difference is made between microgeneration firms and generation firms. In Bolivia, both firms and project of generation are surveyed, as there are fewer firms than in other countries due to the structure of the generation market. In the case of Chile, three groups of generation firms are considered. Whereas the number of generation firms stands at 1,401, out of these, 381 are in operation, 292 are potential projects approved by the Environmental Evaluation System (S.E.A), and 728 are firms with involvement in energy generation but without projects approved by the S.E.A. Out of the 381 firms in operation, 10 are large operators, and 371 are firms with installed capacity. Of the 728 firms with involvement in energy generation but without S.E.A-approved projects, 400 are non-conventional renewable energy, 265 are hydroelectric, and 53 are thermoelectric. In Uruguay, the public company UTE has a monopoly over distribution and transmission and covers about half of the country's generation.

Sector	Uruguay		Chile (those with an identification number)		Bolivia	
	Universe	Sample	Universe	Sample	Universe	Sample
Generation (microgeneration)	80 (750)	**27**	1401 381 (operational) 292 (potential) 728 (not approved)	**55** 24 16 15	14 (19 projects)	**3** **(13 projects)**
Distribution	1	**1**	15	**1**	22	**0**
Transmission	1	**1**	75	**0**	4 (12 projects)	**0**
Engineering and Construction (installation, maintenance, repairs)	+/- 220	**35**	371	**8**	158	**15**
Emerging (Energy services, software, storage, solar panel installation, consultancy, hydrogen, EV)	+/- 450	**23**	109	**23**	21	**5**
Total	+/- 750 (+/- 1500)	**87**	1960	**87**	219	**36**

Table 2. Universe and sample size by country and sector

It is worth noting that in the case of Uruguay, a considerable effort was made once the data was collected to classify firms into their corresponding category, as some firms identified themselves as "others" instead of as part of one of the categories suggested. For instance, we found that in several cases, the firm would have non-energy-related primary activities but that it would sell some of its solar panel-generated energy to the national firm UTE as a second or third activity. To this extent, the firm would classify itself as "others", and in our verification effort, we would then classify it as a "generation" firm.

Testing for sample representativeness (in terms of sector size measured by the number of firms) faces several limitations. First, it was not possible to carry out the usual representativeness checks because the real population is unknown in terms of size, mean, and variance. The universes in the cases of Uruguay, Chile, and Bolivia are estimates and were defined based on assumptions and selection of firm types and sectors, following discussion with experts or Ministerial confidential databases. The fact that "emerging" firms are included is also innovative, and hence there is no reference point for comparison and cross-checking. In other words, there is no universal definition of the energy sector connected to the energy transition, to the best of our knowledge.

It is worth mentioning that while testing for sample representativeness by sector size measured by the number of firms has shortcomings when looking at the installed capacity of the generation sector, of the renewable sector, and of some technologies, in particular, some of our samples are representative. To carry out this exercise, we looked at the installed capacity in MW stated by the surveyed firms, aggregated it at either the technology, renewable source, or generation sector level, and compared it to installed capacity in MW by country and technology found in the sieLAC-OLADE database. The year reported for all countries is 2019. The data collected in our surveys was also for the year 2019.

As Table 3 reports, the Uruguayan generation sample covers 41% of the total installed capacity of the generation sector and 66% of that of the country's biomass sector. In the Chilean sample, solar firms make up 89% of the total existing solar generation. The Bolivian sample represents 68% of non-renewable thermal firms, leading to the overall generation sample covering 45% of the country's installed capacity.

	Uruguay	Chile	Bolivia
Generation sector	**41**	**13**	**45**
Renewables	n.a.	**24**	**8**
Solar	n.a.	**89**	n.a.
Hydro	n.a.	**5**	**7**
Thermal non-renewable	n.a.	n.a.	**68**
Thermal renewable	**66**	n.a.	n.a.
Wind	**29**	n.a.	n.a.

Table 3. Percentage share of the installed capacity (MW) covered by sample firms for the generation sector, the renewable sector, and generation technologies (%)

Source: Own elaboration based on survey data compared to SieLAC-OLADE data reported for 2019

This exercise served two purposes. First, it showed that there are different ways to look at representativeness, and that in our case, we chose to focus on the sector's size by looking at the number of firms, but that the testing could also have been done by looking at the installed capacity, the energy produced, number of workers, capital, and so on, of firms. Installed capacity can only be done for the generation sector, but considering other characteristics could have helped to verify representativeness for other sectors too. However, the lack of data disaggregated to the level of emerging technologies and the new definition of the "emerging sector" makes this test impossible at this stage. Second, these estimates reveal that whereas the sample faces several representativeness shortcomings, this is not the case for all of our case studies, sectors, or technologies when considering generation firms.

In terms of close country-level comparison, the only one we were able to make is a comparison between the number of jobs we found were created by profile and qualification level for generation firms in Uruguay with results from a 2017 ILO study on employment in the generation sector in Uruguay, which actually inspired the present study (Parilla, 2017). Box 1 compares the findings from our study to that of the ILO. Results remain fairly similar, bearing in mind that three years have passed in the meantime and that in our estimates of employment, we do not distinguish between the generation technologies with as many details as the ILO study does.

While this was the only possible country-level comparison, as far as we know, we were still able to benchmark our results for the number of jobs created per million USD invested and per MW based on findings from studies reported in the literature review. This benchmarking exercise is done in part 6.3 below. It allows us to put our findings into perspective and evaluate their robustness, given the limitations of the samples' representativeness.

Second, while the sampling was done randomly, in as much as all firms for which the contact information was available were contacted (at least in Chile and Bolivia), a sample bias cannot be excluded, as the date and time of the phone call made to carry out the survey would have varied by the firm, and as firms' lines that were busy were called again, while other with disconnected lines would be abandoned, for instance.

Third, if as generally considered a 10% population sample for a population that does not exceed 1,000 observations and a 100% population sample for a population that is less than 100, the only sectors that could be considered representative are the overall energy sector in Bolivia, the engineering sector in Bolivia, the emerging sector in Chile and the overall energy sector in Uruguay (excluding microgeneration firms). An alternative sometimes reported in the literature when population parameters are unknown is Slovin's formula (Ansar et al., 2017.). However, even then, using a 90% confidence interval leads to no sample being representative, and when lowering this confidence interval to 85%, the only sectors that would *a priori* be representative of their populations are the generation one in Bolivia, the overall energy sector and the generation one in Chile, and the overall energy, generation and engineering sector in Uruguay. The 15% margin of error could be interpreted such that if the survey were to be repeated an infinite amount of time, 85% of the results would be identical.

Because of the limitations just cited above and the originality of this research in broadening the definition of the energy sector in order to encompass newly developing sectors associated with the energy transition, we consider this research to be exploratory and hence encourage the reader to consider the following results with caution.

We compare our results in terms of the number of direct jobs created on average in the operational phase of generation firms in Uruguay to results found in the 2017 ILO study by Parrilla (2017) for the number of full-time permanent jobs created in the operational and maintenance phase:

Qualification level and profile*	**Our results**	**Wind park with 25 to 30 wind turbines (Parilla, 2017)**	**Solar park with 50 MW installed potential (Parilla, 2017)**	**Biomass with 10MW installed potential (Parilla, 2017)**
STEM professionals/ technicians	3	2	1	3
STEM services	0	0	0	0
Total	**3**	**2**	**1**	**3**
No STEM professionals/ technicians	4	7	7	9
No STEM services	0	0	0	0
Total	**4**	**7**	**7**	**9**
Not qualified professionals/ technicians	5	1	2	15
Not qualified services	2	3	3	8
Total	**7**	**4**	**5**	**23**

* in the ILO study in Spanish, a distinction is made between positions in the owner firm, the operation and maintenance firm and the security firm. We consider all of them together and distinguish between the different profiles based on additional information provided for each employment position. For example, it is usually specified whether the STEM job in the operation and maintenance is an engineer, an electrical technician, or if the employee is someone in administration, etc. There is no information on positions in the directory-management and workers in construction are excluded in the ILO study, therefore we exclude these from our comparison.

Except for the biomass sector that shows higher unqualified employment, the differences between the employment structure reported in the ILO 2017 study and our own study are not significantly. In addition, our numbers include all technologies together, whereas the other numbers are for specific technologies.

Box 1. Comparison of results for validation of sample data

3.3 Sample distribution by sector, technology, and ownership

In this sub-section, we look at the distribution of firms by sector, technology, and ownership for our cases studies. Not all sectors were captured in the survey data collection, due to a lack of responsiveness of firms in these sectors that are usually smaller than others (i.e., distribution and transmissions), and in some cases, though data was collected for them, they were then excluded from the rest of the analysis for confidentiality purposes to respect anonymity. This is, for example, the case of Uruguay, where UTE has a monopoly over transmission and distribution and also generates 50% of electricity.

In the cases of Chile and Bolivia, one and no distribution firms responded, respectively (Figure 1). There were no responses from transmission firms either. The subsequent analysis, therefore, focuses on generation firms, engineering and construction firms, and emerging firms[4].

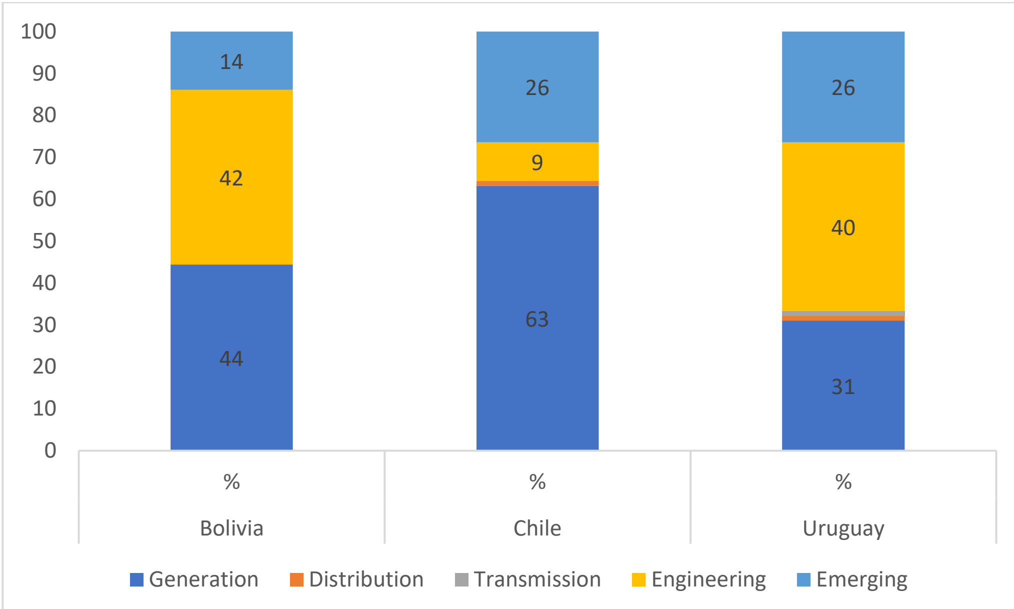

Figure 1. Sample distribution of surveyed firms by sector for each country (%)

Source: Own elaboration based on the surveyed sample

Looking at Figure 2, one can notice that as part of the generation firms, those relying on solar energy are dominant in our samples in Uruguay and Chile. In Bolivia, almost half of the surveyed firms generate hydroelectric power, followed by both thermal and solar.

For Bolivia, thermal is also an important source for electricity generation in real life, which is considered in the sample. Hydroelectric firms have a high representation, followed by one out of four firms surveyed generating solar energy. This is higher than the share suggested in the country's energy matrix[5].

In our samples for Chile and Uruguay, solar firms are overly represented, compared to the share of solar in the countries' energy matrices. Thermal represents a small share in the Chilean sample and is absent in the case of Uruguay. In both cases, however, wind firms are included, which in real life is an important source of electricity generation in both countries, especially Uruguay. Hydroelectric firms are less represented in our sample than in the countries' electricity generation matrix. Bioenergy is present in both countries, as it is in their energy matrices.

Overall, the key point is that all technologies are included. If some technologies are more represented than others, especially if these are renewable energy sources, this is desirable, as the primary objective of the present research is to assess employees in the sectors most affected by

[4] It is worth noting that in some of the analysis, some country or sector might have been excluded when there were no reported answers.

[5] Please refer to Annex VI for an overview of the electricity sectors in our case studies.

the energy transition. In addition, this comparison ought not to be exact, as here we look at the distribution of firms by technology, regardless of how much energy they produce or their installed capacity, whereas in the energy matrices, only the latter is considered. In other words, one firm can generate a lot of energy, whereas many smaller firms could generate less.

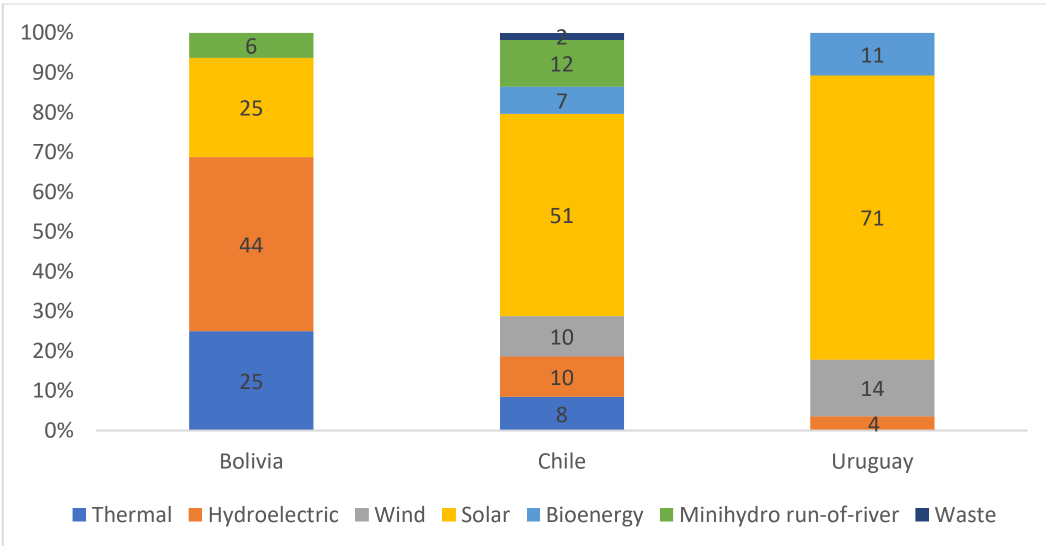

Figure 2. Sample distribution of surveyed generation firms by technology for each country (%)

Source: Own elaboration based on the surveyed sample

NB: in Uruguay, some firms generate from mixed sources; not all generation firms in Chile replied, and projects were also included for Bolivia.

The peculiarity of the Uruguayan energy sector compared to our other case studies is that the National Administration of Power Plants and Electrical Transmissions, more commonly known as UTE, has a monopoly over transmission and distribution, and part of the generation. There is, therefore, only one observation for the sectors of transmission and distribution in Uruguay. In Chile, only one distribution firm participated in the survey, whereas in Bolivia, none did. The lack of observations for these sectors has led to their subsequent exclusion in the following analysis.

For emerging firms, identifying the specific activity they perform is not as straightforward. In the case of Chile, some reported being involved in many activities simultaneously, such as electric vehicles, storage, and energy efficiency. Other report installing solar panels, engaging in energy-efficient activities, and providing advisory and consulting. In the case of Uruguay, specific activities within the spectrum of "emerging" were not always self-reported, but looking into the specific services, the firms said they delivered helped classify them as emerging. Figure 3 below shows how these surveyed emerging firms are distributed across the different activities by country. The total number of observations per country is 23, 5, and 23 firms for Chile, Bolivia, and Uruguay, respectively.

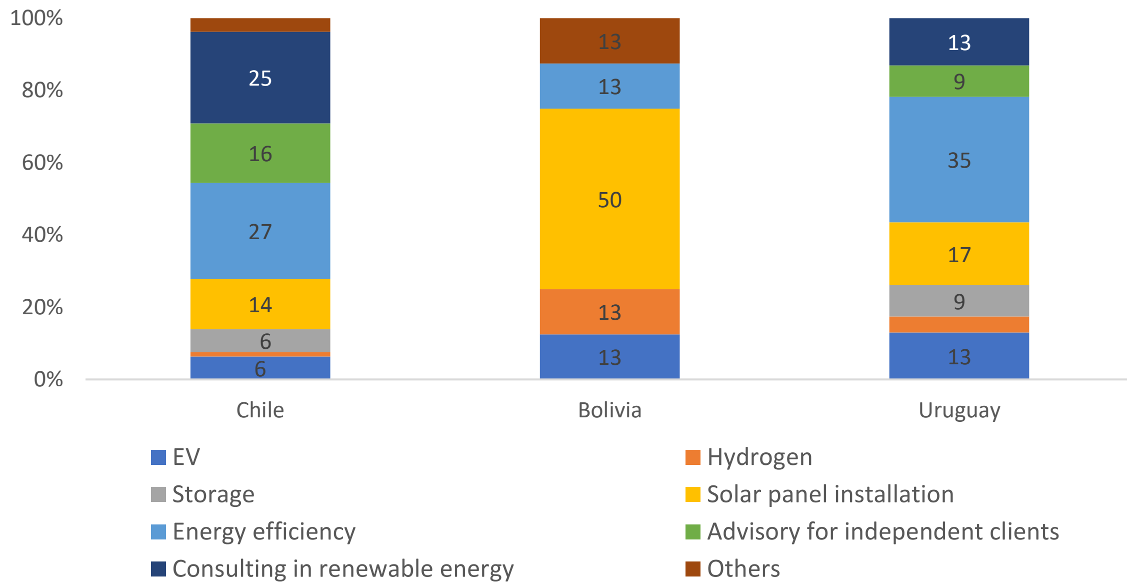

Figure 3. Sample distribution of surveyed emerging firms by activity for each country (%)

Source: Own elaboration based on the surveyed sample

NB: in Bolivia and Chile, some firms participate in several activities at the same time.

4. THE SHIFT IN SKILLS' REQUIREMENTS

The energy sector has seen changes in terms of investment in more renewable energies and in new technologies, becoming increasingly innovative, digitalized, and to a certain extent, automatized. These transformations mean that demand for specific labor skills is also likely to change and to shift from less to more technical skills requirements. This is particularly true for the "emerging" sector that is expanding at a fast pace.

In this section, we start by looking at the profiles and qualifications of employees of the different sectors across countries for which information is available. This is to give us an idea of the employment structure of each sector and to visualize how many employees each firm contracts today on average. We then take a closer look at the employment structure from a gender perspective in order to assess which sector so far is the most gender equalizing and where opportunities for further equalization lie. Finally, we conclude this section by considering two elements that are key to estimating employment. First, the fact that in some sectors, most of the employment creation is temporary and happens prior to the firm being in operation. Second, the fact that some of the employment is not locally contracted but outsourced. These two aspects will limit the potential for local employment creation and need to be accounted for in any estimates of employment creation.

4.1 Innovation, digitalization, and automation

The energy sector is becoming increasingly innovative with developments in digitalization and automation (see Annex VI). As stated in the MIT Energy Initiative's report on The Utility of the Future (2016), "the electric power systems (…) are experiencing an unprecedented set of changes driven by the intersection of several key trends: the increasing decentralization of power systems (…); a proliferation of information and communication technologies (ICTs) that enable energy to be produced, transmitted and consumed more intelligently and efficiently by agents of any size; the growth of variable renewable energy sources such as wind and solar energy; the decarbonization of the energy system as part of global climate change mitigation (…)". (2016:1). In addition, as the report suggests, digitalization and automation are expanding as distributed energy resources' capacity increases.

Whereas this MIT report refers to the US, Europe, and the "rest of the world", its observations can also be applied to the LAC region, as noted in the book by Cavallo et al. (2020) on infrastructure services and structures in the region. For instance, the argument is made that the digitalization of consumption will happen thanks to information and communication technologies that will allow fast and automatized demand responses in the face of changes in the electricity prices and other market shocks at no cost. In parallel, generation and small-scale electricity storage technologies will allow the decentralization of production. All these changes happening together will lead to greater diversity and democratic electricity sources, and decarbonization in order to pave the way to more energy-efficient economies with zero carbon emissions (Cavallo et al., 2020).

These changes are therefore directly related to our "emerging" firms, as the latter includes energy efficiency, storage, the installation of solar panels, and advising and consulting about energy efficiency practices or the use of renewable energy sources, amongst others. Electric vehicles, or "batteries on wheels", can also contribute to the balance between supply and demand by moderating demand around time and place (Cavallo et al., 2020:231). Therefore, the promotion of higher *system flexibility* is also part of the picture and will develop through storage using batteries and hydrogen- an activity which was also included in the present definition of emerging firms (Ibid).

To be able to make an informed decision on future investment initiatives that seek to create employment, we need to assess how many jobs exist for which sector today and which profiles they match. To do so, we look at the average number of workers in a firm by profile and qualification level for generation, engineering, and emerging firms. The qualification levels are categorized using the STEM terminology, which stands for Science, Technology, Engineering, or Mathematics[6]. Other categories include non-STEM for those who have other qualifications that do not fall into this category or are not qualified, for those that do not have any qualification, which would mean no other studies beyond schooling.

This analysis' purpose is manifold. First, it seeks to inform which firm type has the most employees on average. Second, it shows which profiles these employees belong to, which helps identify who the future "employees" might be in light of the transforming energy sector. Third, the employees' qualifications by sector and profile are revealed. All this information allows to make assessments on a sector-by-sector basis, but also to compare across sectors and countries.

Figures 4 to 9 below show the percentage share of workers by qualification level and profile in Bolivia, Chile, and Uruguay, for emerging, generation, and engineering firms, respectively. The average numbers of workers at the firm-level by qualification level and profile by the country for all three sectors, as well as the number of observations, can be found in Annex VII.

If looking at the distribution of its workers between the three different qualification levels (i.e., STEM, not STEM, and not qualified), the STEM share is not necessarily the highest in emerging firms, except for Chile that has a higher number of STEM professionals and technicians (Figures 4 and 5). In Uruguay, on average, an emerging firm has 81% of its employees that are not qualified, but the position they fill is not specified here. An emerging firm seems to have more employees on average overall and more STEM employees on average, compared to the average generation or engineering firm[7].

[6] This includes profiles such as engineers, electrical/electronic/electromechanics/mechanical/other technicians, physicist, chemists, programmers, system analysts, mathematicians, meteorologists, geologists, environmental scientists and architects.

[7] Here we only look at directly contracted employees. The notion of outsourcing or employees hired in the construction phase prior to the operation of the firm are considered further down.

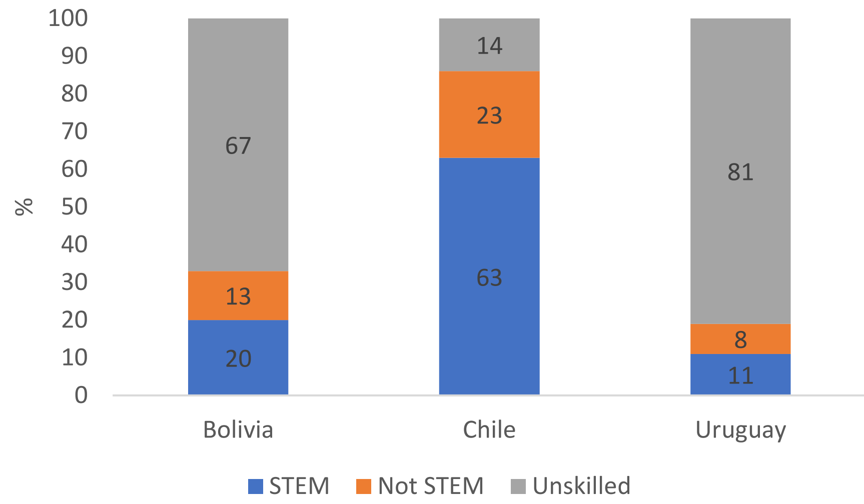

Figure 4. Distribution of workers at the firm-level by qualification level for emerging firms

Source: Own elaboration based on the surveyed sample
NB: some percentages might not add up to a hundred because of rounding; the number of observations for Bolivia, Chile, and Uruguay is 4, 23, and 18, respectively.

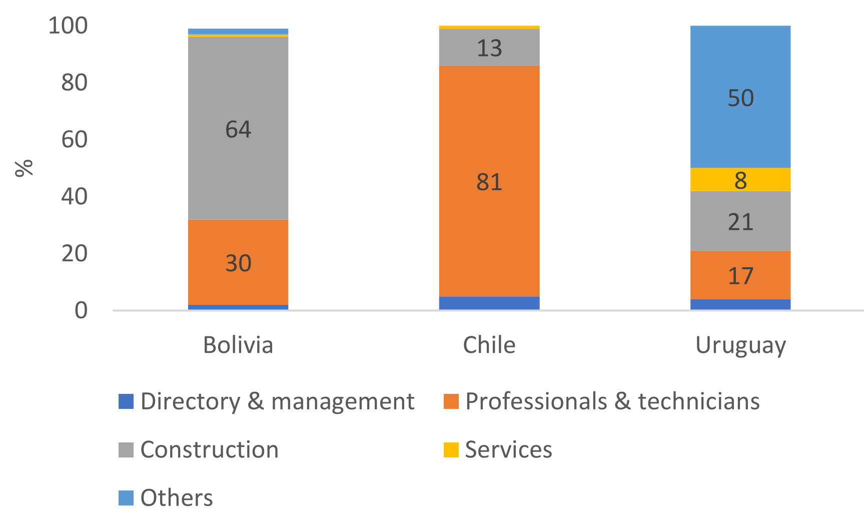

Figure 5. Distribution of workers at the firm-level by profile for emerging firms

Source: Own elaboration based on the surveyed sample
NB: some percentages might not add up to a hundred because of rounding; the number of observations for Bolivia, Chile, and Uruguay is 4, 23, and 18, respectively.

Interestingly, some countries show higher heterogeneity in their employment structure across the different energy sectors. For instance, in Chile, a generation firm has roughly a third of its employees that are STEM and two-thirds that are not qualified, while an engineering firm has its employees more evenly distributed across the qualification levels (Figures 6 and 7).

By contrast, an emerging firm has over half of its labor force qualifying as STEM (Figure 5). On the contrary, the distribution of employees by qualification level in Bolivia is more consistent across sectors, with about two-thirds of the workers being unqualified, one in four or five being STEM, and the rest qualifying as no STEM, regardless of whether the firm is in the generation, emerging or in engineering (Figures 6, 7 and 8).

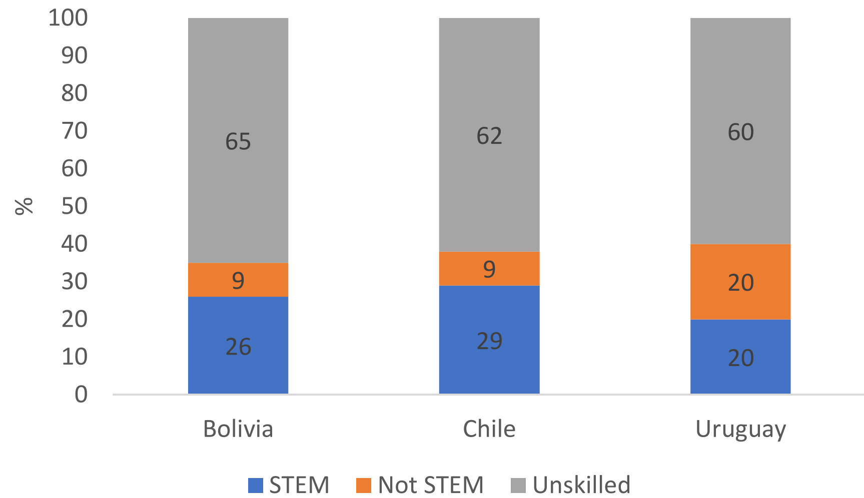

Figure 6. Distribution of workers at the firm-level by qualification level for generation firms

Source: Own elaboration based on the surveyed sample

NB: some percentages might not add up to a hundred because of rounding; the number of observations for Bolivia, Chile, and Uruguay is 8, 53, and 27, respectively.

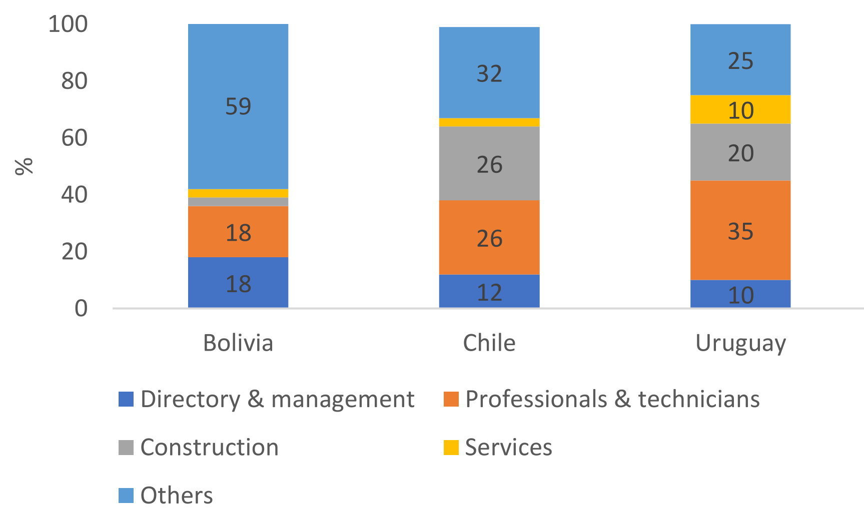

Figure 7. Distribution of workers at the firm-level by profile for generation firms

Source: Own elaboration based on the surveyed sample

NB: some percentages might not add up to a hundred because of rounding; the number of observations for Bolivia, Chile, and Uruguay is 8, 53, and 27, respectively.

In terms of the different profiles, on average, a generation firm has more employees in the directory and management, both in absolute terms and in percentage share of its overall employment (Figure 6, 7, and 8, and Annex VII). A higher share is also attributed to "other" profiles not listed in the survey on average for a generation firm, compared to its counterparts- except in the Uruguayan case of an emerging firm (Figure 9).

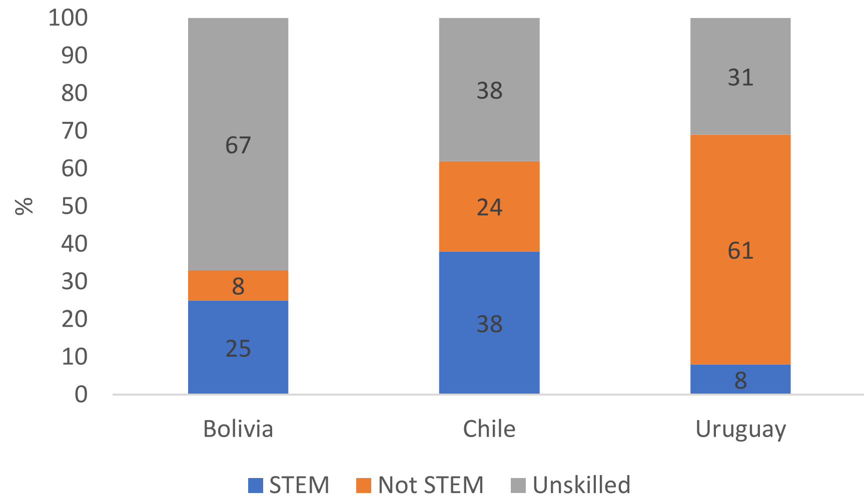

Figure 8. Distribution of workers at the firm-level by qualification level for engineering firms

Source: Own elaboration based on the surveyed sample

NB: some percentages might not add up to a hundred because of rounding; the number of observations for Bolivia, Chile, and Uruguay is 16, 7, and 32, respectively.

By contrast, engineering and emerging firms have more employees who are professionals and technicians or in construction (Annex VII). It is worth, however, noting that workers hired in the construction phase of a generation firm prior to it becoming operational are considered separately, as they consist of temporary employment. We return to this later.

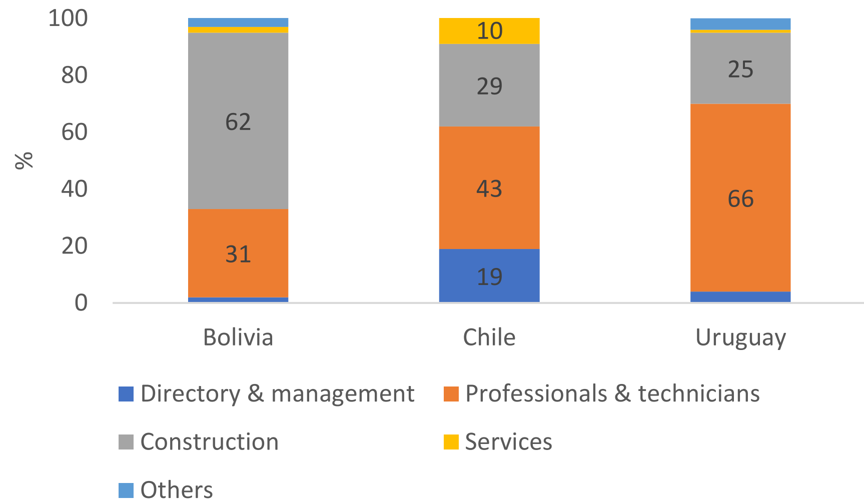

Figure 9. Distribution of workers at the firm-level by profile for engineering firms

Source: Own elaboration based on the surveyed sample

NB: some percentages might not add up to a hundred because of rounding; the number of observations for Bolivia, Chile, and Uruguay is 16, 7, and 53, respectively.

Here, the main takeaways are that: 1) the different sectors of the energy transition have different employment structures; 2) there are considerable disparities between countries for the same type of firm, which can be due to several factors, such as their installed capacity, business environment, local demand, access to finance, etc.; 3) emerging firms on average have the most employees, in absolute terms; and 4) workers with STEM qualifications are less present than those qualified as no STEM or without qualifications, though this is likely to change, as new skilled labor force will be increasingly needed.

4.2 An opportunity to overcome gender imbalances

Further investment in the energy sector to tackle climate change mitigation will come from both public and private counterparts. While there is an opportunity to create qualified and technically skilled employees to meet the future demands of the sector, there is also an opportunity to address gender imbalances in the energy sector.

There are currently considerable gender imbalances in the energy sector. The numbers below show the average share of female workers by sector, by technology for the generation, by activity for emerging firms, and by profile, for our case studies (Figures 10 to 16). A distinction is made between two different measurements of the percentage share. The "average at the firm-level" is measured by looking at the average of all averages calculated for each firm. By contrast, the "at the sector-level" is the average share from the ratio of total female employment over total employment for that sector, technology, or activity. We consider both to estimate the shares overall, as this allows us to perceive the female employment share at the firm level on average, which also tells a different story.

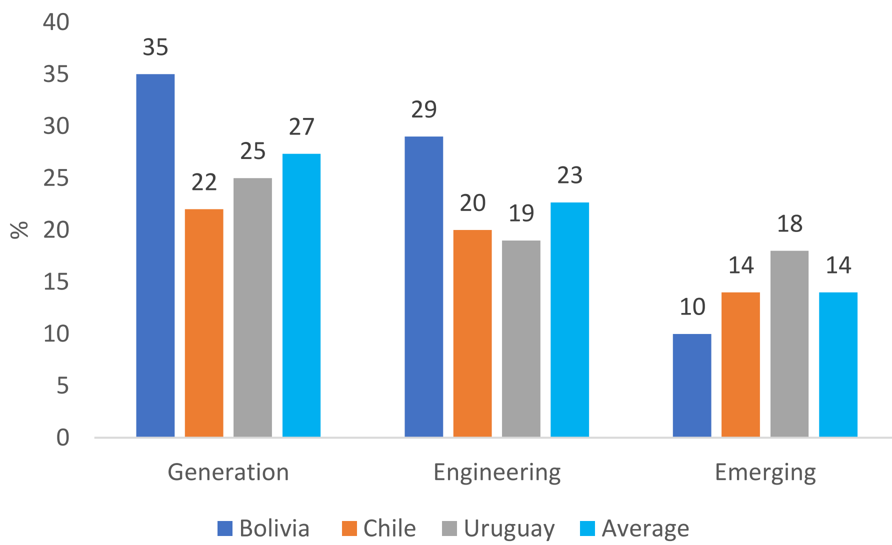

Figure 10. The average share of women at the firm-level by sector

Source: Own elaboration based on the surveyed sample

NB: the numbers of observations for Bolivia, Chile, and Uruguay are 5, 55, and 26 for generation firms, respectively, 10, 8, and 30 for engineering firms, respectively, and 7, 23, and 11 for emerging firms, respectively.

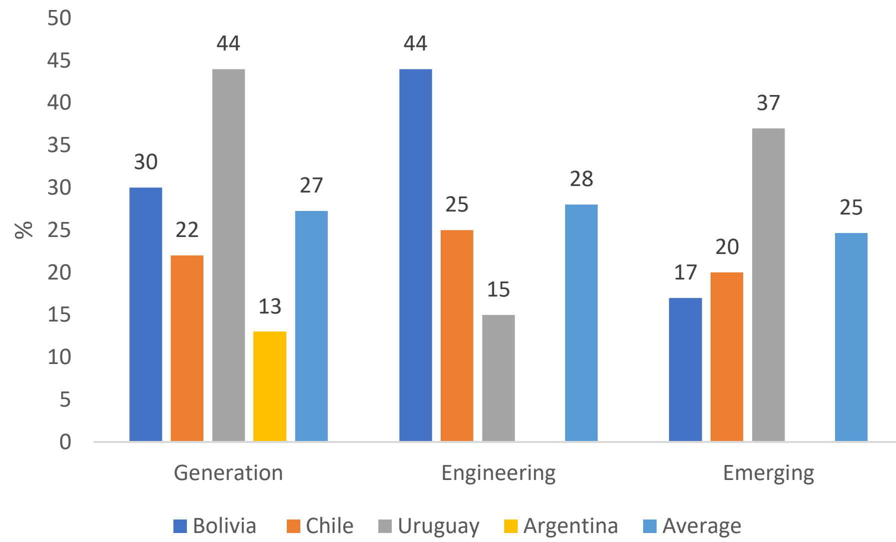

Figure 11. The average share of women at the sector-level by sector

Source: Own elaboration based on the surveyed sample

NB: the numbers of observations for Bolivia, Chile, and Uruguay are 5, 55, and 26 for generation firms, respectively, 10, 8, and 30 for engineering firms, respectively, and 7, 23, and 11 for emerging firms, respectively.

Figures 10 and 11 show that, on average, emerging firms employ fewer women than their counterparts, both at the firm level and at the aggregate sector level. The only exception is the average at the sector level in Uruguay, where 37% of the employed are women.

If taking a closer look at the different technologies of generation firms, one can see that the technology that presents the highest share of the female workforce overall is wind energy in Chile and solar energy in Uruguay (Figures 12 and 13). If looking at the average at the firm level, a wind energy firm also has a higher share of female employment compared to other technologies. The technology where the least female employment is present overall is bioenergy in Chile and Uruguay. At the firm level, it is also the bioenergy firm in Uruguay, but in Chile, the hydroelectric firm seems to hire even fewer female workers. This also applies to Bolivia.

By contrast, this share stands at a mere 17% and 20% in Bolivia and Chile, respectively. The sector that shows to have the highest share of female employment is the generation in Uruguay and engineering in Chile and Bolivia. The firm that shows to have the highest share of female employment on average is the generation firm. This is the case in Bolivia, Chile, and Uruguay.

One common observation is that the generation sector, regardless of the technology used, presents some imbalances in gender in its employment structure. In no case, except for the aggregate wind energy sector in Chile, does female employment come close to equaling male employment.

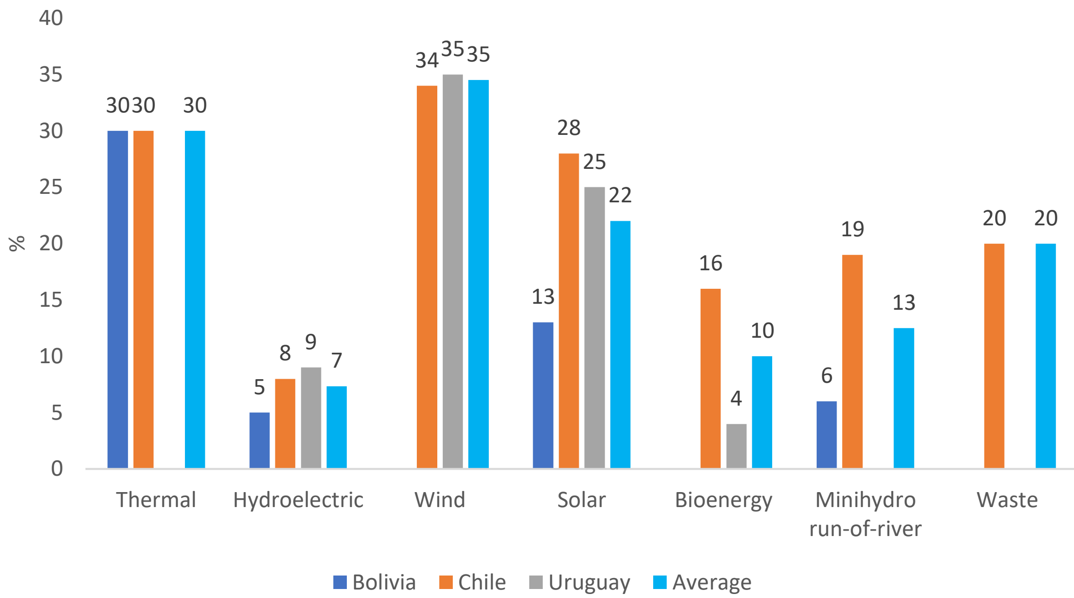

Figure 12. The average share of women at the firm-level by generation technology

Source: Own elaboration based on the surveyed sample
NB: the number of observations can be found in Annex VIII.

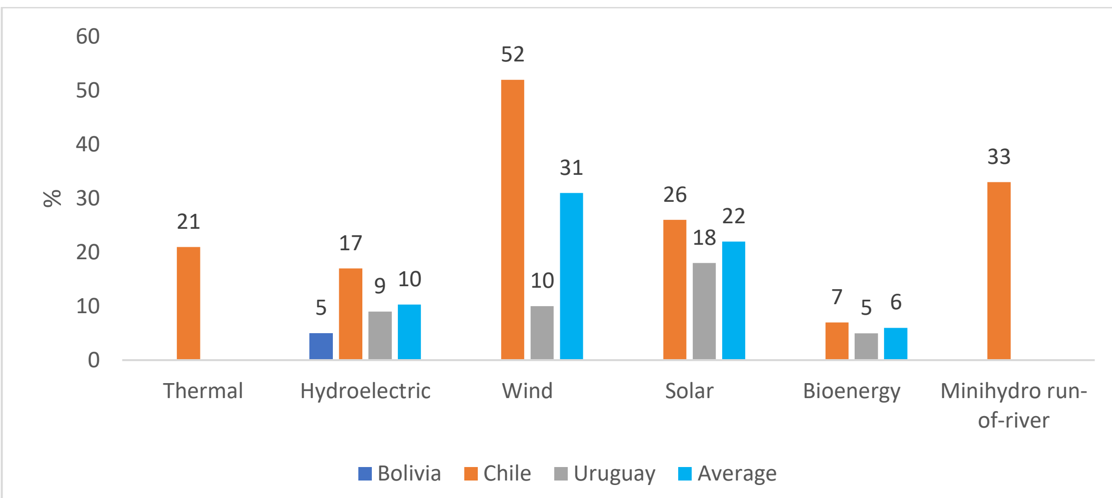

Figure 13. The average share of women at the sector-level by generation technology

Source: Own elaboration based on the surveyed sample
NB: the number of observations can be found in Annex VIII.

The picture for emerging firms is somehow different, as the only firm surveyed in Chile that carries out hydrogen activities has 60% of its labor force that is female, as the unique firm surveyed in energy efficiency in Bolivia reports 55% of women in its labor force, and as solar panel installation in Uruguay also seems to have high female employment- 85% for the average firm and 91% in the overall activity (Figures 14 and 15). However, in Uruguay, firms that manage electric vehicles and provide advice for independent clients do not report any female employment.

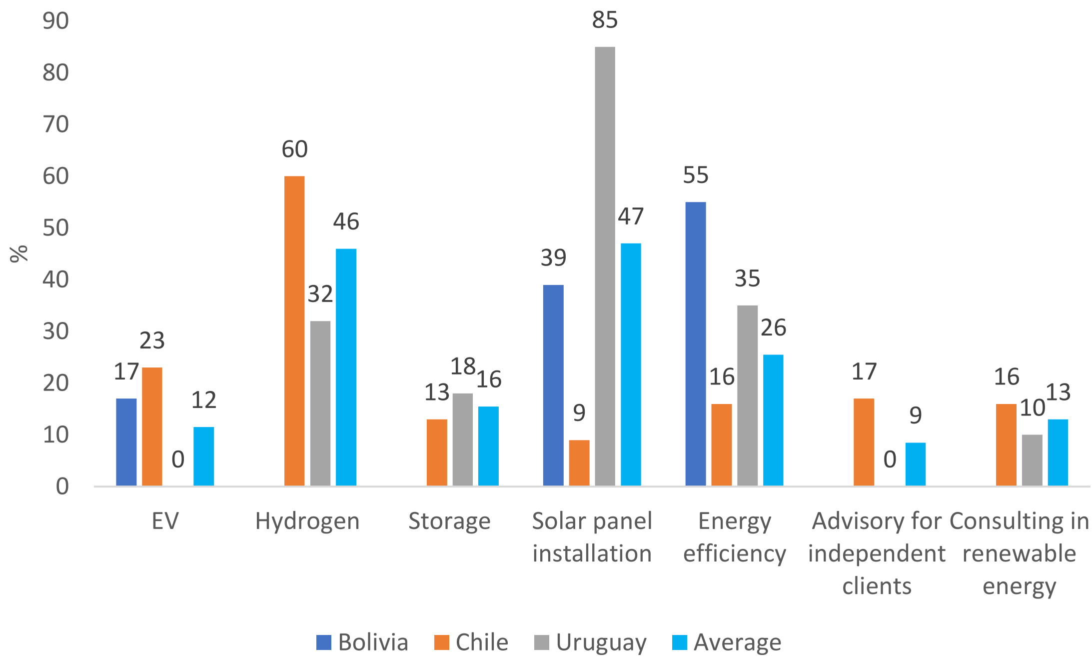

Figure 14. The average share of women at the firm-level by emerging activity

Source: Own elaboration based on the surveyed sample
NB: the number of observations can be found in Annex VIII.

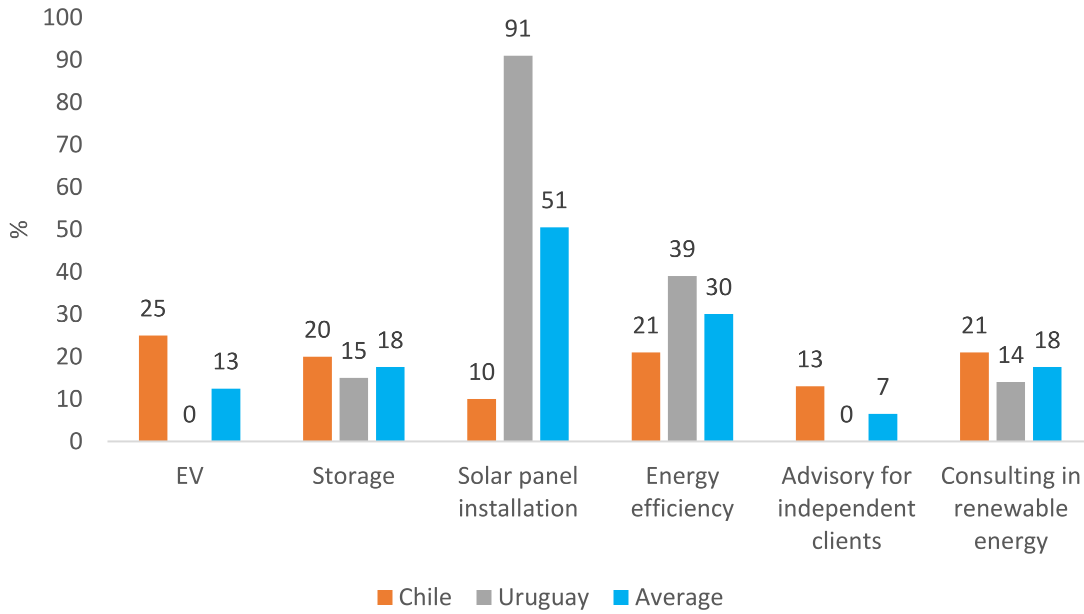

Figure 15. The average share of women at the sector-level by emerging activity

Source: Own elaboration based on the surveyed sample
NB: the number of observations can be found in Annex VIII.

Profiles also show heterogeneity in terms of female employment, as Figure 16 demonstrates. Women who are in management positions are more likely to be no STEM or unqualified, compared to having a STEM qualification level. Overall, the percentage share of workers who are women out of all the no STEM workers regardless of their profile is higher than the counterparts that are STEM or unqualified. This trend also applies to any other profile that is related to the directory or the management.

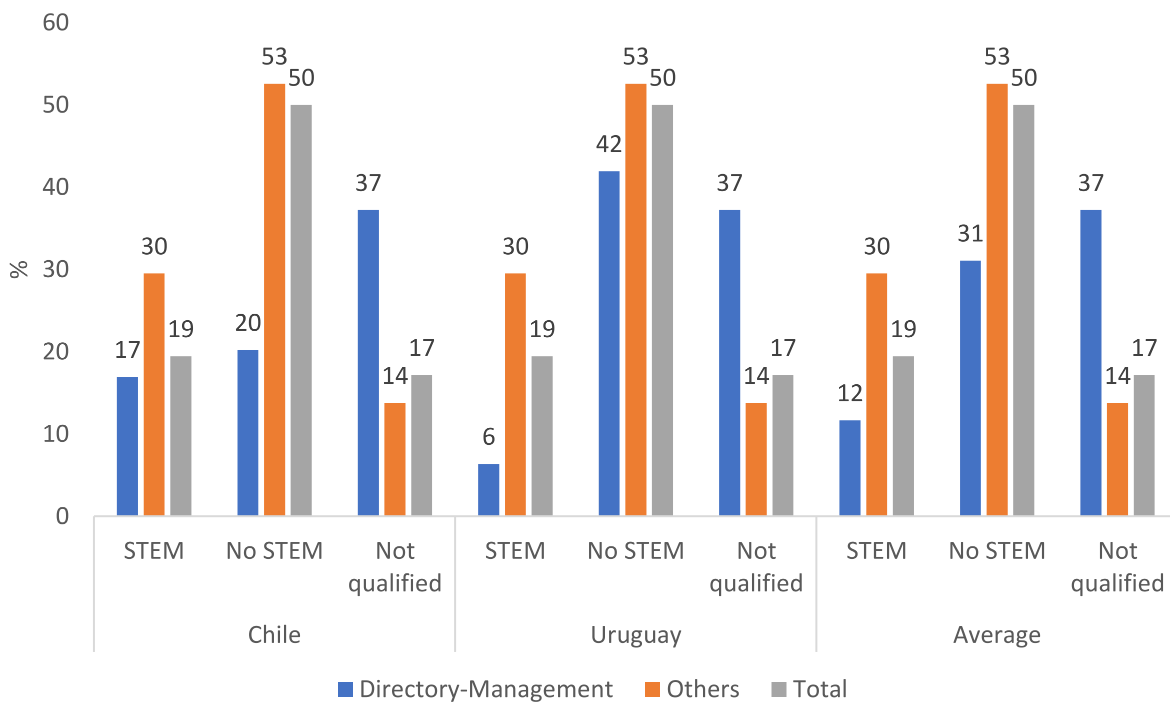

Figure 16. The average share of women at the sector-level by profile and qualification level for generation firms (%)

Source: Own elaboration based on the surveyed sample
NB: the number of observations for Chile and Uruguay is 53 and 27, respectively.

The main takeaways from this sub-section are that considerable gender imbalances still exist in the energy sector, though emerging firms and some generation technologies relative to others seem to create a potential for better gender inclusion. Women amongst STEM workers are still under-represented, but they are not the most unqualified workers either. In line with the argument made in the previous section, the emerging sector not only has potential for employment creation but also for overcoming gender disparities.

4.3 Addressing the issues of temporality and outsourcing

Two aspects that are key to consider when estimating employment are temporary and outsourced employment, which are particularly relevant to the energy sector. These matter because they could lead to over-estimation of the employment creation from investing in the energy sector if ignored. They also matter because they will influence the decision of who to train to meet the skills' requirements resulting from the shift in local demand.

Figure 17 below shows the percentage share of workers, compared to the total number of workers employed, who were only contracted for the construction phase prior to the firm entering into operation. While in Uruguay, these represent only 10% to 30% of the total labor force, in Chile and Bolivia, these numbers are much higher. In Chile, generation firms hire more than two and a half times their operational labor force to work in the construction phase prior to operation. This could be driven by the fact that Chile has a large solar energy sector and hence large solar panels parks that require considerable labor for their construction, but much less so for their operation. In Bolivia, for all sectors, more workers were required for the construction phase compared to the actual operational phase.

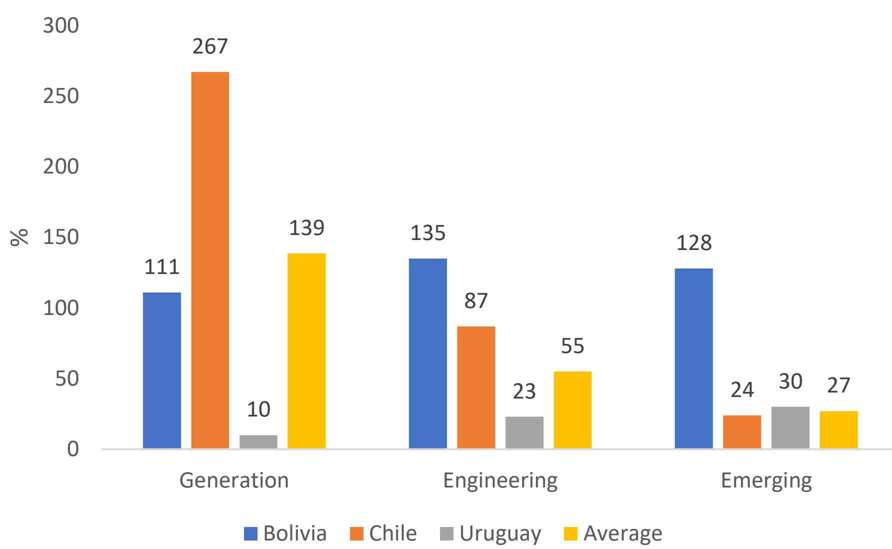

Figure 17. Share of workers directly hired for construction compared to the total number of workers (%)

Source: Own elaboration based on the surveyed sample

NB: for generation firms, the number of construction workers refers to the pre-operational phase. For other sectors, it can include workers while the firm is in operation. Only direct employment is considered here. For Bolivia, firms might be considering construction workers as a separate category from the rest of the workers. The number of observations in Uruguay, Chile, and Bolivia is 27, 53, and 3 for generation firms, respectively, 33, 8, and 14 for engineering firms, respectively, and 19, 23, and 6 for emerging firms, respectively.

Going back to our sample firm distribution figures in section 3.3, we can see that the surveyed generation firms in Bolivia were mostly using solar and hydroelectric energy and that the emerging activity is dominantly solar panel installation. This could explain the level of labor intensity present prior to operation. In the case of Uruguay, the lower share of construction workers compared to the total number of workers in generation firms could be linked to how construction workers are defined by firms and whether these might be limited to construction supervisors rather than the whole workforce.

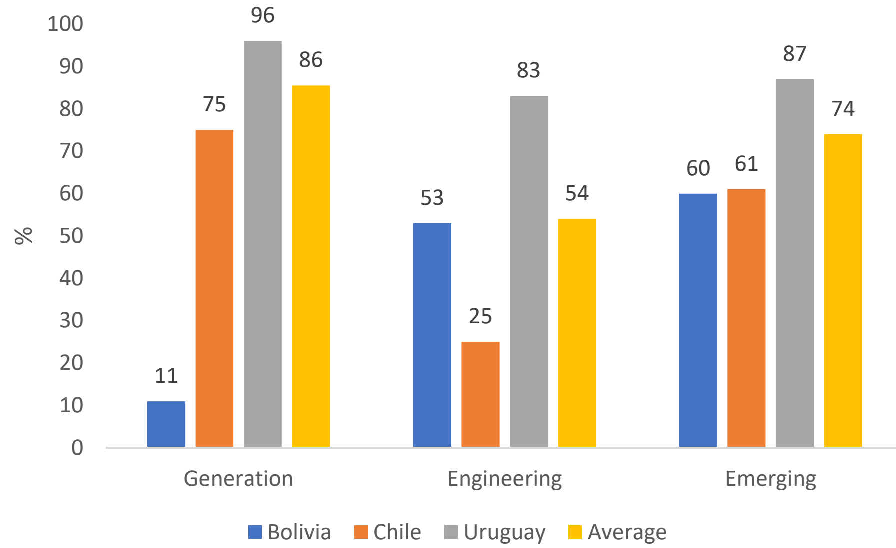

Figure 18. Share of firms that outsource their workers (%)

Source: Own elaboration based on the surveyed sample

NB: for generation firms in Bolivia, firms that did not know were excluded. The number of observations in Uruguay, Chile, and Bolivia is 27, 53, and 9 for generation firms, respectively, 35, 8, and 15 for engineering firms, respectively, and 23, 23, and 5 for emerging firms, respectively.

The second aspect that deserves attention is that of outsourcing. Based on Figure 18, one can see that all firms outsource their workers. The share of outsourced workers is particularly high in Uruguay, as well in generation and emerging in Chile, and in engineering and emerging in Bolivia. These figures are important, as they could be reflecting a lack of available skilled labor supply to respond to the needs of the transforming energy sector.

Zooming into who the outsourced workers are, Figure 19 illustrates that generation firms in Uruguay are mostly involved in construction and assembling, whereas in Chile, they are mostly delivering construction, general, and waste removal services (Figure 20). For engineering firms in Uruguay, most of the services outsourced are for transportation, assembling, and construction (Figure 21). One possible explanation linked to the outsourcing of these services is the lower labor costs.

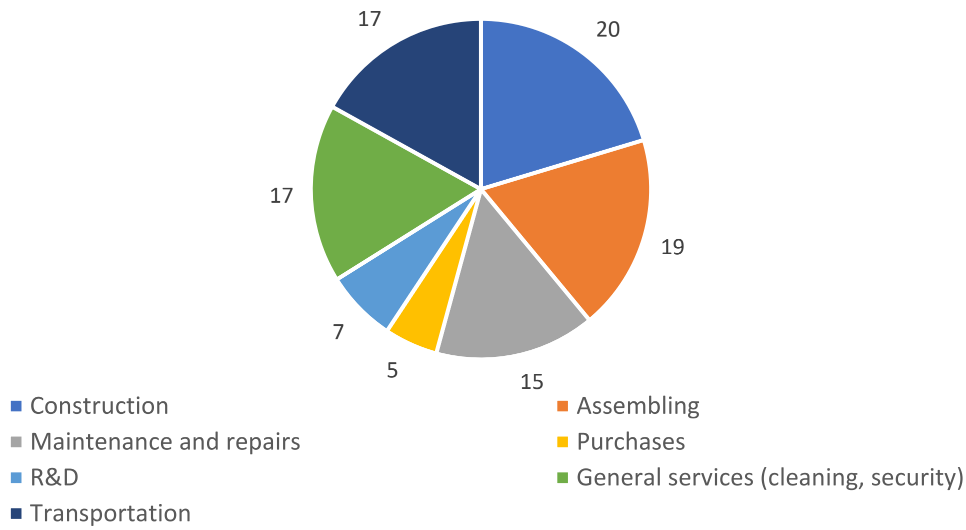

Figure 19. Distribution of outsourced services for generation firms in Uruguay (%)

Source: Own elaboration based on the surveyed sample
NB: category "others" excluded, multiple answers included.

For emerging firms in Uruguay, the outsourced services are slightly different, as almost a third of these have to do with maintenance and repairs (Figure 22). This is an interesting finding, as these are services that require specific technical skills. As the emerging sector grows, more and more labor force with the right technical skills will be required for the maintenance and repairs of electric vehicles and their chargers, energy-efficient appliances, and household solar panels, to cite some examples. This creates an opportunity for providing training on these skills that are not available locally. Unlike employment in construction and assembling, these are services that offer sustainable employment, as they will be continuously required, instead of being delivered at a punctual moment in time and then disappear or move on to another firm, like construction and assembling.

This information is only available for Chile and Uruguay, as firms in Bolivia did not respond to this section.

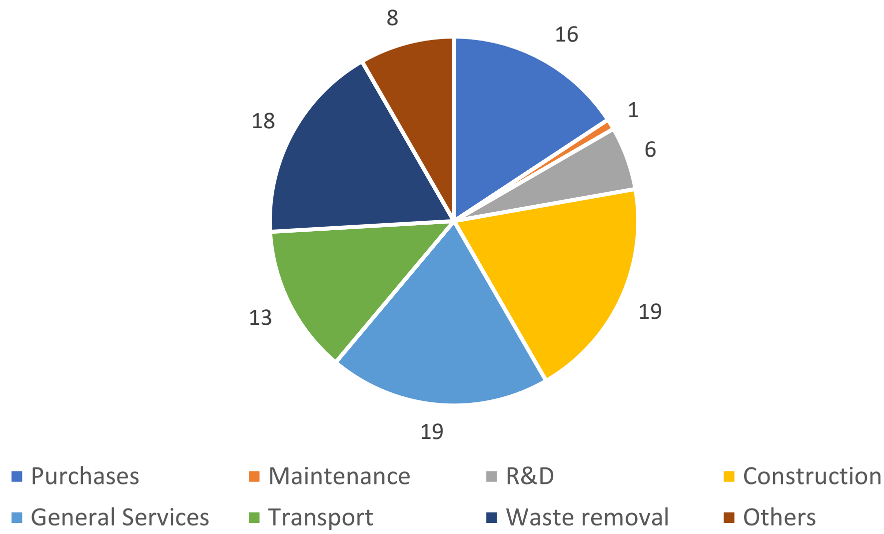

Figure 20. Distribution of outsourced services for generation firms in Chile (%)

Source: Own elaboration based on the surveyed sample

NB: category "others" excluded, multiple answers included.

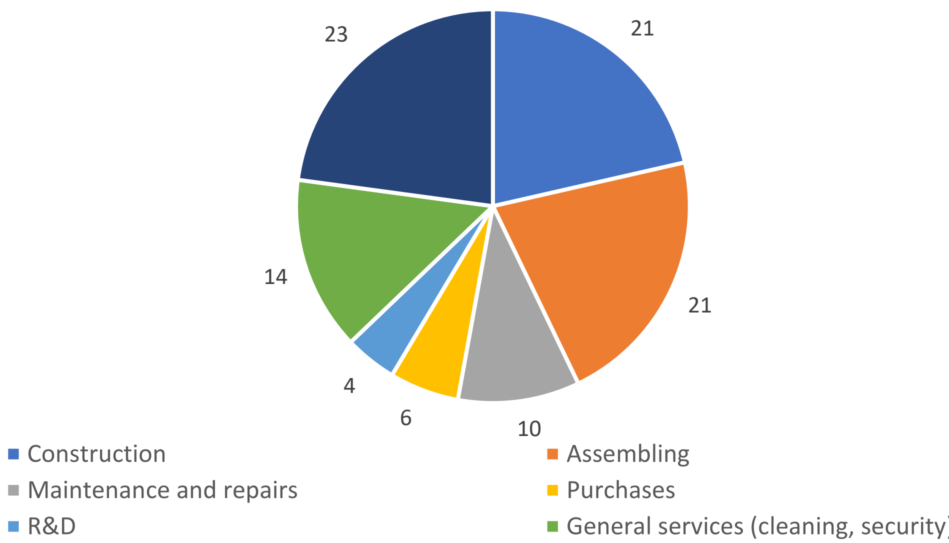

Figure 21. Distribution of outsourced services for engineering firms in Uruguay (%)

Source: Own elaboration based on the surveyed sample

NB: category "others" excluded, multiple answers included.

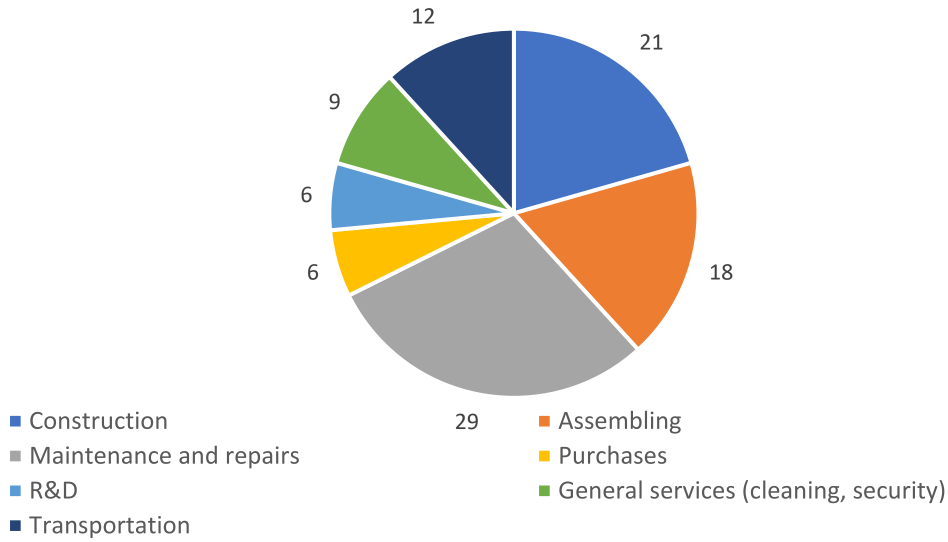

Figure 22. Distribution of outsourced services for emerging firms in Uruguay (%)

Source: Own elaboration based on the surveyed sample
NB: category "others" excluded, multiple answers included.

One additional issue that needs to be considered is whether firms are national or foreign owned. As Figure 23 reveals, in Chile, a third of the surveyed firms are internationally owned, meaning that over half of their ownership is foreign. Meanwhile, in Uruguay, a bit less than one in ten surveyed firms is foreign owned. This finding has two important implications. First, it suggests that some of the employment generated might be international instead of local. Second, when thinking about policymaking and incentives to create and train employees in the energy sector to support the transition, it will be important to include internationally owned firms in the picture.

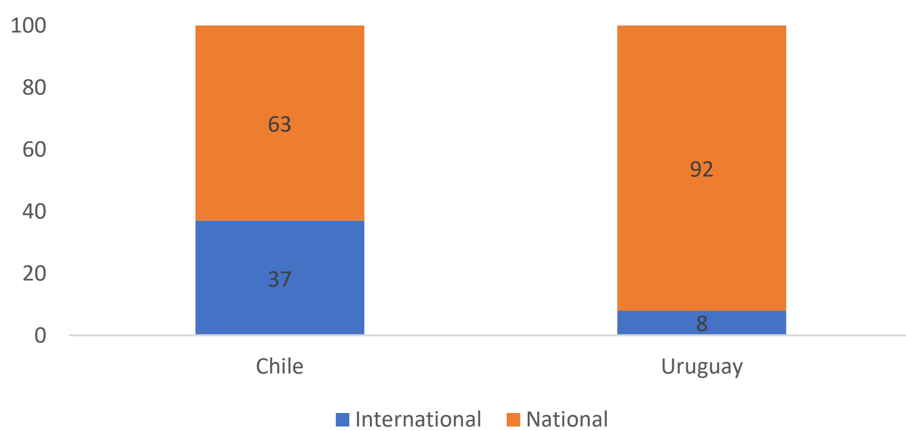

Figure 23. Percentage share of surveyed firms that are internationally owned[8]

Source: Own elaboration based on the surveyed sample
NB: the number of observations for Chile and Uruguay is 73 and 87, respectively.

[8] By definition this means that over 50% of their ownership is foreign.

5. LOOKING TOWARDS AN INCLUSIVE AND SUSTAINABLE TRANSITION

In this section, we provide a forward-looking perspective to inform policymakers of what the energy sector is likely to look like in the next decade and where it might be most desirable to invest to promote employment creation. To make our case and in continuation of the argument made in the previous section about the energy firms' future needs for more technical skills, we show firms' responses to difficulties they face in the recruitment process and the reasons behind their provision of training.

5.1 The future jobs' profiles

One of the sections of the survey questionnaire asked firms about whether they faced difficulties in recruiting workers. Out of all generation firms, one firm in four (five) in Chile (Uruguay) said that it did face difficulties when it came to recruiting (Figure 24).

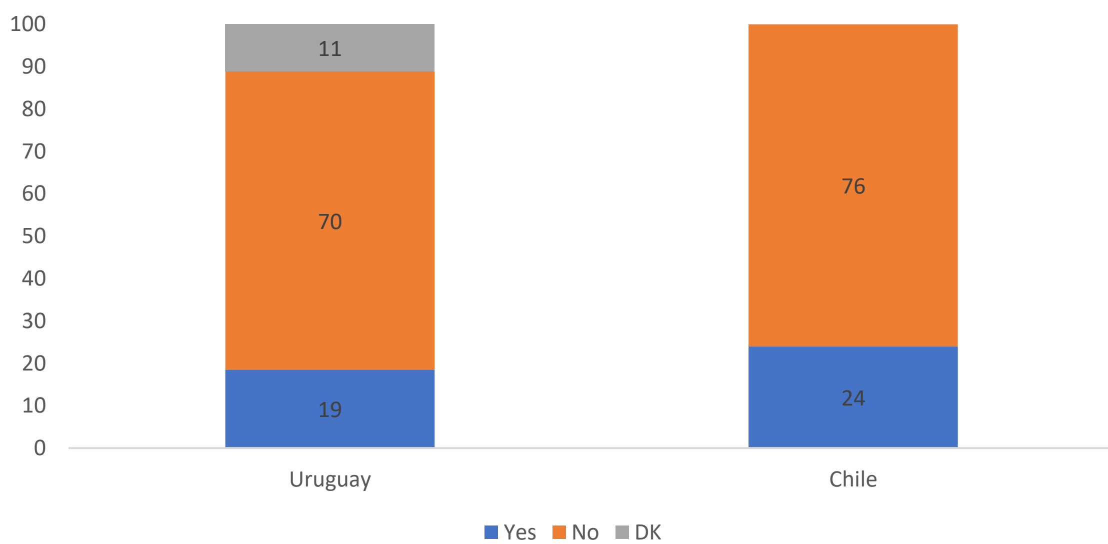

Figure 24. Generation firms' responses when asked about difficulties in recruitment (%)

Source: Own elaboration based on the surveyed sample

NB: the number of observations for Chile and Uruguay is 37 and 27, respectively.

For emerging firms in Chile, this number is much higher, as almost half of the firms replied that they faced difficulties in recruiting, whereas, for Uruguay, the share is slightly less, though still existent (Figure 25). Firms are then asked about the types of profiles and occupations that they face the biggest difficulties recruiting. The answers were left open-ended, but some of the profiles that appeared several times in the responses, for instance, were the need for engineers of all types (i.e., design and development, chemical, industrial, civil, etc.), technicians, data scientists, and economists. The themes in which some of these profiles were found to be missing were energy efficiency, new technologies, automation, research and development, and environmental norms. These responses were reported for all firms in the case of Uruguay.

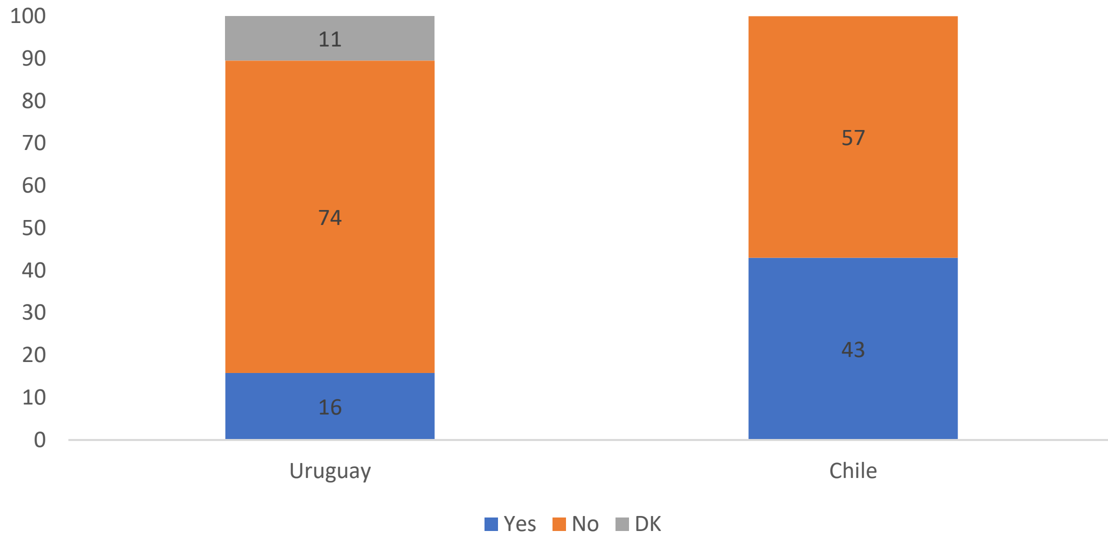

Figure 25. Emerging firms' responses when asked about difficulties in recruitment (%)

Source: Own elaboration based on the surveyed sample

NB: the number of observations for Chile and Uruguay is 7 and 19, respectively.

In the case of Chile, the missing profiles were mostly engineers and technicians, and the areas where the workers were most needed are IT, research, maintenance, and bioprocessing. Firms also reported that the reasons behind some of the recruiting issues they faced had to do with Covid-19 and current restrictions, as well as a lack of labor supply matching the skills required, including a “lack of STEM.” These responses are, of course, to be taken with precaution, as they are mostly qualitative and only reflect the personal experiences of some of the energy firms surveyed. Yet, they can complement our quantitative results by providing some interpretation to our findings.

Finally, both generation and emerging firms in Chile were asked about the importance of some reasons behind the vocational training of some of their employees. We consider two of them, which are relevant to our research story. The first one has to do with technical competencies. The second one is about incorporating new technologies. In all cases, more than half of the firms said that these were very important or important in justifying future training. Incorporating new technologies seems less important for generation firms than for emerging firms. Closing gaps in technical competencies and incorporating new technologies seem more relevant for Uruguayan generation firms than their Chilean counterpart (Figure 26).

Almost nine emerging firms ten in Chile said that these two reasons were very important or important for future training (Figure 27). Technical competencies seem less important for emerging firms than generation firms in Uruguay but incorporating new technologies is slightly more important.

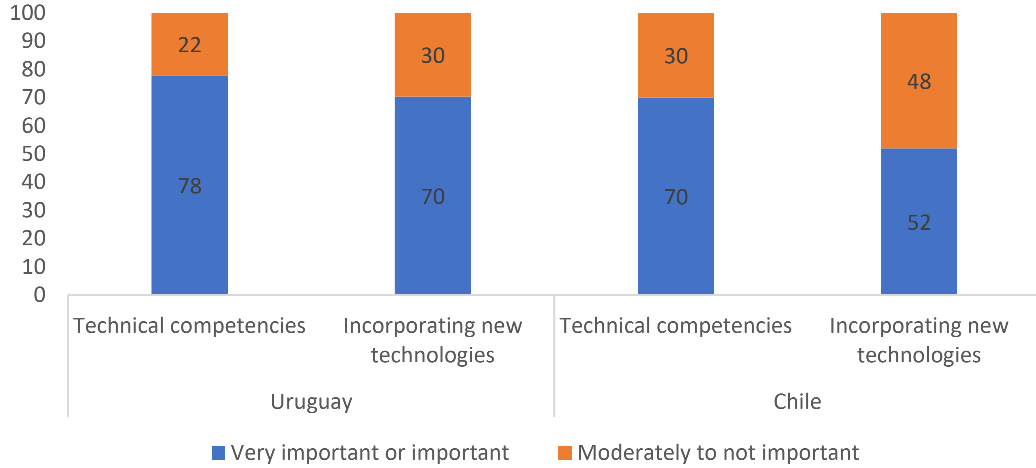

Figure 26. Generation firms' responses when asked about the reasons behind future training (%)

Source: Own elaboration based on the surveyed sample

NB: the number of observations for Chile and Uruguay is 54 and 27, respectively.

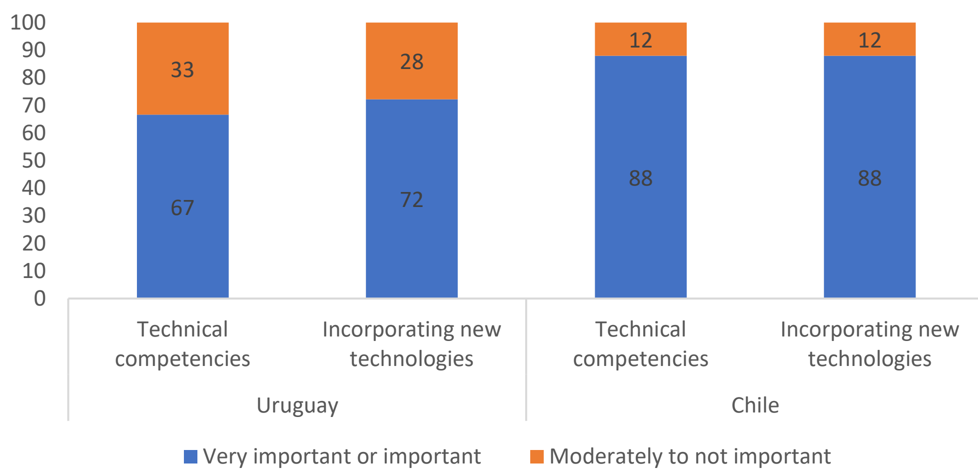

Figure 27. Emerging firms' responses when asked about the reasons behind future training (%)

Source: Own elaboration based on the surveyed sample

NB: the number of observations for Chile and Uruguay is 8 and 18, respectively.

Overall, the key messages are that there is a gap between labor demand and supply in technical competencies, as well as a need to incorporate new technologies that accompany the energy transition, justifying the need for future training of employees. However, this gap is not as pronounced in all countries and for all technologies, and hence the response will need to be tailored according to the needs identified in the case study.

5.2 Investment projections

One question that next comes to mind is how much the energy sector is actually going to increase, and hence how large and with what reach should the training programs be. Both generation and emerging firms in Uruguay were asked about their plan to build, expand or do both or neither in the next ten years. At least half of the generation and emerging firms said that they would either build more, expand or do more (Figures 28 and 29). A quarter of emerging firms did not know. This could be because these firms operate in activities that are still relatively new.

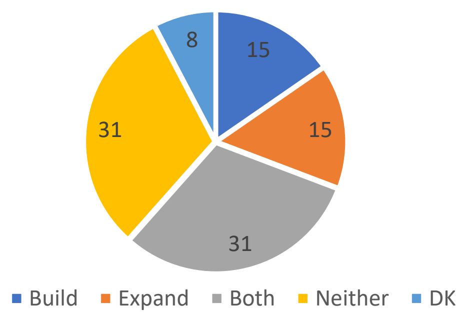

Figure 28. Generation firms' responses regarding projects for the next ten years in Uruguay (%)

Source: Own elaboration based on the surveyed sample
NB: the number of observations is 7.

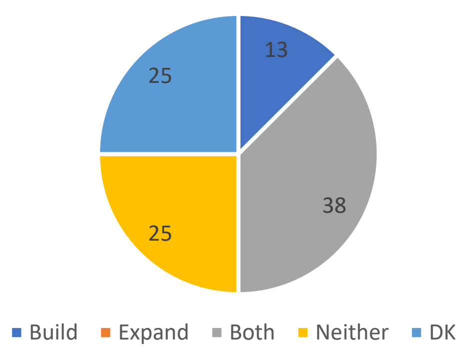

Figure 29. Emerging firms' responses when asked about projects for the next ten years in Uruguay (%)

Source: Own elaboration based on the surveyed sample
NB: the number of observations is 8.

In Chile, generation firms were asked if they would build new projects or expand their current projects (Figure 30). In the former situation, 69% of firms said yes. In the latter case, only 29% said yes. Regarding the construction phase of their future projects, more than three-quarters of the generation firms surveyed confirmed that they would resort to outsourcing. This confirms the previous findings of the concentration of employment creation in the temporary construction phase, especially for generation firms in Chile. This re-emphasizes the importance of considering that this creation of employment is temporary and delocalized when estimating the employment implications of investing in some of the technologies associated with this section.

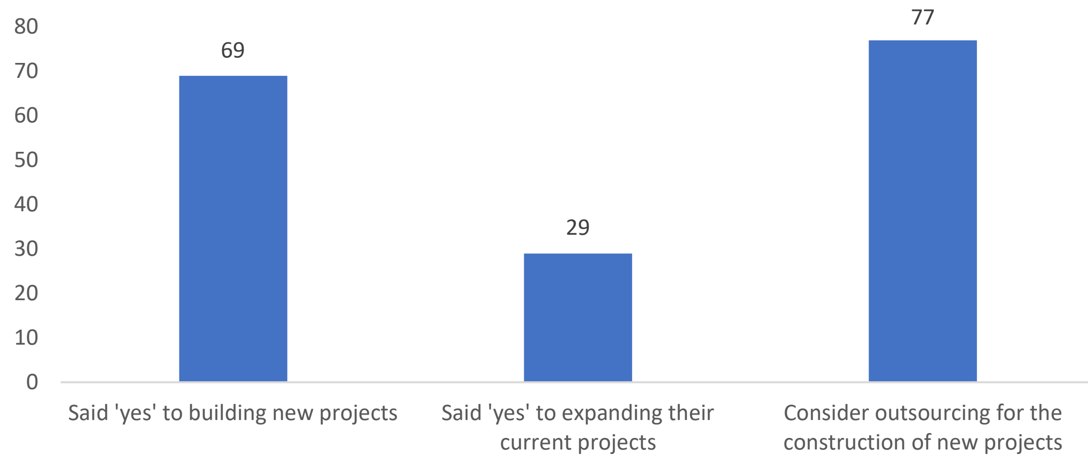

Figure 30. Responses of generation firms in Chile when asked about their investment projections (%)

Source: Own elaboration based on the surveyed sample

NB: the number of observations is 51, 49, and 35, from left to right, respectively.

5.3 Where the most jobs can be created

This section is interested in estimating the average number of jobs that can be created per million USD invested. Most of the literature has focused on the number of jobs created per installed capacity or potential, and less have looked at monetary investment, as detailed in the literature review. A review of the existing literature showed that on average, between 2 and 12[9] direct jobs could be created per million USD invested in generation firms (IEA, 2020) and between 7 and 45 direct jobs in emerging firms (IEA, 2020; Garrett-Peltier, 2017), depending on the technology and case study. In terms of the number of direct jobs created per MW installed, these vary between 0.5 (Parilla, 2017) and 5[10] (Renovar, 2018). We use these numbers as benchmarks. The references of these benchmarks can be found in Annex 1.

We tried to repeat this small exercise reported elsewhere in the literature by estimating overall how many jobs could be created: 1) if one million USD were to be invested in the generation or emerging sectors, and 2) per MW installed in generation. This estimation is rough but gives an estimate of what sector might create the most employment compared to others. The calculation was done by either looking at the total amount invested by the firm or by adding the amounts invested in the firm's largest three (five) projects in the case of Uruguay (Chile and Bolivia). A

[9] Including biofuels increases this number to 28 direct jobs. However, we do not have enough firms in biofuels that participated in the survey to include in our findings in such a way to avoid bias in the results.

[10] Including biogas would boost this number to 31 direct jobs. However, we do not have enough firms in biogas that participated in the survey to include in our findings in such a way to avoid bias in the results.

distinction is made between the operational phase of employment and that during the construction phase.

The estimates show that in all cases, generation firms create less employment than emerging firms, and less so if employment in the construction is not taken into account (Table 4). The number of jobs estimated does not fall too far away from our benchmark, though they are higher in Uruguay and lower in Chile. **The heterogeneity of these results between countries and across sectors highlights the importance of a microeconomic approach, as estimates will vary by technology, by sector, and by country.**

	Uruguay	Chile	Bolivia
Generation	11	3	3
Emerging	16	11	36

Table 4. The number of direct jobs created by investing one million USD[11]

Source: Own elaboration based on the surveyed sample

NB: the numbers of observations for Uruguay, Chile, and Bolivia are 15, 43, and 7 for generation firms, respectively, and 10, 20, and 3 for emerging firms, respectively.

To put these numbers into perspective, Figures 31 and 32 plug the values against our benchmarks[12]. In both cases, the values fall within the minimum and maximum benchmarks. In both generation and emerging firms, Chile seems to create less direct jobs than its counterpart, per million USD invested. In generation firms, Uruguay has the most job creation, and in emerging firms, Bolivia is at the top.

The case of Chile deserves further attention to understand why direct job creation, as we estimated it seems to be on the lower end, and this in spite of the inclusion of pre-operational construction workers, outsourced workers, and known future contracting in the case of generation firms. We took a closer look at this unexpected finding in order to provide partial explanations for this phenomenon. These have mostly to do with the structure of the energy market in Chile. Their sources are based on additional online research, common sense, and consultation with energy experts in Chile.

As discussed previously, a lot of the employment happens in the construction phase and is mostly outsourced. Recalling Figure 30 above, 77% of generation firms in Chile said they would outsource construction workers. The fact that the labor force would be coming from abroad is

[11] In the case of Chile, the number of direct jobs include those in the pre-operational construction phase, those that are outsourced, and future contracting, as these numbers are much more relevant and higher in the Chilean case compared to its counterparts. In the case of Bolivia, workers in the pre-operational construction phase and those that are outsourced, when information was available, are also included, for the same reason as Chile. In the Uruguayan case, whether or not pre-operational construction workers are included in the calculation does not significantly alter the estimates. They were also included, for comparative purposes. It is also worth noting that the number of direct jobs created for Uruguay is an average of the number of jobs created when UTE is included and when it is not, as it generates 50% of the country's energy. in addition, people who generate solar energy and resell it in Uruguay were excluded from these estimates because of high employment numbers where the distinction cannot be made between primary and secondary economic activities.

[12] To recall, these benchmarks were found in the studies of reference, which are all reported in Annex I.

even more relevant in the case of Chile, as we saw above that it had a much higher share of international ownership than firms in Uruguay.

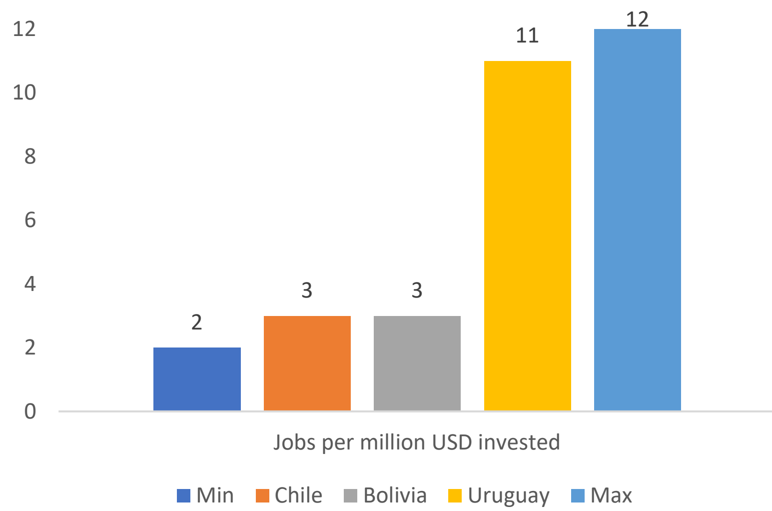

Figure 31. The number of direct jobs created in generation firms by investing one million USD in Chile, Bolivia, and Uruguay, compared to the benchmark

Source: Own elaboration based on the surveyed sample

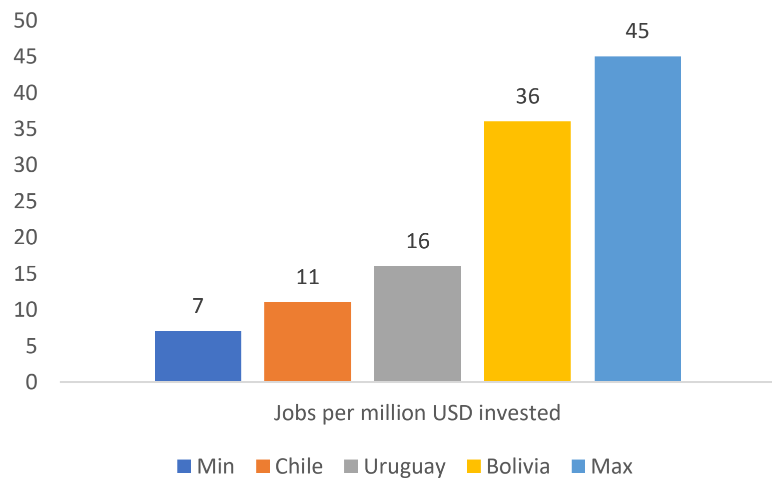

Figure 32. The number of direct jobs created in emerging firms by investing one million USD in Chile, Bolivia, and Uruguay, compared to the benchmark

Source: Own elaboration based on the surveyed sample

Another possible explanation has to do with the fact that some firms have a joint venture with another firm that might have been the one hiring most of the employees, which would then have been left out of the survey.

In addition, it is worth bearing in mind the difference in the industry's structure. For instance, in Uruguay, one publicly owned firm integrates transmission, distribution, and roughly 50% of generation). By contrast, in Chile, there is a fully unbundled and more competitive generation market composed of smaller firms. The market structure may impact job creation, as well as the ability of the survey to capture job creation. To capture the complete information of numerous firms through surveys can be more difficult than if it were of a smaller amount of firms[13]. Moreover, the operational phase of generation firms requires few workers, especially as in the case of Chile, a lot of the management is delocalized and happens from the capital city, Santiago, or even from abroad, such as Europe, depending on the origin of the parent company.

The difference between the Chilean case and that of Uruguay highlights the importance of taking structural factors into account when making estimates and delivering policy messages.

Looking at the number of jobs created per MW installed also reveals findings that fall within the benchmark found in the literature and described in section 2.4 (Figure 33). As previously, Chile and Bolivia stand on the lower end, while Uruguay seems to have the most job creation per MW installed.

Nonetheless, these estimates need to be interpreted cautiously, as they assume that the relationship between the number of jobs created and the installed capacity measured in MW is linear. In the case of the study by the ILO on Uruguay (Parilla, 2017), the actual installed capacity of the generation firms was kept as such when reporting the number of workers hired. Here, we are making linearity assumptions in order to compare the number of workers per MW installed.

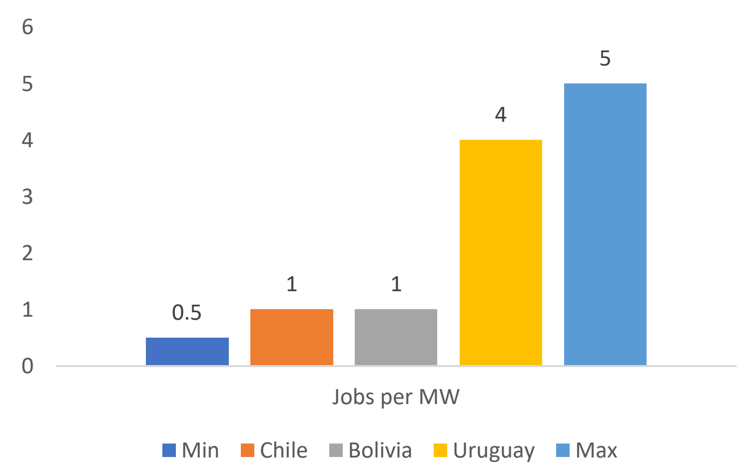

Figure 33. The number of direct jobs created in generation firms per MW installed in Chile, Bolivia, and Uruguay, compared to the benchmark

Source: Own elaboration based on the surveyed sample

Overall, one salient observation from Table 4 is the employment creation power of the emerging sector in all three case studies. As Figure 34 shows, the literature also reports that the

[13] In fact, with the recent 2015 Law on Electrical Public Bidding, the energy market in Chile was considerably opened up. In terms of installed capacity, though generation is still concentrated in the hands of seven to ten actors, as new projects came along, hundreds of firms started to develop engineering projects, negotiated fields, and presented projects to the environmental evaluation system for its consideration. Once environmental qualifications were obtained to allow construction, and after energy sales to mining or industrial independent clients, or regulated clients (through energy distribution firms) were allocated, these projects would then be sold or joint ventures would be developed for their construction and/or operation.

number of jobs created per million USD invested is superior in emerging firms compared to generation firms, both in terms of minimum and maximum numbers reported.

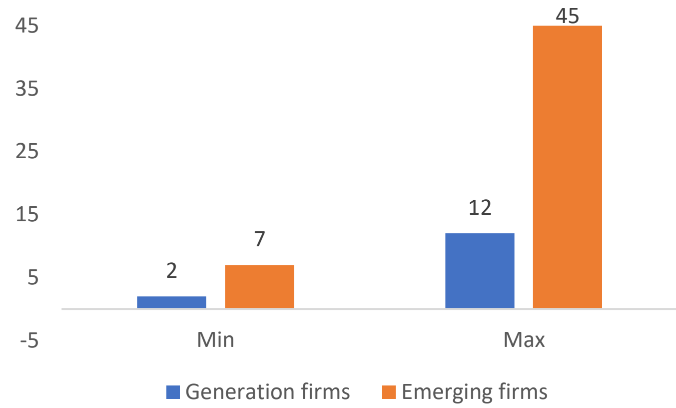

Figure 34. Benchmarks reported in the literature on the number of direct jobs created by investing one million USD

This is also the findings in the IEA 2020's Sustainable Recovery Report if looking at the number of jobs created in construction and manufacturing per million dollars of capital invested in some specific activity or industry related to the energy transition. These show that the emerging industry creates more jobs than the renewable energy sector in the "rest of the world", by contrast to advanced economies. Estimates in that report show that new vehicles, batteries, appliances, clean cooking stoves, and recycling are estimated to create between 9 and 45 jobs per million USD invested, with recycling being the most job-creating activity, compared to between 2 and 12 for wind, new nuclear, new hydro and solar PV.

While the overall finding that the emerging sector has a higher potential for job creation than the generation sector seems consistent with the literature, the specific number of jobs created per million USD and how it can be taken as a target needs to be considered cautiously for several reasons. First, the issue of temporality and outsourcing of work are important elements that need to be considered when putting these numbers into practice, as we saw that in some cases, these could considerably affect the employment outcome. Second, the fact that the samples are not always representative of the country's energy sector means that while these numbers are indicative, they should not be taken at face value. Third, other elements that we did not capture in the present work- through acknowledged- can also drive employment in one direction or another. As such, we neither pretend that the number of jobs created per million USD is linear nor that we accounted for all factors that could potentially affect job creation.

One lesson that we from the present work is the heterogeneity of outcomes between countries, in spite of some of them being neighbors. Whereas understanding this heterogeneity was beyond this work's scope, one could suppose that it lies in differences in labor markets, including demand and supply, in disparities in local demand for some technologies, and the existence of government incentives to use one technology over another, to cite a few examples. Moreover, further analysis of the causes and consequences of the differences in job creation is necessary for a better policy conclusion.

6. WHAT IS TOMORROW MADE OF?

One lesson learned from the present work is that different countries of the LAC region show different outcomes in terms of employment creation as they progress in their energy transition to reach their own targets. We saw that Bolivia, Chile, and Uruguay stand at different stages of their energy transition. Whereas the energy matrix in Uruguay has started moving towards more renewables over a decade ago, the transition has been more sluggish in Bolivia, two countries that are highly reliant on natural gas for their electricity generation. Chile, for its part, has been shown to be moving quickly. More importantly, all countries have shown commitment to transit towards greener energy.

Besides using renewable sources for electricity generation, we have also shown how other areas in the energy sector are contributing to the energy transition and can generate jobs, even more than the traditional areas, such as energy efficiency and sector digitalization.

The extent to which investment should be made in one sector over the other, or where the attention should be drawn nationally, remains an empirical question and should consider several dimensions, especially associated with the efficiency of the sector and their own strategy for the energy transition. As we showed, countries face different realities, and their energy and labor markets have different structures.

However, even with all the heterogeneity, the most important message that emanates from this study is that the emerging sector (i.e., firms in electric mobility, digitalization. hydrogen, storage, energy efficiency, battery, etc.) shows to have the biggest potential for employment creation in the energy transition. As the results from estimations showed, investing one million per USD in the emerging energy sector can create at least seven jobs, and as much as 49, depending on the country.

Based on our findings, it **(1) creates local, permanent, and directly contracted employment, (2) it is one of the sectors with the highest female participation, therefore creating an opportunity for job creation that would contribute to reducing the gender gap in the energy sector, (3) it hires more qualified labor force, on average, compared to the other sectors, and (4) one million USD invested in that sector generates considerably more employment than if it were invested in traditional areas of the value chain.**

The main policy takeaway is that to maximize benefits of the energy transition, it is important to combine holistic policies including energy goals (such as affordability and security of supply), but also, the development of value chain and labor skills. It is especially important in a context of innovation in which emerging firms have the highest potential to create high quality jobs. In order to fully benefit from it and meet future labor demand, it is important to increase the skills and qualifications of the labor force.

As demonstrated above, firms have difficulties recruiting, and emerging firms more. **Most of the respondents considered that they could not find workers with the required skills. Some even mention that it is extremely difficult to find degrees that match the required skills.** This situation is even more problematic in rural areas where the lack of expertise is higher (IDB, 2020).

As part of the survey's section on firms' difficulties to recruit, these appear to face the biggest challenges in recruiting workers with STEM qualifications to fill in positions of engineers and data scientists, for instance. **Recurrent themes mentioned by firms where there is not enough available or skilled labor force are associated with the transformation of the energy sector**. These are energy efficiency, new technologies, IT, automation, research and development, and environmental norms, to cite a few. Jobs at the intersection between digitalization and energy sector are an important group thar require more skills.

In spite of the difficulties they face, employers are still not linked to universities or centers of high-tech education to hire people with the background needed to perform the company's task. In addition, a similar percentage does not set up collaboration or cooperation agreements with universities or specialized centers to train its employees. Here, **there might be a potential to explore collaboration with universities both to hire and to train.**

One important aspect to take into account when looking at the results and thinking about policymaking is whether these profiles that are lacking require people trained at the university level in these fields, meaning that they will have to wait for a new generation of graduates, or whether some of these skills can be taught 'on the field' and therefore be added to an existing curriculum. This would help meet the employment and skills requirements of the firms at a **fast pace** and make the current labor force more qualified so that it is not just 'left aside' while waiting for the new, more, and better-qualified workforce. **The focus should therefore be on 'skilling the unskilled' through the use of online educational platforms, courses, and specific professional training. As the results from estimations showed, investing one million per USD in the emerging energy sector can create between 11 and 49 jobs, depending on the country.**

Another potential impact of the energy transition is gender equity in the energy sector. Historically, this sector has shown considerable inequity. The energy transition, if accompanied by adequate policies, can be a window of opportunity to transform the sector. Comparing the three analyzed countries, we observe high heterogeneity. Bolivia had its highest female share in engineering. For Uruguay, the highest female share was in the emerging sector, but not in the same sub-sector as Chile. In the former, the number of female employees is particularly high in solar panel installation. In the latter, it is higher in electric mobility compared to Uruguay. These different patterns illustrate the need for a tailored approach and for a pre-identification of where the biggest challenges lie and where training programs, if desirable, are most needed.

In other words, countries need to design their energy transition strategies involving all stakeholders in the process and addressing the challenges that they will face in order to make sure that all opportunities will materialize. This can be done in line with Article 4 of the Paris agreement and their long-term strategies and involving the Ministries of Environment and Energy, Labor, and Education, amongst others

In terms of future research, there are many topics related to the analysis of these labor markets associated with the energy transition that would need to be addressed. First, one might want to consider how much **financial public support** should be provided and at which technology it should be directed. Second, reducing **informal labor**, or at least increasing its reporting, is key. Its contribution to the economy is underreported, with the subsequent productive and fiscal consequences (Alaimo et al., 2015). This should also increase the security coverage against illness, unemployment, or old age, as informal labor still represents half of the paid workers in low- and medium-income countries (ILO, 2018a). Third, even if overall women are more educated than men, the **gender gap in terms of wage** has not disappeared or even reduced yet (O'Reilly et al., 2015), and when they join sectors where the male presence dominates, this pushes down salaries according to Murphy and Oesch (2015). Special attention on this area should be kept; as women are generally less present in jobs related to STEM or TIC areas and, when they do, they cover for the lowest specialized and worst paid jobs (ONU, 2019).

One additional area to explore would be to **electrify remote rural areas** where most of the poor population lives and where energy shortfall and a shortage of qualified job offers are additional problems for the quality of life of this population. The energy transition can, therefore, also become an opportunity to enhance electrification through sustainable means and renewable sources, especially in areas with a high contribution to the agricultural sector, therefore also creating an opportunity to develop better infrastructure provisions (Saget et al., 2020). Here there might also be an opportunity to **transform agricultural jobs into green energy-related jobs**, especially if some of these agricultural jobs were relying on non-renewable energy sources.

Finally, it will be interesting to look back to 2020 and 2021 a few years from now to estimate the **overall impact of the Covid-19**, if any, on employment in the energy sector. Whereas so far, the surveys we carried out this year do not reveal any trend of higher dismissals due to the sanitary crisis, there might be longer-term consequences on employment that we are not able to capture just yet. For instance, there is a big discussion around a 'green recovery' in the post-Covid-19 era. Could this be a once-in-a-lifetime opportunity to accelerate the transition and create greener jobs?

References

ACEEE, 2011. How Does Energy Efficiency Create Jobs? American Council for an Energy-Efficient Economy, Fact Sheet.

AEE, 2009. Estudio Macroeconómico del Impacto del Sector Eólico en España, Actualización 2009, Asociación Empresarial Eólica.

Almutairi, K., Thoma, G., Durand-Morat, A., 2018. Ex-Ante Analysis of Economic, Social and Environmental Impacts of Large-Scale Renewable and Nuclear Energy Targets for Global Electricity Generation by 2030. Sustainability 10. doi:10.3390/su10082884

Ansar et al., 2017. The influence of school culture on the performance of high school English teachers in Gorontalo province. International Journal of Education and Research, 5(10).

Atkinson, R., Castro, D., Ezell, S., 2009. The Digital Road to Recovery: A Stimulus Plan to Create Jobs, Boost Productivity and Revitalize America. The Information Technology & Innovation Foundation.

Balza, L., Blanco Vecchi, S., Snyder, V., and Unzueta, A. The time is now, tomorrow will be too late! Lithium, Li-ion batteries and the energy transition. IADB Energy Blog. Accessible from: https://blogs.iadb.org/energia/en/the-time-is-now-tomorrow-will-be-too-late-lithium-li-ion-batteries-and-the-energy-transition/

Becker, T., Sidhu, I., 2009. Electric Vehicles in the United States: A New Model with Forecasts to 2030. Center for Entrepreneurship & Technology, University of California Berkeley.

Blanco, M., Rodrigues, G., 2009. Direct Employment in the Wind Energy Sector: An EU Study. Energy Policy 37, pp. 2847-2857.

Bulavskaya, T., Reynes, F., 2018. Job Creation and Economic Impact of Renewable Energy in the Netherlands. Renewable Energy 119, pp. 528-538.

Cavallo, E., Powell, A., and Serebrisky, T., 2020. De Estructuras a Servicios: El Camino a una Mejor Infraestructura en América Latina y el Caribe. IDB Publication, IDB-BK-266. Accessible from: https://publications.iadb.org/publications/spanish/document/De-estructuras-a-servicios-El-camino-a-una-mejor-infraestructura-en-America-Latina-y-el-Caribe.pdf

Chilean Ministry of Energy, 2021. *Ministro de Energía anuncia que "para el 2025 habremos retirado el 50% de las centrales a carbón*", April 28. Accessible from: https://energia.gob.cl/noticias/nacional/ministro-de-energia-anuncia-que-para-el-2025-habremos-retirado-el-50-de-las-centrales-carbon.

E2 and E4thefuture, 2018. Energy Efficiency Jobs in America. Environmental Entrepreneurs and E4The Future.

ECO Canada, 2019. Energy Efficiency Employment in Canada. ECO Canada.

Eurofound and ILO, 2019. Working conditions in a global perspective, Publications Office of the European Union, Luxembourg, and International Labor Organization, Geneva.

Frondel, M., Ritter, N., Schmidt, C. M., & Vance, C., 2010. Economic impacts from the promotion of renewable energy technologies: The German experience. Energy Policy, 38(8), 4048-4056.

Garrett-Peltier, H., 2017. Green versus Brown: Comparing the Employment Impacts of Energy Efficiency, Renewable Energy, and Fossil Fuels Using and Input-Output Model. Economic Modelling 61, pp. 439-447.

Hendricks, B., Campbell, B., Goodale, P., 2010. Efficiency Works: Creating Good Jobs and New Markets through Energy Efficiency. Center for American Progress and Energy Resource Management Corp.

Hillebrand, B., Buttermann, H., Behringer, J., Bleuel, M., 2006. The Expansion of Renewable Energies and Employment Effects in Germany. Energy Policy 34, pp. 3484-3494.

ILO, 2012. Working Towards Sustainable Development: Opportunities for Decent Work and Social Inclusion in a Green Economy. International Labor Office, Geneva.

International Energy Agency, 2020. World Energy Outlook Special Report, Sustainable Recovery. IEA Publishing, Paris. Available from: https://www.iea.org/reports/sustainable-recovery

IRENA, 2019a. *Renewable Energy and Jobs Annual Review 2019*, International Renewable Energy Agency, Abu Dhabi.

IRENA, 2019b. *Renewable Energy: A Gender Perspective*, International Renewable Energy Agency, Abu Dhabi.

IRENA, 2021. *IRENA Statistics*. Available from: https://www.irena.org/Statistics/View-Data-by-Topic/Finance-and-Investment/Renewable-Energy-Finance-Flows

IRENA and ILO, 2021. Renewable Energy and Jobs- Annual Review 2021. International Renewable Energy Agency, International Labour Organization, Abu Dhabi, Geneva. Available from: https://www.irena.org/publications/2021/Oct/Renewable-Energy-and-Jobs-Annual-Review-2021

Jacobson, M. Z., Delucchi, M. A., Ingraffea, A. R., Howarth, R. W., Bazouin, G., Bridgeland, B., ... & Escher, G., 2014. A roadmap for repowering California for all purposes with wind, water, and sunlight. Energy, 73, 875-889.

Jacobson, M. Z., Delucchi, M. A., Bauer, Z. A., Goodman, S. C., Chapman, W. E., Cameron, M. A., ... & Erwin, J. R., 2017. 100% clean and renewable wind, water, and sunlight all-sector energy roadmaps for 139 countries of the world. Joule, 1(1), 108-121.

Janssen, R., Staniaszek, D., 2012. How Many Jobs? A Survey of the Employment Effects of Investment in Energy Efficiency of Buildings. Published by The Energy Efficiency Industrial Forum.

KEMA, 2008. The U.S. Smart Grid Revolution, KEMA's Perspectives for Job Creation. Prepared for GridWise Alliance.

Markandya, A., Arto, I., Gonzáles-Eguino, M., Román, M., 2016. Towards a Green Energy Economy? Tracking the Employment Effects of Low-Carbon Technologies in the European Union. Applied Energy 179, pp. 1342-1350.

Melaina, M., Bush, B., Eichman, J., Wood, E., Stright, D., Krishnan, V., Keyser, D., Mai, T., McLaren, J., 2016. National Economic Value Assessment of Plug-In Electric Vehicles, Volume I. National Renewable Energy Laboratory.

Mönnig, A., Schneemann, C., Weber, E., Zika, G., Helmrich, R., 2020. Electromobility 2035: Economic and Labor Market Effects through the Electrification of Powertrains in Passenger Cars. IAB-Discussion Paper, No. 8/2019.

Murphy, E.; Oesch, D. 2015. The feminization of occupations and change in wages: A panel analysis of Britain, Germany and Switzerland, SOEP Papers on Multidisciplinary Panel Data Research Paper No. 731, Feb., German Socio- Economic Panel Study (SOEP), DIW Berlin, Germany.

NASEO and EFI, 2020. U.S. Energy and Employment Report, 2020, Energy Efficiency. National Association of State Energy Officials and Energy Futures Initiative.

ONU (Naciones Unidas). 2017. Informe de los Objetivos de Desarrollo Sostenible (Nueva York, NY).

O'Reilly, J.; Smith, M.; Deakin, S.; Burchell, B. 2015. Equal pay as a moving target: International perspectives on forty-years of addressing the gender pay gap, Cambridge Journal of Economics, 39(2):299-317.

Parrilla, S., 2017. Uruguay: Empleos Verdes en el Sector de las Energías Renovables, Organización Internacional del Trabajo.

Pastor, C., Rivas, M., Brichetti, J., Dorr, J., Serebrisky, T., 2020. El potencial de la inversión en infraestructura para impulsar el empleo en América Latina y el Caribe. Inter-American Development Bank, Washington D.C.

Pollin, R., Garrett-Peltier, H., 2009. Building the Green Economy: Employment Effects of Green Energy Investments for Ontario. GEEA, Blue Green Canada and WWF-Canada.

Ram, M., Aghahosseini, A., Breyer, C., 2020. Job Creation during the Global Energy Transition towards 100% Renewable Power System by 2050. Technological Forecasting & Social Change 151.

Rehák, R., 2018. Electromobility in the European Union. Economy of Tourism and Entrepreneurship Scientific Journal 32, pp. 53-63.

REN21, 2020. Renewables 2020 Global Status Report, (Paris: REN21 Secretariat). Renewables Now. ISBN 978-3-948393-00-7.

Rijter, G., 2018. Generación de Empleo Energías Renovables, Programa RenovAr y MATER, Subsecretaría de Energías Renovables, Ministerio de Energía.

Rockefeller Foundation, Deutsche Bank, 2012. United States Buildings Energy Efficiency Retrofits: Market Sizing and Financing Models. The Rockefeller Foundation and DB Climate Change Advisor, Deutsche Bank Group.

Rojo, S., Epifanio, D., Ernst, C., Romero, C., 2020. Herramientas para la Investigación de los Efectos de la Producción Bioenergética sobre el Empleo en las Provincias. Organización de las Naciones Unidas para la Alimentación y la Agricultura, Organización Internacional del Trabajo.

Saget, C., Vogt-Schilb, A., and Luu, T., 2020. Jobs in a Net-Zero Emissions Future in Latin America and the Caribbean. Inter-American Development Bank and International Labour Organization, Washington D.C. and Geneva.

Simas, M., Pacca, S., 2014. Assessing Employment in Renewable Energy Technologies: A Case Study for Wind Power in Brazil. Renewable and Sustainable Energy Reviews 31, pp. 83-90.

Shortall, R., Davidsdottir, B., Axelsson, G., 2015. Geothermal Energy for Sustainable Development: A Review of Sustainability Impacts and Assessment Framework. Renewable and Sustainable Energy Reviews 44, pp. 391-406.

Sooriyaarachchi, T., Tsai, I., Khatib, S., Farid, A., Mezher, T., 2015. Job Creation Potentials and Skill Requirements in, PV, CSP, Wind, Water-to-Energy and Energy Efficiency Value Chains. Renewable and Sustainable Energy Reviews 52, pp. 653 - 668.

Sustainlabour and Fundación Biodiversidad, 2012. Green Jobs for Sustainable Development: A Case Study for Spain. Sustainlabour and Fundación Biodiversidad.

The Solar Foundation, 2020. The Solar Foundation, National Solar Jobs Census 2019, February 2020, available at http://www.SolarJobsCensus.org

U.S. Department of Energy, 2004. Buried Treasure: The Environmental, Economic and Employment Benefits of Geothermal Energy. Energy Efficiency and Renewable Energy, U.S. Department of Energy.

Viteri Andrade, A., 2019. Impacto económico y laboral del retiro y/o reconversión de unidades a carbón en Chile (Estudio desarrollado para el Ministerio de Energía de Chile).

Vogt-Schilb, A., Feng, K., 2019. The labor impact of coal phase down scenarios in Chile. Inter-American Development Bank. https://doi.org/10.18235/0001961

Vogt-Schilb, 2021. *Stronger Sustainable Growth.* In Eduardo Cavallo and Andrew Powell, Coordinators, "Opportunities for Stronger and Sustainable Postpandemic Growth." InterAmerican Development Bank.

Annex I: Main characteristics of reviewed studies

Author	Location	Sector	Methodology	Gross vs. Net	Other	Findings (n° of jobs per million of USD invested / n° of jobs per MW of installed capacity)
ACEEE (2011)	US	Energy Efficiency	Use of multipliers / Direct, indirect, and induced	Gross	full-time jobs per million. Multipliers are derived from the IMPLAN US model 2009.	21 per million USD over life cycle investment; 45 full-time direct, indirect,, and induced in the first year per million USD
Almutairi et al. (2018)	Global	Renewables	Forecast using a Computable General Equilibrium model/ Direct and Indirect	Net	This study found negative effects: -analysis per MW during operation and maintenance, ignoring development, manufacturing, construction stages	
Atkinson et al. (2009)	US	Smart Grid	I-O multipliers / direct, indirect, and induced	Net		
Becker and Sidhu (2009)	US	Electric vehicles	Forecasts using revenue-per-employee ratios	Net	Authors use the revenue-per-employee ratios of comparable industries in the 2009 Forbes survey of U.S. industries	
Blanco and Rodrigues (2009)	Europe	Wind	Analytical / Direct	Gross	Gender	
Bulavskaya and Reynes (2018)	Netherlands	Renewables	Forecast: multi-sector macro-economic model / Direct, indirect, and induced	Net	The model is a type of neo-Keynesian Computable General Equilibrium Model	
E2 and E4thefuture, 2018	US	Energy Efficiency	Official numbers from the U.S. Bureau of Labor Statistics and a supplemental survey (Analytical)	Gross		
ECO Canada (2019)	Canada	Energy Efficiency	Survey / Direct	Gross		
Frondel, 2010	Germany	Renewables	I-O multipliers/	Gross		

			Direct and Indirect			
Garrett-Peltier (2017)	US	Energy Efficiency	Input-Output / Direct and indirect	Net and Gross	full-time jobs per million invested	5 per million USD on average (2 in fossil fuels, 7.5 in renewables)
Hendricks et al. (2010)	US	Energy Efficiency (buildings)	Use of multipliers / Direct and indirect	Gross		
ILO, 2012	Global	Energy, Buildings, Transportation and other sectors	Direct	Gross	For the case of Germany, referenced in the literature review, numbers are provided by the German Ministry of Transport.	
International Energy Agency, 2020	Global	Green economy	Multipliers from I-O national tables / Analytical Direct and Indirect	Net		2-12 per million USD (generation); 9-45 per million USD (emerging)
IRENA (2019a)	Global	Renewables	Analytical / Direct and indirect	Gross	Gender and type of jobs considered	
Jacobson et al. (2014)	California	Green economy	Forecast model / Direct, indirect, and induced	Net	Based on the I-O model developed by NREL. https://www.nrel.gov/analysis/jedi/methodology.html	
Jacobson et al. (2017)	139 Countries	Green economy	Forecast model / Direct, indirect, and induced	Net	Based on the I-O model developed by NREL. https://www.nrel.gov/analysis/jedi/methodology.html	
Janssen and Staniaszek (2012)	EU	Energy Efficiency (buildings)	Literature Review	Net	-full-time jobs per million	19 per million euros (energy efficiency)
Markandya et al. (2016)	European Union	Green energy	Input-output/ Direct, indirect	Net	Finds positive and negative net effects depending on the country	
Melaina et al. (2016)	US	Electric vehicles	Forecast: using an I-O model / Direct	Net		
Mönnig et al. (2020)	Germany	Electrification of passenger trains	Forecast using an Input-Output model / Direct, Indirect and Induced	Net		
NASEO and EFI, 2020	US	Energy storage	Survey / Direct	Gross		

Parrilla, 2017	Uruguay	Renewables	Analytical / Direct	Gross	Considers permanent vs non-permanent jobs	133 per 100MW (solar); 73 per 100MW (biogas); 34 per 100MW (wind)[14]
Pollin and Garrett-Peltier (2009)	Ontario, Canada	Demand Mgmnt, Smart Grids, Conservation	I-O / Direct and indirect	Gross		7 per million USD in smart grid 9 per million USD in demand management
Ram et al. (2020)	Global	Renewables and storage	Forecast model (Analytical) / Direct	Net		
Rijter, 2018	Argentina	Renewables	Analytical / Direct	Gross	In construction and maintenance stages	31 per MW (biogas); 4 per MW (wind); 6 per MW (solar)
Rojo et al. (2020)	Argentina	Biofuel	Analytical / Direct, indirect, induced	Gross	Analyze employment quality	
Saget (2020)	Latin America and the Caribbean	Input-Output	Analytical / Direct and indirect	Net		
Shortall et al., 2015	US	Geothermal	Direct (Survey), Indirect and Induced (I-O model)	Gross	Numbers were taken from: Jennejohn, 2010. Green Jobs Through Geothermal Energy. Geothermal Energy Association.	
Sooriyaarachchi et al. (2015)	Germany, Spain, US, and Middle Eastern	Renewables	Input-output/ Direct, indirect	Gross		
Sustainlabour and Fundación Biodiversidad, 2012	Spain	Green energy	Analytical / Direct and indirect	Gross		
The Solar Foundation, 2020	US	Solar	Analytical / Direct and indirect	Gross	Gender and race	3 per MW

[14] In the report of results from this study, we assume that the number of jobs created per MW installed is linear, for the sake of estimates and comparison.

Annex II: Baseline survey

CREACIÓN DE EMPLEO EN EL SECTOR DE ENERGÍA ASOCIADO A LA TRANSICIÓN VERDE

Fecha Encuesta		Hora Inicio		Hora término	
Nombre Encuestador/a					

Estimado/a (…),

Buenos días / tardes. Mi nombre es (….). Estoy realizando una encuesta para el Banco Interamericano de Desarrollo (BID). Esta encuesta busca estimar la creación de empleos a futuro en el marco de la transición a energías más sustentables. Su empresa ha sido elegida por ser parte de este proceso de transformación social, económico y ambiental.

Esta encuesta dura aproximadamente media hora, y podemos realizarla ahora mismo, o bien en un horario donde le acomode.

Sus respuestas quedaran en absoluta reserva y anonimato, y los resultados serán presentados de manera agregada, y en ningún caso se identificará a alguna empresa en particular.

(SI LO SOLICITA EL ENCUESTADO) **INFORMACIÓN ADICIONAL SOBRE EL ESTUDIO**

El objetivo principal del presente estudio es recopilar datos sobre el número y los tipos de puestos de trabajo creados en las distintas empresas que participan del sector energético en Chile, específicamente en energías renovables, eficiencia energética, gestión de la demanda, electromovilidad, hidrógeno, geotermia y almacenamiento, con el fin de compararlos entre los diferentes sectores y hacer estimaciones sobre cuántos puestos de trabajo y de qué tipo se pueden crear si se realiza una determinada inversión en este sector.

A. CARACTERIZACIÓN GENERAL

A.i.- Identificación del Encuestado

1. Nombre de entrevistado/a			
2. Cargo de entrevistado			
3. Nivel de Estudios (último aprobado)			
4. Correo o teléfono			
5. Años en la empresa		**7. Sexo**	Mujer (1) Hombre (2)

A.ii.- Identificación de la Empresa

8. Nombre o razón social de la empresa	
9. Rut de la empresa (VALIDAR)	

10. (FILTRO) ¿Es esta una empresa de generación de energía?

Sí	1	**Continuar**
No	2	**Finalizar encuesta**

10.1. (TIPIFICACIÓN DE EMPRESAS - DEFINICIÓN MUESTRA) **Además de la generación de energía, ¿esta empresa realiza alguna de las siguientes actividades? (RESPUESTA MÚLTIPLE)**

Distribución	2
Transmisión	3
Empresas de Ingeniería, Consultoras y Fondos de Inversión	4
Constructora	5
Operación y mantenimiento centrales eléctricas	6
Autogeneración	
Otra ¿Cuál?:	

11.1. ¿Cuál es el nombre de la planta o instalación?

11.2. ¿Cuándo se APROBÓ ambientalmente este proyecto? (ANOTAR AÑO DE APROBACIÓN)

11.3. ¿Cuándo se comenzó a CONSTRUIR esta central o planta? (ANOTAR AÑO DE CONSTRUCCIÓN)

11.4. ¿Cuál es la fecha de INICIO DE OPERACIÓN DE de esta central o planta? (ANOTAR AÑO DE INICIO DE LAS OPERACIONES, DE LA PRIMERA PLANTA SIN CONSIDERAR AMPLIACIONES POSTERIORES)

11.1.	
11.2.	
11.3	
11.4	

12. ¿El porcentaje mayor de propiedad de esta empresa es internacional o nacional?

Internacional	**1**	**Nacional**	**2**

12.1.País de origen	

13. REGIÓN donde se encuentra la casa matriz (DEFINICIÓN MUESTRA)

14. REGIÓN donde tiene proyectos la empresa (MÚLTIPLE)

Región	P13	P14
Arica y Parinacota	15	15
Tarapacá	1	1
Antofagasta	2	2
Atacama	3	3
Coquimbo	4	4
Valparaíso	5	5
Metropolitana	13	13
O'Higgins	6	6
Maule	7	7
Ñuble	16	16
Biobío	8	8
Araucanía	9	9
Los Ríos	14	14
Los Lagos	10	10
Aysén	11	11
Magallanes	12	12

B. PRODUCCIÓN Y PROVISIÓN DE INSUMOS DE EMPRESAS GENERADORAS

15. ¿Cuál es la capacidad instalada de su empresa? (MW)

16. ¿Cuál es la cantidad de energía producida anual? (GWh)

15.	Energía producida	
16.	Capacidad instalada	

17. **Qué tipo de tecnologías usan para generar energía?** (PREGUNTAR SEGÚN CORRESPONDA – FILTRO POR TIPO DE ENERGÍA)

18. (EN FUNCIÓN DE RESPUESTA ANTERIOR)(SI ES MÁS DE UN PAÍS, ANOTAR PORCENTAJE EXTRANJERO Y NACIONAL) **¿Qué porcentaje es chileno y qué porcentaje es extranjero?**

19. **¿Qué empresa es la proveedora de esta tecnología?**

Tecnologías	P 17	18 % tecnología		19. Proveedor
		Nacional	Internacional	
MiniHidro de Pasada	1			
Hidráulica de Pasada	2			
Hidráulica de Embalse	3			
Hidráulica océano (Pumped Storage)	4			
Mareomotriz	5			
Solar Fotovoltaica	6			
Solar Térmica	7			
Eólica	8			
Biomasa	9			
Biogás	10			
Biocombustible líquido	11			
Geotérmica	12			
Energía a partir de desechos (waste energy)	13			
Termoeléctrica a Gas Natural	14			
Termoeléctrica a Carbón	15			
Termoeléctrica Diesel	16			

C. CERTIFICACIÓN DE ENERGÍA LIMPIA

20. **¿Su empresa tiene alguna certificación de huella de carbono o de energía renovable no convencional ?**

Si	**1**
No	**2**
NS/NR	**9**

D. ESTRUCTURA DE EMPLEO

21. A continuación, le solicitaré información general de la empresa y de sus trabajadores considerando los <u>últimos datos que tenga disponibles.</u> (SI NO TIENE LA CIFRA EXACTA A MANO ENTREGUE DATOS APROXIMADOS) (SI NO SABE, ANOTE 99)

21. a	N° de trabajadores total de la empresa	
21. b	N° de trabajadores mujeres total	
21. c	N° de trabajadores en esta filial u operación	
21. d	N° de trabajadores extranjeros	
21. e	N° de trabajadores con discapacidad	

<u>Glosario</u>: Trabajadores: propios de la empresa, considerando todos los tipos de contratos y tipos de jornadas. Se excluye los trabajadores subcontratados. 7

22. ¿Cuál es la modalidad de turnos predominantes en su empresa? (Ejemplo: 5x2 o de lunes a viernes, 6x1, etc) (SI NO SABE ANOTE 99)

SISTEMA DE TURNOS PREDOMINANTE	

23. Previo a la entrada en operación de su empresa, ¿Cuántos trabajadores participaron del proceso de construcción? (SI NO SABE ANOTE 99)

24. ¿Cuánto duró la construcción? (ANOTAR CANTIDAD DE AÑOS)(SI NO SABE ANOTE 99)

Nº de TRABAJADORES	
TIEMPO TOTAL DE CONSTRUCCIÓN	

25. **¿Qué cantidad de trabajadores contrató de manera directa en los siguientes servicios o funciones?:** (SI NO SABE ANOTE 99, SI NO CONTRATÓ, ANOTE 0)

	Nº Trabajadores
Construcción	
Instalación de máquinas / tecnología	
Mantenimiento	
Compra de insumos y tecnología	
Investigación y Desarrollo	
Reparaciones	
Servicios generales (Limpieza, seguridad)	
Transporte	
Retiro de desechos, residuos o reciclaje	
Otros:	

E. TRABAJADORES Y CALIFICACIÓN

26. **Y de acuerdo a la siguiente clasificación de nivel educacional ¿Cuántos trabajadores tienen los siguientes perfiles o calificaciones?** (SI NO SABE ANOTE 99)
27. **¿Cuántas son mujeres?** (SI NO SABE ANOTE 99)

Nivel educacional	**P26 N°**		**P27 Mujeres N°**	
a. Sin educación formal	26.a		27.a	
b. Educación básica o media no finalizada	26.b		27.b	
c. Enseñanza media finalizada	26.a		27.a	
d. Educación técnica o universitaria no finalizada	26.c		27.c	
e. Educación universitaria finalizada	26.d		27.d	

En las siguientes preguntas, consultaremos por los perfiles de su empresa separados en 3 categorías:

STEM: Es decir: *Puestos con formación en carreras universitarias y terciarias vinculadas con ciencia, tecnología, ingeniería y matemáticas (por sus siglas en inglés Science, Technology, Engineering, Mathematics). Son profesiones incluidas, por ejemplo, las siguientes: Ingenieros, Técnicos eléctricos/electrónicos/electromecánicos/mecánicos/otros; físicos; químicos; programadores; analistas de sistemas; matemáticos; meteorólogos; geólogos; científicos ambientales; arquitectos.*

NO STEM: *Otros profesionales con formación profesional pero fuera de las categorías mencionadas antes.*
NO CALIFICADOS: *Es decir, que solo cuentan con estudios de educación básica o media finalizados.*

Por lo tanto, al clasificar los perfiles que le voy a nombrar, por favor le solicito separar estas categorías.

28.a. En la empresa ¿cuántos trabajadores del directorio califican como STEM? (SI NO TIENE LA CIFRA EXACTA A MANO, ENTREGUE DATOS APROXIMADOS) (SI NO RESPONDE→ DIGITAR 99)

28.b. ¿Cuántas de ellos son mujeres?

28.c. ¿Y cuántos Gerentes califican como STEM?

28.d.¿Cuántas de ellos son mujeres?

29.a. ¿Cuántos miembros del directorio califican como profesionales NO STEM?

29.a. ¿Cuántas de ellos son mujeres?

29.b. ¿Y cuántos Gerentes califican como NO STEM?

29.c. ¿Cuántas de ellos son mujeres?

30.a. ¿Cuántos gerentes son NO CALIFICADOS?

30.b.¿Cuántas de ellos son mujeres?

30.c.¿Y cuántos Gerentes son NO CALIFICADOS?

30.d.¿Cuántas de ellos son mujeres?

Perfiles/funciones	**P28 STEM**				**P29 NO STEM**				**P30 NO CALIFICADO**			
		Total		**Mujeres**		**Total**		**Mujeres**		**Total**		**Mujeres**
a. Directorio	28.a		28.c		29.a		29.c		30.a		30.c	
b. Gerencia	28.b		28.d		29.b		29.d		30.b		30.d	

31. **Y de las siguientes funciones ¿Cuántos trabajadores corresponden a…?** (SI NO TIENE LA CIFRA EXACTA A MANO, ENTREGUE DATOS APROXIMADOS) (SI NO RESPONDE→ DIGITAR 99)
32. **¿Cuántas son mujeres?** (SI NO TIENE LA CIFRA EXACTA A MANO, ENTREGUE DATOS APROXIMADOS) (SI NO RESPONDE→ DIGITAR 99)

Perfiles/funciones	**P31 N°**		**P32 Mujeres**	
a. Profesionales y técnicos STEM* (Ciencia, tecnología, ingeniería y matemáticas)	31.a		32.a	
b. Profesionales y técnicos NO STEM (Administración, Finanzas, Abogados, diseñadores, relacionadores, etc)	31.b		32.b	

33. **Y respecto a los trabajadores sin calificación, de las siguientes funciones ¿Cuántos trabajadores corresponden a…?** (SI NO TIENE LA CIFRA EXACTA A MANO, ENTREGUE DATOS APROXIMADOS) (SI NO RESPONDE→ DIGITAR 99)
34. **¿Cuántas son mujeres?** (SI NO TIENE LA CIFRA EXACTA A MANO, ENTREGUE DATOS APROXIMADOS) (SI NO RESPONDE→ DIGITAR 99)

Perfiles/funciones	**P33 N**		**P34 Mujeres**	
c. Construcción (obreros, operarios, construcción)	33.a		34.a	
d. Servicios (Limpieza, guardias de seguridad)	33.b		34.b	
e. Otros (especificar):	33.c		34.c	

35. **¿Cuál fue la dotación promedio del último año?** (SI NO TIENE LA CIFRA EXACTA A MANO, ENTREGUE DATOS APROXIMADOS) (SI NO RESPONDE→ DIGITAR 99)
    a. **¿Cuántas de ellos fueron mujeres?**
36. **¿Podría indicar el número total de trabajadores que fueron contratados en el último año?** (INCLUYENDO LOS REEMPLAZOS POR DESVINCULACIONES Y/O RENUNCIAS).
    a. **¿Cuántas de ellos fueron mujeres?**
37. **¿Cuántas personas han sido desvinculadas durante el año 2020?**

a. ¿Cuántas de ellas fueron mujeres?

38. ¿Cuál es la dotación de la empresa al día de hoy?

a. ¿Cuántas de ellas son mujeres?

	35. Promedio 2019	36. Trabajadores Contratados 2019	37. Trabajadores Desvinculados durante 2020	38. Dotación Contratados a la fecha
Nº de trabajadores				
Nº Mujeres				

39. ¿En el último año ha tenido dificultades para reclutar y contratar trabajadores?

	P39 RECLUTAR Y CONTRATAR	
Si	1	CONTINUAR
No	2	PASAR A PREGUNTA 42
NS/NR	99	

40. ¿Me pueden indicar en cuál o cuáles perfiles u ocupaciones tuvo mayor dificultad para reclutar y contratar trabajadores?

41. ¿Y cuál ha sido la principal dificultad? (PREGUNTAR PARA CADA OCUPACIÓN NOMBRADA)

	P40. Perfiles u Ocupaciones donde se dificultó reclutamiento y contratación	P41. Razones
Ocupación 1		
Ocupación 2		
Ocupación 3		

F. CALIDAD DEL EMPLEO

42. Durante 2019 y hasta antes de la pandemia ¿Reportó algún accidente laboral? (ANTE SUBSECRETARÍA DE SEGURIDAD SOCIAL (SUSESO))

Si	1
No	2
NS/NR	99

42.1. ¿Cuántos accidentes reportó?

Accidentes laborales (aproximado)	

43. ¿A cuantos trabajadores tiene usted contratados con pago de cotizaciones mensual?

44. ¿Y Cuántos trabajadores tiene contratados a honorarios?

	Cantidad de trabajadores

43.Contrato	
44. Honorarios	

45. ¿Su empresa ofrece algún seguro complementario de salud a sus empleados?

Si	1
No	2
NS/NR	99

45.1 ¿Cuantos empleados del total son miembros de este seguro?

Empleados con seguro de salud	

G. DEMANDAS Y NECESIDADES DE CAPACITACIÓN

46. Para reclutar personal para su planta, ¿se vincula con universidades o centros tecnológicos?

47. ¿Y para capacitar a su personal?

	P46 RECLUTAMIENTO	P47 CAPACITACIÓN
Si	1	1
No	2	2
NS/NR	99	99

48. De las siguientes razones que comúnmente dan las empresas para capacitar a sus trabajadores, ¿Me puede indicar cuán importante es cada una de ellas, utilizando una escala de 1 a 5 donde 1 significa "Nada importante" y 5 "Muy importante"? (LEER ESCALA, NOMBRAR Y REGISTRAR UNA A UNA)

RAZONES DE CAPACITACIÓN		NIVEL DE IMPORTANCIA					
		Nada Importante	2	3	4	Muy Importante	NS/NR
48.a	Disminuir brechas en competencias técnicas	1	2	3	4	5	9
48.b	Incorporación de nuevas tecnologías	1	2	3	4	5	9
48.c	Programas de crecimiento en la línea de carrera	1	2	3	4	5	9
48.d	Desarrollo de capacidades conductuales	1	2	3	4	5	9
48.e	Cumplimiento de estándares de seguridad	1	2	3	4	5	9
48.f	Otro (REGISTRAR ABAJO LITERAL)						
47. Otra	¿Cuál?:						

49. ¿La empresa utiliza el modelo de competencias laborales definidas por el Sistema Nacional de Competencias Laborales – ChileValora? (Para energías renovables, códigos CIIU 3510 y CIUO 2151)?

Si	1
No	2
NS/NR	99

50. **Por favor, indique cuáles son las temáticas en las que usted considera que necesitaría capacitar a su personal para el proceso de transición energética de su empresa.** Pueden estar referidas a aspectos técnicos específicos o a conocimientos generales.
51. **Y a su juicio, ¿quiénes dentro de la empresa requieren más esa capacitación para actualizarse en dicha temática?** (CONSULTAR PARA CADA TEMÁTICA NOMBRADA)

	P50. Temáticas Perfiles u ocupaciones que necesita capacitar	P51. Ocupaciones o perfiles que requieren más esa capacitación
Temática 1		
Temática 2		
Temática 3		

H. INVERSIÓN / GASTOS

52. **¿El proyecto ha contado o cuenta con apoyo o financiamiento del estado de Chile para su etapa de diseño, construcción, operación y mantenimiento?** (CONSIDERANDO INSTRUMENTOS ESTATATALES: CONCESIONES DE TERRENOS DE BIENES NACIONALES, FONDOS DE INVERSIÓN TECNOLÓGICA -CORFO-, SUBSIDIOS O EXCENCIONES TRIBUTARIAS)
53. **¿El proyecto cuenta con algún tipo de apoyo financiamento internacional de alguna institución (independiente del capital de los propietarios) para su etapa de diseño, construcción, operación y mantenimiento?**
54. (PARA CUALQUIERA DE LOS CASOS) **¿Cuál es el nombre de esta institución?**

	Apoyo o financiamiento del Estado de Chile	Apoyo o financiamiento instotución internacional	INSTITUCIÓN
Diseño	1	1	
Construcción	2	2	
Operación	3	3	

55. **A continuación le consultaré por una serie de gastos propios de una empresa, me gustaría que pudiera indicar montos aproximados de los mismos para hombres y mujeres por separado en el tipo de moneda en la que usted le acomode en montos anuales.** (ANOTAR MONEDA DEFINIDA: USD, CLP, ETC)

	Hombres	**Mujeres**
a. Gastos en remuneraciones <u>STEM*</u> (Salarios brutos, contribuciones patronales y pagos que no generan contribuciones sociales. Incluye comidas, transportes pagos y otros beneficios.)		
b. Gastos en remuneraciones otros profesionales (Calificados/ NO STEM) (Salarios brutos, contribuciones patronales y pagos que no generan contribuciones sociales. Incluye comidas, transportes pagos y otros beneficios.)		
c. Gastos en remuneraciones no profesionales (No calificados o sin formación) (Salarios brutos, contribuciones patronales y pagos que no generan contribuciones sociales. Incluye comidas, transportes pagos y otros beneficios.)		

**STEM: puestos con formación en carreras universitarias y terciarias vinculadas con ciencia, tecnología, ingeniería y matemáticas (por sus siglas en inglés Science, Technology, Engineering, Mathematics).*

Son profesiones incluidas, por ejemplo, las siguientes: Ingenieros, Técnicos eléctricos/electrónicos/electromecánicos/mecánicos/otros; físicos; químicos; programadores; analistas de sistemas; matemáticos; meteorólogos; geólogos; científicos ambientales; arquitectos.

56. **A continuación le consultaré por una serie de gastos propios de una empresa, me gustaría que pudiera indicar montos aproximados, esta vez sin diferenciar hombres y mujeres en el tipo de moneda en la que usted le acomode en montos anuales.** (ANOTAR MONEDA DEFINIDA: USD, CLP, ETC)

d. Costo de <u>materiales</u> para la prestación de servicios (Comprende aquellos bienes no durables que se consumieron en el proceso productivo, sin ser materia prima.)	

57. **A continuación le consultaré por una serie de gastos propios de una empresa, me gustaría que pudiera indicar montos aproximados, en el tipo de moneda en la que usted le acomode en montos anuales.** (ANOTAR MONEDA DEFINIDA: USD, CLP, ETC)

e. Costo de materias primas y materiales consumidos en la producción (Completar con nombre de materia prima según orden de importancia.)	Materia prima 1	$
	Materia prima 2	$
	Materia prima 3	$
f. Trabajos industriales realizados por terceros (Completar con nombre de los trabajos según orden de importancia)	Servicios 1	$
	Servicios 2	$
	Servicios 3	$

58. **Continuando con los gastos, le consultaré por una serie de gastos propios de su empresa, me gustaría que pudiera indicar montos aproximados en el tipo de moneda en la que usted le acomode en montos anuales.** (ANOTAR MONEDA DEFINIDA: USD, CLP, ETC)

g. Contratación de trabajos de construcción, refacción o reparación de equipos o de infraestructura	
h. Servicios prestados por terceros	
i. Fletes contratados	
I. Energía eléctrica, combustibles y lubricantes (también para autoconsumo)	
J. Impuestos (Comprende impuestos provinciales -incluido Ingresos Brutos-, nacionales y tasas municipales. Excluye IVA deducible, impuestos internos, a los combustibles, a las ganancias y a todos los específicos sobre bienes y servicios.)	

I. VINCULACIÓN O SUBCONTRATACIÓN

59. Actualmente, ¿su empresa subcontrata servicios a otras empresas?

Si	1	Continuar
No	2	Pasar a pregunta 62
NS/NR	9	

60. Actualmente, en cuáles de los siguientes servicios su empresa acude a la subcontratación: (LEER UNO A UNO) (RESPUESTA MÚLTIPLE)**:**

60.1. ¿Cuántas empresas tiene subcontratadas en este servicio en la actualidad?

60.2. ¿Cuánto personal o cantidad de trabajadores hombres tiene subcontratado actualmente en cada servicio?

60.3. ¿Cuánto personal o cantidad de trabajadores mujeres tenía subcontratado en cada servicio?

61. En el proceso anterior a la entrada en operación de su empresa, en cuáles de los siguientes servicios su empresa acudió a la subcontratación (RESPUESTA MÚLTIPLE)**:**

61.1. Aún pensando antes de la entrada en operación ¿Cuántas empresas tenía subcontratadas en este servicio?

61.2. ¿Cuánto personal o cantidad de trabajadores hombres tenía subcontratado en cada servicio?

61.3. ¿Cuánto personal o cantidad de trabajadores mujeres tenía subcontratado en cada servicio?

	Actualidad				Pasado			
	P 60	P60.1 Nº Empresas	P60.2 Nº Trabajadores Hombres	P60.3 Nº Trabajadores Mujeres	P 61	P61.1 Nº Empresas	P61.2 Nº Trabajadores	61.3 Nº Trabajadores Mujeres
Mantenimiento	1				1			
Compra de insumos y tecnología	2				2			
Investigación y Desarrollo	3				3			
Construcción y reparaciones	4				4			
Servicios generales (Limpieza, seguridad)	5				5			
Transporte	6				6			
Retiro de desechos, residuos o reciclaje	7				7			
Otros:	8				8			

J. PROYECCIONES DE INVERSIÓN Y CONTRATACIÓN

62. Finalmente, en cuando a las proyecciones de su empresa y la energía renovable, usted ¿Cuál diría que es la principal razón que motiva a esta empresa a generar este tipo de energía?

Programas de gobierno y estatales que impulsan estas medidas	1
La creciente demanda de este tipo de energía	2
Por un compromiso con el Medio Ambiente	3
Otra (Cuál?):	4

63.1. En los próximos 10 años, ¿Tienen planes para construir nuevos proyectos?

63.2. ¿Y tienen considerado ampliar los proyectos existentes?

	63.1 Construir	63.2 Ampliar	
Si	1	1	Continuar
No	2	2	

(NO LEER) Dada la situación, no lo tienen claro	3	3	Finalizar encuesta si responde NO en ambas
NS/NR	99	99	

64. En qué plazo pretende construir este o estos nuevos proyectos (el más próximo)?

64.1. ¿Y ampliar?

64. Construir (Nº de Años)	
64.1 Ampliar (Nº de Años)	

65. ¿Me puede indicar de qué manera es probable que ejecute los siguientes servicios de manera directa o subcontratados para este o estos nuevos proyectos?

66. (PARA CONTRATACIONES DIRECTAS) **¿Cuántos trabajadores cree que contrate de manera directa en este servicio, para este o estos nuevos proyectos?**

67. (PARA SUBCONTRATACIONES) **¿Cuántos trabajadores cree que se subcontraten en este servicio para este o estos nuevos proyectos?**

	P65		P66		P67	
	Directa	Subcontratado	Nº trabajadores Directos		Nº Trabajadores subcontratados	
a. Construcción y reparaciones	1	2	a.		a.	
b. Instalación de máquinas	1	2	b.		b.	
c. Compra de insumos y tecnología	1	2	c.		c.	
d. Investigación y Desarrollo	1	2	d.		d.	
e. Mantenimiento	1	2	e.		e.	
f. Servicios generales (Limpieza, seguridad)	1	2	f.		f.	
g. Transporte	1	2	g.		g.	
h. Retiro de desechos, residuos o reciclaje	1	2	h.		h.	
i. Otros:	1	2	i.		i.	

EN NOMBRE DEL BANCO INTERAMERICANO DE DESARROLLO LE AGRADECEMOS SU TIEMPO Y DISPOSICIÓN PARA PARTICIPAR DE ESTE ESTUDIO QUE BUSCA PROYECTAR LA GENERACIÓN DE EMPLEOS VERDES PARA LA REGIÓN.

Annex III: Survey in the case of Uruguay

Número de planilla :

Cód. Encuestador:

Cuestionario

Buenos días, nuestra organización «OPCION CONSULTORES» está realizando un Estudio para .... Nos gustaría hacerle algunas preguntas sencillas

Estimado/a (),
Buenos días / tardes. Mi nombre es (.). Estoy realizando una encuesta para el Banco Interamericano de Desarrollo (BID) desde Opcion Consultores. Esta encuesta busca estimar la creación de empleos a futuro en el marco de la transición a energías más sustentables. Su empresa ha sido elegida por ser parte de este proceso de transformación social, económico y ambiental.
Esta encuesta dura aproximadamente 30 minutos, y podemos realizarla ahora mismo, o bien en un horario donde le acomode.
Sus respuestas quedaran en absoluta reserva y anonimato, y los resultados serán presentados de manera agregada, y en ningún caso se identificará a alguna empresa en particular.
Toda la información requerida en esta encuesta corresponde al año fiscal 2019, salvo excepciones en preguntas específicas que se indicará en su debido momento.

I Caracterización General

Para comenzar le solicitamos algunos datos básicos sobre Usted y su empresa.

P3. **¿Me podría decir su nombre?** *

Ingrese un texto corto

|V24|

P4. **¿Cual es su Cargo en la empresa?** *

Ingrese un texto corto

|V25|

P5. **¿Me podría decir su nivel de Estudios?** *

|V26|

Primaria completa o menos	○	1
Secundaria incompleta	○	2
Secundaria completa	○	3
Educación terciaria / universitaria incompleta	○	4

Educación terciaria / universitaria de grado (licenciatura) completa ○ 5

Maestría (en curso o finalizada) ○ 7

Doctorado (en curso o finalizado) ○ 8

P6. **¿Cual es su Correo electrónico?** *

|V27|

P7. **¿podría darnos su Teléfono?** *

#

|V28|

P8. **¿Hace cuantos años está en la empresa?** *

#

|V29|

P9. **¿Podría indicarnos su sexo?** *

|V30|

Masculino ○ 1

Femenino ○ 2

P10. **por favor, indique el nombre o razón social de la empresa** *

Ingrese un texto corto

|V31|

P11. **Indique qué porcentaje de la propiedad de esta empresa es internacional. (Indique 0 si la empresa es propiedad de capitales nacionales unicamente)** *

1. Internacional	* # Rango [0 a 100] |V65|

P12. **¿Cuál es el país de origen de la empresa?** *

Ingrese un texto corto

|V67|

Mostrar: Sólo si «Internacional: Internacional» es mayor que 0 (Vea pregunta: P11). En caso contrario, pasar a la siguiente pregunta.

P13. **¿La casa Matriz queda en Uruguay?** *

|V69|

Si ○ 1

No	○	2

Mostrar: Sólo si «Casa matriz queda en uruguay» es «Si» (Vea pregunta: P13). En caso contrario, pasar a la siguiente pregunta.

P14. **Departamento donde se encuentra la casa matriz** ✱

|V68|

Artigas	○	1
Canelones	○	2
Cerro Largo	○	3
Colonia	○	4
Durazno	○	5
Flores	○	6
Florida	○	7
Lavalleja	○	8
Maldonado	○	9
Montevideo	○	10
Paysandú	○	11
Río Negro	○	12
Rivera	○	13
Rocha	○	14
Salto	○	15
San José	○	16
Soriano	○	17
Tacuarembó	○	18
Treinta y Tres	○	19

P15. **¿A qué tipo de empresa corresponde esta razón social?** ✱

|V33|

Transmisora	○	1
Distribuidora	○	2
Ingeniería y Construcción	○	3
Emergente	○	4
Generadora	○	5
|V460| Otra. especifique	○	6

P16. **¿A quién o quiénes les presta servicios su empresa? (Marque todas las que corresponda)** ✱

|V403|

Empresas de generación de energía	☐	1
Empresas de transmisión de energía	☐	2
Empresas de distribución de energía	☐	3
|V404| Empresas no energéticas ¿cuál?	☐	4
Clientes residenciales	☐	5
Sector público	☐	6

Municipios ☐ 7

P17. **¿Qué tipo de servicios presta? Por favor, nombre los 3 servicios más importantes** ✱

① |V405|

② |V406|

③ |V407|

P18. **¿Su empresa tiene alguna certificación de huella de carbono o de energía renovable no convencional ?** ✱

|V71|

Si	○	1
No	○	2
No sabe/No contesta	○	3

Mostrar: Sólo si «Tipo empresa corresponde razón social» es «Ingeniería y Construcción» (Vea pregunta: P15). En caso contrario, pasar a la siguiente pregunta.

P19. **¿de que tipo de empresa de ingeniería y construcción?** ✱

|V34|

	Desarrollo de proyectos de Ingeniería Eléctrica	☐	1
	Servicios de Construcción	☐	2
	Servicios Instalación y Montaje	☐	3
	Servicios de Mantenimiento y Reparación	☐	4
	Estudios asociados a proyectos de Ingeniería	☐	5
|V35|	Otros ¿Cuáles? ESPECIFICAR	☐	6

Mostrar: Sólo si «Tipo empresa corresponde razón social» es «Emergente» (Vea pregunta: P.11). En caso contrario, pasar a la siguiente pregunta.

P20. **¿de que tipo de empresa emergente?** ✱

|V36|

	Electromovilidad	☐	1
	Hidrógeno	☐	2
	Almacenamiento	☐	3
	Instalación de Techo Solares	☐	4
	Eficiencia Energética	☐	5
	Asesoría para Clientes Libres	☐	6
	Consultoría Energías Renovables	☐	7
|V37|	Otros ¿Cuáles? ESPECIFICAR	☐	8

Mostrar: Sólo si «Tipo empresa corresponde razón social» es «Generadora» (Vea pregunta: P.11). En caso contrario, pasar a la siguiente pregunta.

P21. **¿de que tipo de empresa generadora?** ✱

|V38|

Solar	☐	1
Eólica	☐	2
Biomasa	☐	3
Hídráulica embalse (dulce)	☐	4
Biogas	☐	5
Biocombustible líquido	☐	6
Geotérmica	☐	7
Hídráulica océano (Pumped Storage)	☐	8
Mareomotríz	☐	9
Energía a partir de desechos (waste energy)	☐	10
|V39| Otros ¿Cuáles? ESPECIFICAR	☐	11

Mostrar: Sólo si «Tipo empresa corresponde razón social» es «Generadora» (Vea pregunta: P15). En caso contrario, pasar a la siguiente pregunta.

P22. **¿Cuál es el nombre de la planta o instalación?** ✱

Ingrese un texto corto

|V40|

Mostrar: Sólo si «Tipo empresa corresponde razón social» es «Generadora» (Vea pregunta: P15). En caso contrario, pasar a la siguiente pregunta.

P23. **¿Cuándo se APROBÓ ambientalmente este proyecto? (Mes y Año)** ✱

Ingrese un texto corto

|V41|

Mostrar: Sólo si «Tipo empresa corresponde razón social» es «Generadora» (Vea pregunta: P15). En caso contrario, pasar a la siguiente pregunta.

P24. **¿Cuándo se comenzó a CONSTRUIR esta central o planta? (Mes y Año)** ✱

Ingrese un texto corto

|V42|

P25. **Previo a la entrada en operación de su empresa, ¿Cuántos trabajadores participaron del proceso de construcción?**
y ¿Cuánto duró la construcción? ✱

1. Nº de TRABAJADORES	✱ # Rango [0 a 1000] |V86| No aplica ☐ -99
2. TIEMPO TOTAL DE CONSTRUCCIÓN (meses)	✱

#	Rango [0 a 1000]	|V87|
No aplica	☐	-99

Mostrar: Sólo si «Tipo empresa corresponde razón social» es «Generadora» (Vea pregunta: P15). En caso contrario, pasar a la siguiente pregunta.

P26. **¿Cuál es la fecha de INICIO DE OPERACIÓN DE de esta central o planta? (Mes y Año)** ✱

Ingrese un texto corto

|V43|

P27. **Ahora le pediremos algunos datos básicos sobre los proyectos que desarrolla su empresa** ✱

A continuación se muestra una tabla mixta, complete la tabla según el tipo de dato solicitado

1. ¿Cuántos km de línea de transmisión tiene su empresa? (En kilometros)	✱ #	Rango [0 a 999999999]	|V413|
2. ¿Cuantos Clientes Domiciliarios tiene su Empresa?	✱ #	Rango [0 a 999999999]	|V408|
3. ¿Cuantos Clientes Industriales tiene su Empresa?	✱ #	Rango [0 a 2147483647]	|V409|
4. ¿Cuántos proyectos desarrolló durante el 2019?	✱ #	Rango [0 a 100]	|V410|
5. ¿Cuántos proyectos de propiedad de su empresa (Autofinanciados)?	✱ #	Rango [0 a 100]	|V411|
6. ¿Cuántos para terceros?	✱ #	Rango [0 a 100]	|V412|

P82. **En cuantos proyectos se encuentra trabajando la empresa actualmente?** ✱

|V455|

P28. **¿Podría nombrar el nombre de los 3 proyectos principales que tiene su empresa y el monto de la inversión en dólares?**

1. Proyecto 1	1.1. Nombre del proyecto	* |V414|
	1.2. Monto Inversión	* # Rango [0 a 100000000] |V60|
2. Proyecto 2	2.1. Nombre del proyecto	|V415|
	2.2. Monto Inversión	# Rango [0 a 100000000] |V61|
3. Proyecto 3	3.1. Nombre del proyecto	|V416|
	3.2. Monto Inversión	# Rango [0 a 100000000] |V62|

P29. **respecto al principal proyecto de su empresa... ¿El proyecto ha contado o cuenta con apoyo estatal o de algún tipo de financiamiento internacional para su etapa de diseño, construcción u operación? (CONSIDERANDO INSTRUMENTOS ESTATATALES: CONCESIONES DE TERRENOS DE BIENES NACIONALES, FONDOS DE INVERSIÓN TECNOLÓGICA -CORFO-, SUBSIDIOS O EXCENCIONES TRIBUTARIAS) Por favor, indique institución.** *

1. Diseño	* |V242| |V247| Si (especifique institución) ○ 1 No ○ 2
2. Construcción	* |V243| |V248| Si (especifique institución) ○ 1 No ○ 2
3. Operación	* |V244| |V249| Si (especifique institución) ○ 1 No ○ 2

P30. **Departamentos donde tiene proyectos la empresa (Marque todas las que corresponda)** *

|V70|

Artigas ☐ 1

Canelones	☐	2
Cerro Largo	☐	3
Colonia	☐	4
Durazno	☐	5
Flores	☐	6
Florida	☐	7
Lavalleja	☐	8
Maldonado	☐	9
Montevideo	☐	10
Paysandú	☐	11
Río Negro	☐	12
Rivera	☐	13
Rocha	☐	14
Salto	☐	15
San José	☐	16
Soriano	☐	17
Tacuarembó	☐	18
Treinta y Tres	☐	19

P32. **A continuación, le solicitaré información general de la empresa y de sus trabajadores considerando los últimos datos que tenga disponibles.**
Glosario: Trabajadores: propios de la empresa, considerando todos los tipos de contratos y tipos de jornadas. Se excluye los trabajadores subcontratados. *

1. N° total de trabajadores de la empresa	* #	Rango [0 a 10000]	|V72|
2. N° de trabajadores mujeres total	* #	Rango [0 a 10000]	|V73|
3. N° de trabajadores en esta filial u operación	* #	Rango [0 a 10000]	|V74|
4. N° de trabajadores extranjeros no residentes	* #	Rango [0 a 10000]	|V75|
5. N° de trabajadores extranjeros residentes	* #	Rango [0 a 10000]	|V76|
6. N° de trabajadores ciudadanos uruguayos	* #	Rango [0 a 10000]	|V77|
7. N° de trabajadores con discapacidad	* #	Rango [0 a 10000]	|V78|

P34. **Dotación de trabajadores** *

1. . ¿Cuál fue la dotación promedio de trabajadores de su empresa durante 2019?	1.1. Cantidad	* # Rango [0 a 10000] |V193|
	1.2. Mujeres	* # Rango [0 a 10000] |V199|
2. ¿Podría indicar el número total de trabajadores que fueron contratados en 2019?	2.1. Cantidad	* # Rango [0 a 10000] |V194|
	2.2. Mujeres	* # Rango [0 a 10000] |V200|
3. ¿Cuántas personas han sido desvinculadas durante el año 2020?	3.1. Cantidad	* # Rango [0 a 10000] |V195|
	3.2. Mujeres	* # Rango [0 a 10000] |V201|
4. ¿Cuántas personas realizaban teletrabajo para la empresa en 2019?	4.1. Cantidad	* # Rango [0 a 10000] |V196|
	4.2. Mujeres	* # Rango [0 a 10000] |V202|
5. ¿Y cuántas personas realizan teletrabajo para la empresa actualmente?	5.1. Cantidad	* # Rango [0 a 10000] |V197|
	5.2. Mujeres	* # Rango [0 a 10000] |V203|

6. ¿Cuál es la dotación de la empresa al día de hoy?	6.1. Cantidad	* # Rango [0 a 10000] |V198|
	6.2. Mujeres	* # Rango [0 a 10000] |V204|

P35. **¿Qué cantidad de trabajadores contrató de manera directa en los siguientes servicios o funciones durante 2019?:** *

1. Construcción	* # Rango [0 a 1000] |V89|
2. Instalación de máquinas / tecnología	* # Rango [0 a 1000] |V443|
3. Mantenimiento	* # Rango [0 a 1000] |V444|
4. Compra de insumos y tecnología	* # Rango [0 a 1000] |V92|
5. Investigación y Desarrollo	* # Rango [0 a 1000] |V436|
6. Reparaciones	* # Rango [0 a 1000] |V447|
7. Servicios generales (Limpieza, seguridad)	* # Rango [0 a 1000] |V448|
8. Transporte	* # Rango [0 a 1000] |V449|
9. Retiro de desechos, residuos o reciclaje	* # Rango [0 a 1000] |V97|
10. Otros:	* # Rango [0 a 1000] |V451|

P36. **¿Cuántos trabajadores de su empresa trabajan en relación de dependencia (empleados) y cuántos lo hacen mediante el régimen de facturación de servicios (independientes)?** *

1. En relacion de dependencia	* # Rango [0 a 1000] |V213|
2. Independientes	* # Rango [0 a 1000] |V214|

Mostrar: Sólo si «Tipo empresa corresponde razón social» es «Generadora» (Vea pregunta: P11). En caso contrario, pasar a la siguiente sección.

III EMPRESAS GENERADORAS - BLOQUE ESPECÍFICO

P37. **¿Cuál es aproximadamente la cantidad de energía producida por su empresa en un mes?** *

|V99|

P38. **¿Cuál es la capacidad instalada mensual?** *

|V100|

P39. **En función a la capacidad instalada total de su empresa, ¿Qué porcentaje de esta capacidad se produjo en un mes promedio de 2019?** *

A continuación se muestra una tabla mixta, complete la tabla según el tipo de dato solicitado

1. Energía producida	* # Rango [0 a 100000000] |V101|
2. Capacidad instalada	* # Rango [0 a 100000000] |V102|
3. % producido en mes promedio	* # Rango [0 a 100] |V103|

P41. **¿ Cuáles de los siguientes tipos de tecnologías usan para generar esta energía?** *

1. Fotovoltaica	*

		|V107|
	Si	○ 1
	No	○ 2
2. Termoeléctrica	*	|V108|
	Si	○ 1
	No	○ 2
3. Eólica ubicada en tierra	*	|V109|
	Si	○ 1
	No	○ 2
4. Hidroeléctrica (>100MW)	*	|V110|
	Si	○ 1
	No	○ 2
5. Residuos agrícolas	*	|V111|
	Si	○ 1
	No	○ 2
6. Residuos forestales	*	|V112|
	Si	○ 1
	No	○ 2
7. Biogás de vertedero	*	|V113|
	Si	○ 1
	No	○ 2
8. Biogás de digestores	*	|V114|
	Si	○ 1
	No	○ 2
9. Estiércol	*	|V115|
	Si	○ 1
	No	○ 2

P42. **¿Qué empresa es la proveedora de esta tecnología?** *

1. Fotovoltaica	1.1. Pais de origen	*	✎ ________ |V118|
	1.2. Porcentaje tecnología internacional	*	# [ ] Rango [0 a 100] |V136|
	1.3. Proveedor	*	✎ ________ |V145|
2. Termoeléctrica	2.1. Pais de origen	*	✎ ________ |V119|
	2.2. Porcentaje tecnología internacional	*	# [ ] Rango [0 a 100] |V137|
	2.3. Proveedor	*	✎ ________ |V146|
3. Eólica ubicada en tierra	3.1. Pais de origen	*	✎ ________ |V120|
	3.2. Porcentaje tecnología internacional	*	# [ ] Rango [0 a 100] |V138|
	3.3. Proveedor	*	✎ ________ |V147|
4. Hidroeléctrica (>100MW)	4.1. Pais de origen	*	✎ ________ |V121|
	4.2. Porcentaje tecnología internacional	*	# [ ] Rango [0 a 100] |V139|
	4.3. Proveedor	*	✎ ________ |V148|
5. Residuos agrícolas	5.1. Pais de origen	*	

			✎ ______ |V122|
	5.2. Porcentaje tecnología internacional	*	# Rango [0 a 100] |V140|
	5.3. Proveedor	*	✎ ______ |V149|
6. Residuos forestales	6.1. Pais de origen	*	✎ ______ |V123|
	6.2. Porcentaje tecnología internacional	*	# Rango [0 a 100] |V141|
	6.3. Proveedor	*	✎ ______ |V150|
7. Biogás de vertedero	7.1. Pais de origen	*	✎ ______ |V124|
	7.2. Porcentaje tecnología internacional	*	# Rango [0 a 100] |V142|
	7.3. Proveedor	*	✎ ______ |V151|
8. Biogás de digestores	8.1. Pais de origen	*	✎ ______ |V125|
	8.2. Porcentaje tecnología internacional	*	# Rango [0 a 100] |V143|
	8.3. Proveedor	*	✎ ______ |V152|
9. Estiércol	9.1. Pais de origen	*	✎ ______ |V126|
	9.2. Porcentaje tecnología internacional	*	# Rango [0 a 100] |V144|

	9.3. Proveedor	* ✎ ____________________ |V153|

IV TRABAJADORES Y CALIFICACIÓN

P43. **Y de acuerdo a la siguiente clasificación de nivel educacional ¿Cuántos trabajadores de su empresa tienen...?** *

1. Secundaria incompleta	1.1. cantidad empleados	* # Rango [0 a 1000] |V155|
	1.2. Cantidad de mujeres	* # Rango [0 a 1000] |V163|
2. Secundaria completa	2.1. cantidad empleados	* # Rango [0 a 1000] |V156|
	2.2. Cantidad de mujeres	* # Rango [0 a 1000] |V164|
3. Educación terciaria / universitaria de grado (licenciatura) finalizada	3.1. cantidad empleados	* # Rango [0 a 1000] |V158|
	3.2. Cantidad de mujeres	* # Rango [0 a 1000] |V166|
4. Maestría (finalizada)	4.1. cantidad empleados	* # Rango [0 a 1000] |V160|
	4.2. Cantidad de mujeres	* # Rango [0 a 1000] |V168|
5. Doctorado (finalizado)	5.1. cantidad empleados	* # Rango [0 a 1000] |V161|
	5.2. Cantidad de mujeres	* # Rango [0 a 1000] |V169|

P44. **Respecto al personal que trabaja en su empresa, Ud diría que:** *

|V424|

Todos / la mayoría ingresa con la formación técnica necesaria para ejercer su cargo	O	1
La mitad ingresa con la formación técnica necesaria para ejercer su cargo	O	2
Ninguno / la minoría ingresa con la formación técnica necesaria para ejercer su cargo	O	3

P45. **Su empresa suele brindar capacitación técnica a los trabajadores que la integran:** *

|V425|

Si	O	1
No	O	2

Mostrar: Sólo si «Empresa suele brindar capacitación técnica a los trabajadores integran» es «Si» (Vea pregunta: P45). En caso contrario, pasar a la siguiente pregunta.

P46. **La decisión de brindar cursos de capacitación es porque:** *

|V426|

El mercado actualmente no los ofrece	O	1
El mercado los ofrece pero son insuficientes para la competencias que su empresa requiere.	O	2
|V456| Otros	O	3

P47. **De las siguientes razones que comúnmente dan las empresas para capacitar a sus trabajadores, ¿Me puede indicar cuán importante es cada una de ellas, utilizando la siguiente escala?** *

1. Disminuir brechas en competencias técnicas *

|V222|

Nada importante	O	1
Poco importante	O	2
Moderadamente importante	O	3
importante	O	4
Muy importante	O	5

2. Incorporación de nuevas tecnologías *

|V223|

Nada importante	O	1
Poco importante	O	2
Moderadamente importante	O	3
importante	O	4
Muy importante	O	5

3. Programas de crecimiento en la línea de carrera *

|V224|

		Nada importante ○ 1 Poco importante ○ 2 Moderadamente importante ○ 3 importante ○ 4 Muy importante ○ 5
4. Desarrollo de capacidades conductuales	*	|V225| Nada importante ○ 1 Poco importante ○ 2 Moderadamente importante ○ 3 importante ○ 4 Muy importante ○ 5
5. Cumplimiento de estándares de seguridad	*	|V226| Nada importante ○ 1 Poco importante ○ 2 Moderadamente importante ○ 3 importante ○ 4 Muy importante ○ 5

En las siguientes preguntas, consultaremos por los perfiles de su empresa separados en 3 categorías:
STEM: Es decir: Puestos con formación en carreras universitarias y terciarias vinculadas con ciencia, tecnología, ingeniería y matemáticas (por sus siglas en inglés Science, Technology, Engineering, Mathematics). Son profesiones incluidas, por ejemplo, las siguientes: Ingenieros, Técnicos eléctricos/electrónicos/electromecánicos/mecánicos/otros; físicos; químicos; programadores; analistas de sistemas; matemáticos; meteorólogos; geólogos; científicos ambientales; arquitectos.

NO STEM: Otros profesionales con formación profesional pero fuera de las categorías mencionadas antes.

NO CALIFICADOS: Es decir, que solo cuentan con estudios de educación básica o media finalizados.
Por lo tanto, al clasificar los perfiles que le voy a nombrar, por favor le solicito separar estas categorías.

P49. **Indique cuántos integrantes del directorio y las gerencias de la empresa son STEM** *

1. Directorio	1.1. Cantidad	*	# Rango [0 a 80] |V170| No sabe ☐ 99
	1.2. Mujeres	*	# Rango [0 a 80] |V172|

		No sabe ☐ 99
2. Gerencia	2.1. Cantidad	* # Rango [0 a 80] |V171| No sabe ☐ 99
	2.2. Mujeres	* # Rango [0 a 80] |V173| No sabe ☐ 99

P50. **Indique cuántos integrantes del directorio y las gerencias de la empresa son No STEM** *

1. Directorio	1.1. Cantidad	* # Rango [0 a 80] |V174| No sabe ☐ 99
	1.2. Mujeres	* # Rango [0 a 80] |V175| No sabe ☐ 99
2. Gerencia	2.1. Cantidad	* # Rango [0 a 80] |V176| No sabe ☐ 99
	2.2. Mujeres	* # Rango [0 a 80] |V177| No sabe ☐ 99

P51. **Indique cuántos integrantes del directorio y las gerencias de la empresa son personas sin estudios universitarios** *

1. Directorio	1.1. Cantidad	* # Rango [0 a 80] |V178|

			No sabe ☐ 99
	1.2. Mujeres	*	# Rango [0 a 80] |V179| No sabe ☐ 99
2. Gerencia	2.1. Cantidad	*	# Rango [0 a 80] |V180| No sabe ☐ 99
	2.2. Mujeres	*	# Rango [0 a 80] |V181| No sabe ☐ 99

P52. **Ahora pensando en TODOS los trabajadores de su empresa, cuántos son... (SI NO TIENE LA CIFRA EXACTA A MANO, ENTREGUE DATOS APROXIMADOS)** *

1. Profesionales y técnicos STEM* (Ciencia, tecnología, ingeniería y matemáticas)	1.1. Cantidad	*	# Rango [0 a 200] |V182| No sabe ☐ 99
	1.2. Mujeres	*	# Rango [0 a 80] |V184| No sabe ☐ 99
2. Profesionales y técnicos NO STEM (Administración, Finanzas, Abogados, diseñadores, relacionadores, etc)	2.1. Cantidad	*	# Rango [0 a 200] |V183| No sabe ☐ 99
	2.2. Mujeres	*	# Rango [0 a 80] |V185|

		No sabe ☐ 99

P53. **Y respecto a los trabajadores sin calificación, de las siguientes funciones ¿Cuántos trabajadores corresponden a? (SI NO TIENE LA CIFRA EXACTA A MANO, ENTREGUE DATOS APROXIMADOS)** ✱

1. Construcción (obreros, operarios, construcción)	1.1. Cantidad	✱ # Rango [0 a 1000] |V186| No sabe ☐ 99
	1.2. Mujeres	✱ # Rango [0 a 1000] |V187| No sabe ☐ 99
2. Servicios (Limpieza, guardias de seguridad)	2.1. Cantidad	✱ # Rango [0 a 1000] |V188| No sabe ☐ 99
	2.2. Mujeres	✱ # Rango [0 a 1000] |V189| No sabe ☐ 99
3. Otros (especificar):	3.1. Cantidad	✱ # Rango [0 a 1000] |V190| No sabe ☐ 99
	3.2. Mujeres	✱ # Rango [0 a 1000] |V191| No sabe ☐ 99

P54. **¿En el último año ha tenido dificultades para reclutar y contratar trabajadores?** ✱

|V205|

- Si ○ 1
- No ○ 2

No sabe/No contesta ○ 3

Mostrar: Sólo si «Último año tenido dificultades reclutar y contratar trabajadores» es «Si» (Vea pregunta: P52). En caso contrario, pasar a la siguiente pregunta.

P55. **¿Me puede indicar en cuál o cuáles perfiles u ocupaciones tuvo mayor dificultad para reclutar y contratar trabajadores?**

1. Ocupación 1	1.1. Perfiles u Ocupaciones donde se dificultó reclutamiento y contratación	* ______ |V206|
	1.2. Por cuales razones	* ______ |V207|
2. Ocupación 2	2.1. Perfiles u Ocupaciones donde se dificultó reclutamiento y contratación	______ |V208|
	2.2. Por cuales razones	______ |V209|
3. Ocupación 3	3.1. Perfiles u Ocupaciones donde se dificultó reclutamiento y contratación	______ |V210|
	3.2. Por cuales razones	______ |V211|

V CALIDAD DE EMPLEO

P56. **cambiando de tema, ¿Hubo algún accidente grave en su establecimiento en el ultimo año antes de la pandemia?** *

|V212|

Si ○ 1

No ○ 2

No sabe/No contesta ○ 3

P57. **¿Su empresa ofrece algún seguro complementario de salud a sus empleados?** *

|V215|

Si	O	1
No	O	2
No sabe/No contesta	O	3

Mostrar: Sólo si «Empresa ofrece seguro complementario salud a empleados» es «Si» (Vea pregunta: P58). En caso contrario, pasar a la siguiente pregunta.

P58. **¿Cuantos empleados del total son miembros de este seguro?** *

#

|V216|

VI DEMANDAS Y NECESIDADES DE CAPACITACIÓN

P59. **Para reclutar personal para su empresa, ¿se vincula con universidades o centros tecnológicos? Y ¿para capacitar a su personal?** *

1. Reclutamiento	* |V217| Si O 1; No O 2; No sabe/No contesta O 3
2. Capacitación	* |V218| Si O 1; No O 2; No sabe/No contesta O 3

P60. **¿Su empresa demanda servicios de investigación y desarrollo en Uruguay?** *

|V219|

Si	O	1
No	O	2

Mostrar: Sólo si «Empresa demanda servicios investigación y desarrollo en uruguay» es «Si» (Vea pregunta: P60). En caso contrario, pasar a la siguiente pregunta.

P61. **¿A qué sector(es) se le demandan dicho servicios de investigación y desarrollo?** *

Ingrese un texto corto

✎ ________________________________ |V220|

P62. **Por favor, indique cuáles son las temáticas en las que usted considera que necesitaría capacitar a su personal para el proceso de transición energética de su empresa. Y a su juicio, ¿quiénes dentro de la empresa requieren más esa capacitación para actualizarse en dicha temática?**

1. Temática 1	1.1. Temática	* ✎ ________ |V232|
	1.2. Ocupaciones o perfiles que requieren más esa capacitación	* ✎ ________ |V234|
2. Temática 2	2.1. Temática	✎ ________ |V233|
	2.2. Ocupaciones o perfiles que requieren más esa capacitación	✎ ________ |V235|

Mostrar: Sólo si «Tipo empresa corresponde razón social» es «Ingeniería y Construcción» (Vea pregunta: P15). En caso contrario, pasar a la siguiente pregunta.

P63. **Por favor, indique cuáles son las temáticas en las que usted considera que necesitaría capacitar a su personal para el proceso de incorporación de nuevas tecnologías. Pueden estar referidas a aspectos técnicos específicos o a conocimientos generales. Y a su juicio, ¿quiénes dentro de la empresa requieren más esa capacitación para actualizarse en dicha temática?**

1. Temática 1	1.1. Temática	* ✎ ________ |V236|
	1.2. Ocupaciones o perfiles que requieren más esa capacitación	* ✎ ________ |V237|
2. Temática 2	2.1. Temática	✎ ________ |V238|
	2.2. Ocupaciones o perfiles que requieren más esa capacitación	✎ ________ |V239|

VII INVERSIÓN / GASTOS

P65. **A continuación le consultaré por los gastos en remuneraciones de su empresa durante 2019 y le pediré que me indique los montos invertidos en dólares americanos** *

1. Gastos en remuneraciones STEM	1.1. Gasto en Hombres	* # Rango [0 a 1000000000]	|V252|
	1.2. Gasto en mujeres	* # Rango [0 a 1000000000]	|V254|
2. Gastos en remuneraciones otros profesionales (Calificados/ NO STEM)	2.1. Gasto en Hombres	* # Rango [0 a 1000000000]	|V256|
	2.2. Gasto en mujeres	* # Rango [0 a 1000000000]	|V258|
3. Gastos en remuneraciones no profesionales (No calificados o sin formación)	3.1. Gasto en Hombres	* # Rango [0 a 1000000000]	|V260|
	3.2. Gasto en mujeres	* # Rango [0 a 1000000000]	|V262|

VIII VINCULACIÓN O SUBCONTRATACIÓN

Ahora le haremos algunas pocas preguntas sobre sub-contratación de servicios.

P69. **Actualmente, ¿su empresa subcontrata servicios a otras empresas?** *

|V288|

Si	○	1	
No	○	2	☞ {Ir P71
No sabe/No contesta	○	3	☞ {Ir P71

P70. **Actualmente, en cuáles de los siguientes servicios su empresa acude a la subcontratación:** *

|V289|

	Construcción	☐	1
	Montaje en General	☐	2
	Mantención y Reparación de Infraestructura de Distribución	☐	3
	Adquisiciones y compras	☐	4
	Investigación y Desarrollo	☐	5
	Servicios generales (Limpieza, seguridad)	☐	6
	Transporte	☐	7
|V290|	Otros:	☐	8

P71. **Indique el origen de las empresas que tiene subcontratadas en este servicio en la actualidad.** *

1. Construcción	* |V315|	Nacional	○	1
		Internacional	○	2
2. Montaje en General	* |V316|	Nacional	○	1
		Internacional	○	2
3. Mantención y Reparación de Infraestructura de Distribución	* |V317|	Nacional	○	1
		Internacional	○	2
4. Adquisiciones y compras	* |V318|	Nacional	○	1
		Internacional	○	2
5. Investigación y Desarrollo	* |V319|	Nacional	○	1
		Internacional	○	2

6. Servicios generales (Limpieza, seguridad)	* |V320| Nacional ○ 1 ; Internacional ○ 2	
7. Transporte	* |V321| Nacional ○ 1 ; Internacional ○ 2	
8. [V290]	* |V322| Nacional ○ 1 ; Internacional ○ 2	

IX PROYECCIONES DE INVERSIÓN Y CONTRATACIÓN

Para ir finalizando, le haremos algunas preguntas sobre futuros proyectos

Mostrar: Sólo si «Tipo empresa corresponde razón social» es «Transmisora» ó «Tipo empresa corresponde razón social» es «Distribuidora» ó «Tipo empresa corresponde razón social» es «Generadora» (Vea pregunta: P11). En caso contrario, pasar a la siguiente pregunta.

P77. **Pensando en los próximos 10 años su empresa tiene previsto...** *

|V375|

Unicamente construir nuevos proyectos	○	1
Unicamente ampliar proyectos en curso	○	2
Construir nuevos proyectos y ampliar proyectos en curso	○	3
Ni ampliar ni construir	○	4
No sabe/No contesta	○	5

P78. **Proyección de inversiones**

1. En qué plazo (años) pretende construir este o estos nuevos proyectos (el más próximo)?	# Rango [0 a 30] |V419| ; No sabe ☐ -99
2. En qué plazo (años) pretende ampliar este o estos proyectos (el más próximo)?	# Rango [0 a 30] |V420|

	No sabe ☐ -99
3. ¿Cuántos proyectos nuevos tiene en cartera?	# Rango [0 a 100] |V421| No sabe ☐ -99
4. ¿Cuál es el monto de Inversión total que tiene la cartera de nuevos proyectos?	# Rango [0 a 1000000] |V422| No sabe ☐ -99
5. ¿En cuántos años se materializarán estos proyectos?	# Rango [0 a 30] |V423| No sabe ☐ -99

Mostrar: Sólo si es falso que («Pensando en los próximos 10 años empresa previsto...» es «Ni ampliar ni construir») (Vea pregunta: P77). En caso contrario, pasar a la siguiente pregunta.

P79. **¿Me puede indicar con cuantos trabajadores es probable que ejecute los siguientes servicios ya sea de manera directa o subcontratados para este o estos nuevos proyectos?** ✱

1. Instalación de máquinas	✱ # Rango [0 a 1000] |V394| No corresponde ☐ -99
2. Compra de insumos y tecnología	✱ # Rango [0 a 1000] |V395| No corresponde ☐ -99
3. Investigación y Desarrollo	✱ # Rango [0 a 1000] |V396| No corresponde ☐ -99
4. Mantenimiento	✱ # Rango [0 a 1000] |V397| No corresponde ☐ -99

5. Servicios generales (Limpieza, seguridad)	* # Rango [0 a 1000] |V398| No corresponde ☐ -99	
6. Transporte	* # Rango [0 a 1000] |V399| No corresponde ☐ -99	
7. Retiro de desechos, residuos o reciclaje	* # Rango [0 a 1000] |V400| No corresponde ☐ -99	
8. Otros	* # Rango [0 a 1000] |V401| No corresponde ☐ -99	

P80. **En lo que respecta a las proyecciones de su empresa y la energía renovable, ¿Cuál diría que es la principal razón que motiva a esta empresa a generar este tipo de energía?** *

|V402|

- Programas de gobierno y estatales que impulsan estas medidas ○ 1
- La creciente demanda de este tipo de energía ○ 2
- Por un compromiso con el Medio Ambiente ○ 3

X Culminando

EN NOMBRE DEL BANCO INTERAMERICANO DE DESARROLLO LE AGRADECEMOS SU TIEMPO Y DISPOSICIÓN PARA PARTICIPAR DE ESTE ESTUDIO QUE BUSCA PROYECTAR LA GENERACIÓN DE EMPLEOS VERDES PARA LA REGIÓN.

P.83. **Comentarios**

Ingrese un texto corto

______________________________ |V461|

Annex IV: Adjustments to the survey by country

A. <u>General questions</u>

In the case of **Chile**, this section varies depending on the different firm sectors. For instance, for the sector that looks at generation firms that are not yet operational, an additional question is asked to know at which stage the project is. The survey on generation firms that are not yet operational is only applied to Chile, thanks to resources that allowed to also capture these firms in the sample, and refers to different hydraulic, solar panels and tidal power firms. For firms not yet operational, the survey only continues if the firm replies that it has been (i) environmentally evaluated, (ii) in the construction planning phase, or (iii) currently under construction. Otherwise, the survey is dropped.

On the contrary to Chile, in the case of **Uruguay**, only one survey is used with redirecting questions depending on whether they are relevant for each firm. The survey for Chile is used as a baseline, and adjustments were made to it with the support of the Uruguayan consulting firm *Opcion Consultores* and advice from the Ministry of Industry, Energy, and Mining (MIEM). It can be found in Annex III. Slight differences include the fact that only details about the three main projects instead of the five main projects are asked in the case of Uruguay, that the regions localizing the firm in Chile are replaced by the Departments in Uruguay, and that some of the generation technologies, for instance, will also vary, depending on whether they are relevant in each case study.

For **Bolivia**, similar surveys as the ones for Chile are used. The exception is the generation whose survey is split into one about the firm and the other about projects per se (in the case of generation and transmission firms). This is because there are fewer firms in the Bolivian energy sector than in the case of Chile. For example, 80% of the generation, 88% of the transmission, and 60% of the distribution are state-owned in Bolivia. Projects are therefore considered as well to have a larger sample size. As such, questions about projects (i.e., construction start date, name of the project, investment, etc.) are excluded from the general question part in the firm survey and instead included in the survey specifically designed for projects.

B. <u>Production and provision of supplies</u>

The baseline survey for generation firms in Chile has an additional section named "Production and provision of supplies", which basically questions the firm about the exact technology it uses as a renewable source, as per listed in Table 1, as well as whether this specific technology is national or international and in case of the latter, who provides it. The firm is also asked about its installed capacity in MW and the annual energy it produces in GWh.

In the survey for Uruguay, firms who stated that they are generating energy from the beginning are also redirected to a specific question asking about which renewable source they use (as per Table 1). However, this is done at an earlier stage of the survey, right after the category of the firm has been confirmed and just before asking for details about the name of the plant, when it was environmentally approved, and other information about its construction phase.

Finally, for Bolivia, the same survey structure as for Chile is used, except that the technologies are different, as the energy sector also has different characteristics. The selection of technologies only applies when the survey is done at the firm, and not project, level.

C. Clean energy certificate

This question is asked to all firms in the case of Chile and those in Bolivia but is excluded from the survey in Uruguay.

D. Employment structure

These questions are applied to all surveys. In the case of Uruguay, an additional specificity is asked when it comes to foreign workers, as a difference is made between foreign workers who are no residents in the country, those who are, and Uruguayan residents.

For all firms in Chile and in Uruguay, as well as projects in Bolivia, the different services and tasks are construction, machinery or technology installation, maintenance, input and technology purchase, research and development, repairs, general services such as cleaning and security, transportation, and recycling waste or residual removal. This section is absent from the firm survey in Bolivia.

E. Workers' profiles and their qualifications

In the case of Bolivia, the education question is only included when it comes to projects, as this is quite specific information that might be harder to detect at the firm level when many projects are being realized in parallel. In all three cases, the number of workers and their gender per education level is requested. In Uruguay, firms have the option to select between a bachelor, master, or Ph.D. level for tertiary education.

This qualification classification of STEM, non-STEM, and not qualified has been used in all surveys. In Chile, Bolivia, and Uruguay, all profiles are described are mentioned. The only exception is in the Bolivian survey for projects that do not include the category of directory and management, as these would come at the firm level.

The set of questions on the average number of workers contracted in the previous and those that have been dismissed since 2020 does not appear in the project survey in Bolivia. In the case of Uruguay, it was included earlier in the survey, in part on the employment structure.

The last questions are whether the firm had difficulties hiring workers, which profiles or positions were most affected, and why. The questions appear in the Chilean survey version, the Bolivian one for projects, and the Uruguayan survey.

F. Quality of employment

In the survey for Chile and for Bolivian firms, the questions are on whether any work accident had taken place and how many, whether workers are entitled to monthly payments through a contract, or whether they are paid honorarily, whether the firm offers complementary health insurance, and if so, how many workers are entitled to it. In the case of Uruguay, this part is shortened due to a shorter survey duration compared to Chile, and hence only the questions on the work accident (whether it took place) and the complementary health insurance are included.

G. Demands and required training

This part is included as described in the main text in both Chile's and Bolivia's firm's surveys. In Uruguay, however, the segment asking about capacitation needs has been moved under the workers' profiles and qualifications section and was replaced by a question on whether the firm seeks research and development services. This is because, in the case of Uruguay, it seemed more natural to ask about the different reasons why capacitation might be needed right after looking at the education level of workers.

H. Investment and costs

As the question on financial support only focuses on projects, it is only asked in the project survey for Bolivia and all surveys for Chile. It is absent in the survey for Uruguay due to time and space constraints.

In the baseline survey for all Chilean firms, gross salaries for STEM, non-STEM, and not qualified workers are asked, including costs for materials used for service delivery, costs of raw materials and materials consumed during the production phase, costs for outsourced work, costs for hiring construction and reparation workers, costs of services performed by outsourcing, costs for contracted freight, costs for electrical energy, fuels, and lubricants, including for self-consumption, and finally, taxes.

This set of questions about costs' details appears in the firm survey for Bolivia and in all surveys for Chile. For Uruguay, it is reduced to only salaries for STEM, non-STEM, and not qualified for both men and women.

I. Linkages and outsourcing

This part was incorporated into the baseline survey and replicated in all surveys for Chile, in project one for Bolivia, and Uruguay. For Chile and Bolivia, the number of firms from which workers are outsourced is also asked, and the whole question is repeated for the past (as opposed to present) in an attempt to capture the consequences of the sanitary crisis in terms of recruitment. The list of services is the same as that under part (D) on the structure of employment.

In the case of Uruguay, information on whether the workers are outsourced nationally or internationally is requested. This helps understand whether the national, regional, or local labor force can meet local demand for employment.

J. Investment and employment projections

This part is present in all three surveys. In the Uruguayan survey, additional information on the potential investment cost is also requested.

Annex V. Data collection process

In this annex, we discuss the different stages of the data collection process, from identifying the firms to selecting a representative sample, the data collection method used and its length, as well as obstacles encountered on the way.

1 Firm identification

One of the biggest preparations prior to carrying out the surveys was to identify which firms to consider. In all cases, this identification process was done through collaboration with consultancy firms, as well as through collaboration with the respective Ministries of Energy. In this respect, the biggest challenge lied in finding firm information and in predicting in which of the five pre-selected energy transition sectors they would fit (i.e., generation, transmission, distribution, engineering and construction, and emerging)[15]. This was especially in the case for the sector of emerging firms, which as its name states, is still a relatively new sector.

In **Chile**, to identify firms connected to the energy transition, a search was made in the Internal Tax Service (SII) using the national identification number of each firm. The identification was supported by secondary sources and expert referrals in order to end with a database that would represent the universe of the energy transition sector in Chile. In a second step, in order to obtain more detailed information, the list of firms from the Electric National Coordinator (C.E.N.) was explored. This helped identify operating firms. Finally, to capture firms that are in the process of the realization of their energy project and awaiting their environmental license, the online registry from the Environmental Evaluation System (S.E.A.) was contemplated.

In **Uruguay**, the process of firm identification was greatly facilitated by the MIEM, which supported the study by providing a list of firms that they had previously classified themselves under different categories. These are software firms, categorized ESCOS, generation firms, microgeneration firms, public administration, infrastructure organisms, certified firms under the Energy Management Systems, certified agents, energy efficiency instrument firms, the academic sector, manufacturers of bicycles with assistance, manufacturers of charging equipment, electric vehicles providers and renters, used battery recycling, electromobility research, and development firms. Only some firms and categories out of the list were selected based on the pre-existing identified energy transition sectors and the available contact information.

The energy sector in **Bolivia** behaves differently than in Chile, as the State is involved in 80% of the generation, 88% of the transmission, and 60% of the distribution. To such an extent, the universe of firms is less than in other case studies, which motivated the inclusion of projects. The identification of firms relevant to the energy transition sector was made thanks to supporting from a national expert advisor. It is worth noting that in Bolivia and Chile, some thermoelectric firms were included in the data collection process to have a benchmark against which to measure the estimation of job creation from the energy transition. In Bolivia, thermoelectric firms constitute 60% of the total installed

[15] It is worth mentioning that this selection was not done at random, but rather initially designed based on the universe of firms in Chile that take part in the energy transition. As such, one of the exercises was to look at all existing firms and try to categorize them into comparable and independent groups.

capacity, compared to 8% for non-conventional renewable energy sources and 32% for hydroelectric generation. These firms all together account for 20 projects out of 5 projects related to energy generation.

2 Methods and survey characteristics

In all cases, a preliminary email presenting the project and inviting firms to participate in the survey was sent out. The survey was completed either over the phone or through an online platform, depending on the availability of the interviewee at the time of the call. In Chile, trained interviewers filled out the information as the interviewee responded to the questions over the phone when the survey was carried out telephonically, whereas, in Uruguay, the interviewee could fill out the survey directly by themselves while being accompanied by the interviewer over the phone. The firms were also given the option to fill the survey out by themselves if they were busy at the time of the call or if they would not respond to several call attempts. The purpose of accompanying the respondent through the process in the Chilean case was to ensure that the information was clear and to be able to address any doubt or confusion. In fact, in the case of Chile, all phone surveys were recorded, and checks were realized to verify the information. In addition, evaluations of supervisors of the phone survey were carried out to identify potential areas to be improved and make changes accordingly.

The duration of the survey was estimated to be roughly half an hour. The length mostly depended on who answered the survey, which is related to how easily they could access the required information. Tables 1 and 2 below show the average duration in minutes according to the different firms interviewed at that stage of the data collection process in Chile and Bolivia, as an example. The second group of generation firms in Chile is the ones that are not yet operational. Then it means that they also face a shorter survey and have to rely more on estimates compared to actual numbers from their archives. In the case of Bolivia, answering the survey took twice as long for generation firms compared to engineering and construction firms.

Grupo	Promedio minutos
Generadoras Grupo 1	34,07
Generadoras Grupo2	25,28
Generadoras Grupo3	40,43
Distribuidoras	42,76
Transmisoras	-
Ingeniería	40,1
Emergentes	28,78

Table A1. Example of average duration of surveys in Chile, as of December 11th, 2020

Grupo	Promedio minutos
Generadoras	58,32
Ingeniería	29,98

Table A2. The average duration of surveys in Bolivia, as of December 11th, 2020

3 Obstacles and solutions

One of the challenges faced in the survey preparation phase is directly linked to the survey duration. There is a trade-off between the rate of successful responses and the number of questions to be answered, as firms either do not have time to go through the whole survey or the patience or lose their focus after a certain time. Several adjustments had to be made following the pilot surveys and the first responses collected. Some choices also had to be made over the importance of questions and the priorities and objectives set by the overall research project.

Additional efforts were made following the pilot survey and firms' approach to the overall project. For instance, a formal letter signed by both the Inter-American Development Bank and the respective Ministries, explaining the project and what will be done with the results, was sent to all firms in Chile and Uruguay. A blog was also published on the IDB's Energy Blog page and disseminated via social media to add transparency to the project and formalize it[16]. In Uruguay, the MIEM published an advice note on its official page, whereas in Chile, an informal workshop about the survey and the related project was carried out, to which all heads of the energy associations were invited. The idea was to create an opportunity where questions could be asked and for the associations to inform the firms about the forthcoming survey.

In spite of all the efforts directed at increasing the response rate, the latter stood at 8,5% and 10% in Chile and Bolivia, respectively (Tables 3 and 4). In the case of Chile, close to 1000 firms were contacted. Almost a third of the calls were unanswered. Then, it makes that our data representative with a 15% margin of error. In 13% of the cases, the phone did not exist, in 9%, the firm refused to participate, and in 7% of the cases, the firm asked to be called on another day.

For Bolivia, almost half of the firms did not pick up the phone, 14% asked to be called on another day, and in 13% of cases, the number was wrong. Out of 161 attempts, only two firms refused to participate in the survey. For Uruguay, in total, 561 attempts were made, out of which 81 have been successful so far, resulting in a response rate of 14%. From the 81 surveys, 73 were by phone, and eight were auto-administered after receiving the link by email. Out of the other attempts made, 53% are ongoing, and 33% were rejected.

It is worth noting that in Chile and Bolivia, almost all firms who were part of the universe were called, as at the end of the survey period, the numbers as shown in Tables 3 and 4 were higher. In Uruguay, however, if we include microgeneration firms, we stand far from having called the whole universe, with a total of 561 attempts against roughly 1500 firms (Table 5). These numbers are important when it comes to whether the sampling method was randomized or not.

The reported responses on which our results are built are those from firms who accepted to take part in the survey. If the whole universe was called, then to a certain extent, this overcomes selection bias, as opposed to only calling a selected group of firms (unless that selection is proven to be entirely random). In addition, in some cases where the line was busy at the moment of calling, several attempts were made again to avoid excluding the firm based on the fact that the line was busy.

[16] The blog in Spanish can be found here: https://blogs.iadb.org/energia/es/transicion-energetica-en-america-latina-cuales-son-las-implicaciones-en-el-empleo/

ESTADO	INCIDENCIAS ESPECÍFICAS	N	%	N SEGÚN EL ESTADO	% SEGÚN EL ESTADO
LOGRADAS	Entrevista correcta	79	8,5%	79	8,5%
EN PROCESO DE LOGRO	Llamar más tarde	4	0,4%	146	15,6%
	Llamar otro día	68	7,3%		
	Suspendida en curso	15	1,6%		
	Gestión adicional	59	6,3%		
NO LOGRADA (PROBLEMA TEMPORAL DEL TELÉFONO)	Ocupado	51	5,5%	361	38,7%
	Buzón de Voz	33	3,5%		
	No contesta	277	29,7%		
NO LOGRADA (PROBLEMA PERMANENTE DEL TELÉFONO)	Teléfono equivocado	67	7,2%	217	23,2%
	Teléfono fuera de servicio	28	3,0%		
	Teléfono inexistente	122	13,1%		
RECHAZOS	Entrevista rechazada	82	8,8%	113	12,1%
	Contestan y cortan	31	3,3%		
Otro	No pasa filtro	18	1,9%	18	1,9%
Total	Total contactos utilizados	934	100,0%	934	100,0%
Contactos no usados		0			

Table A3. Example of survey response rates in Chile (December 11th, 2020)

One limitation that the present work also acknowledges has to do with the surveys' response rates, and the fact that some firms were public and others private, and that whether one status over another might have influenced the responsiveness rate of firms is unknown. This could have led to a potential bias in the response rate. For instance, in the case of Uruguay, the publicly owned utility UTE has a monopoly over transmission and distribution and is responsible for roughly 50% of the country's generation. The fact that the utility might have known that the IDB's initiative of conducting the survey was supported by the Ministry of Energy could have influenced its responsiveness to the survey. By contrast, in Chile, the response rate from transmission and distribution firms that are not public was not as high.

However, we assume that this bias is minimized, in as much as the upcoming survey was advertised in advance to all firms equally, and also mediatized with a publicly accessible blog on the page of the IDB, and in the case of Uruguay, with a press release from the MIEM, and that no compensation whatsoever was offered in exchange for participation in the survey.

ESTADO	INCIDENCIAS ESPECÍFICAS	N	%	N SEGÚN EL ESTADO	% SEGÚN EL ESTADO
LOGRADAS	Entrevista correcta	18	10,9%	18	10,9%
EN PROCESO DE LOGRO	Llamar más tarde	0	0,0%	34	20,6%
	Llamar otro día	24	14,5%		
	Suspendida en curso	5	3,0%		
	Gestión adicional	5	3,0%		
NO LOGRADA (PROBLEMA TEMPORAL DEL TELÉFONO)	Ocupado	0	0,0%	80	48,5%
	Buzón de Voz	0	0,0%		
	No contesta	80	48,5%		
NO LOGRADA (PROBLEMA PERMANENTE DEL TELÉFONO)	Teléfono equivocado	17	12,7%	25	15,2%
	Teléfono fuera de servicio	3	1,8%		
	Teléfono inexistente	1	0,6%		
RECHAZOS	Entrevista rechazada	2	1,2%	4	2,4%
	Contestan y cortan	2	1,2%		
Otro	No pasa filtro	4	2,4%	4	2,4%
Total	Total contactos utilizados	161	100,0%	165	100,0%
Contactos no usados		0			

Table A4. Example of survey response rates in Bolivia (December 11th, 2020)

Empresas y/o sectores	Exitosas	Pendientes	Rechazos	Total	Tasa de respuesta
ESCO	22	21	17	60	37%
MICROGENERADORES	20	108	38	166	12%
EMPRESAS CERTIFICADAS BAJO SGE	11	22	12	45	24%
GENERADORES	9	15	28	52	17%
PROVEEDORES DE RENOVABLES	8	75	55	138	6%
PROVEEDORES EFICIENTES	7	42	24	73	10%
ADMINISTRACION PUBLICA	1	0	0	1	100%
CONSTRUCTORAS DE BICICLETAS DE PEDALEO ASISTIDO	1	7	3	11	9%
CONSTRUCTORAS DE EQUIPOS DE GESTION DE CARGA	1	0	0	1	100%
IMPORTADORAS DE BATERIAS y AFINES	1	4	2	7	14%
ORGANISMOS DE INFRAESTRUCTURA ENERGETICA	0	4	3	7	0%
TOTAL	***81***	***298***	***182***	***561***	14%

Nota: Los casos pendientes y de rechazos únicamente incluyen empresas contactadas vía telefónica

Table A5. Example of survey response rates in Uruguay (December 18th, 2020)

Annex VI. Overview of the electricity sector's transformation

The electricity sector in LAC has been changing over the past ten years. It will continue to do so as it moves to meet its climate change mitigation plan and lower energy consumption targets. In Bolivia, and Chile, non-renewable thermal sources, followed by hydroelectric energy, dominated the installed capacity for electricity generation in 2010 (Figure 1). In contrast, in Uruguay, the latter had already taken the lead. In Chile, Uruguay, and Bolivia (though to a much lesser extent), renewable thermal was next. In Chile, the installed capacity for the wind was close to that of renewable thermal, while in Uruguay, it was less present.

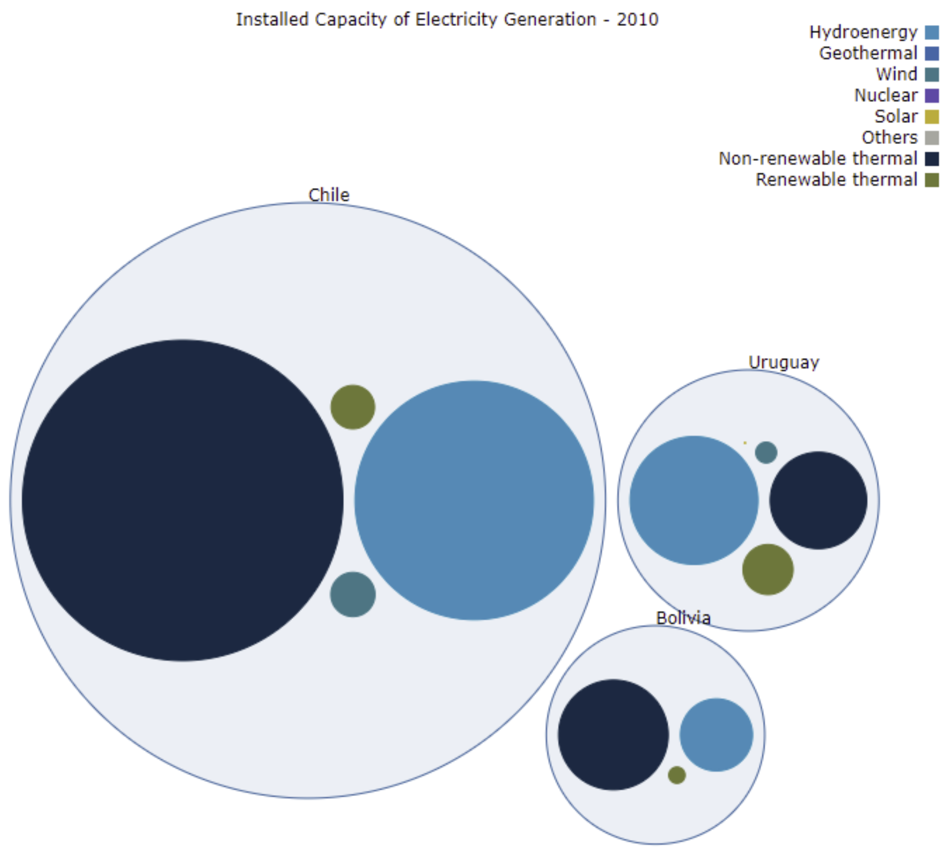

Figure A1. Installed capacity of electricity generation of selected countries in 2010

Source: sieLAC-OLADE

Almost ten years later, in 2018, the picture looks somewhat different. Solar is now part of the picture in Uruguay, Chile, and Bolivia, geothermal is growing in Chile, as well as wind in Bolivia. In Uruguay, the participation of non-renewable thermoelectrics in the electric installed capacity is very low in 2018 (Figure 2). In 2010, non-renewable thermoelectrics was the resource with the second biggest installed capacity. In 2018, it came far behind hydroelectric, wind, and renewable thermoelectric in the share in electric generation.

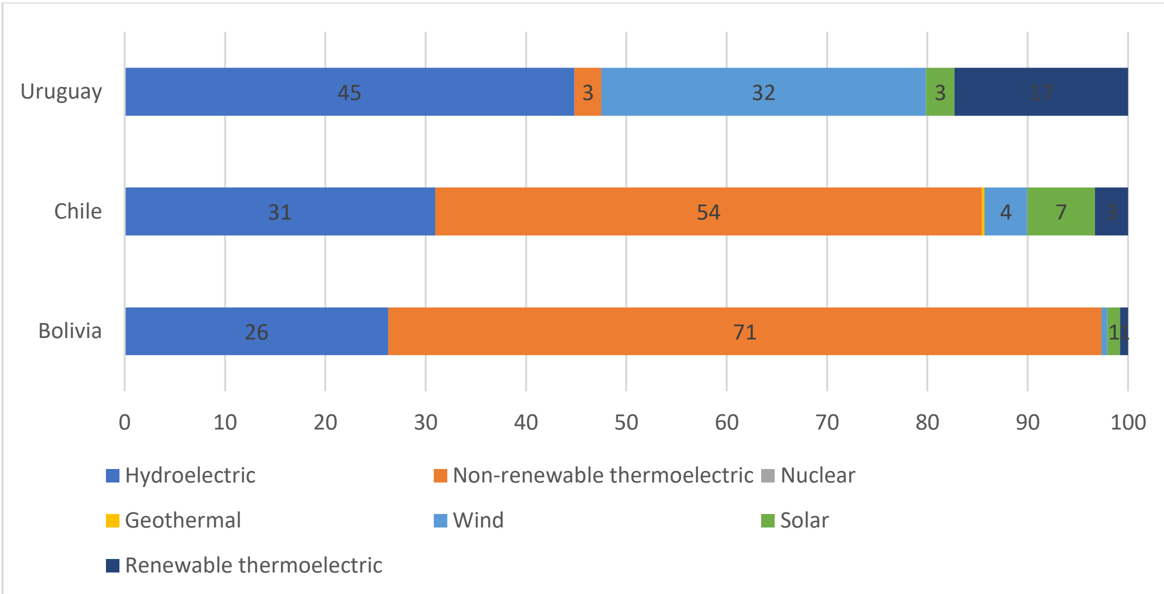

Figure A2. Electricity generation matrix of selected countries in 2018

Source: Own elaboration based on data from OLADE

These changes are not surprising when one looks at public investment in renewables sources as a percentage share of GDP by country between 2006 and 2016. As Figure 3 below shows, between our countries of observation, Uruguay invested the most, in geothermal, wind, renewable[17] and solar, in order of size. Next is Bolivia, with considerable investment in hydroelectric energy, followed by renewable and less so in solar. Finally, Chile mostly invested in solar energy and in hydroelectric.

Zooming into the public investment in renewable sources between 2009 and 2016, all countries have invested in solar and renewable energy (Figure 4). Chile invested the most in solar during this period, with almost one billion USD in 2012. Chile and Uruguay all invested in wind energy. Uruguay showed the largest investment overall and in 2013, more specifically, with roughly 140 million USD. Bolivia invested the most in hydroelectric power, especially in 2016.

These numbers reflect a transformation in the energy sectors of these countries and a shift towards renewable energy sources for electricity generation. However, the renewable sector is not the only one changing and expanding in the transition towards greener energy.

[17] Renewable here refers to "Multiple renewable", which according to IRENA's database website refers to "commitments that target more than one renewable energy technology, such as equity investments, green bonds, investment funds, multiple project commitment, projects that combine technologies and other commitment that cannot be clearly categorized under one single technology" (https://www.irena.org/Statistics/View-Data-by-Topic/Finance-and-Investment/Renewable-Energy-Finance-Flows).

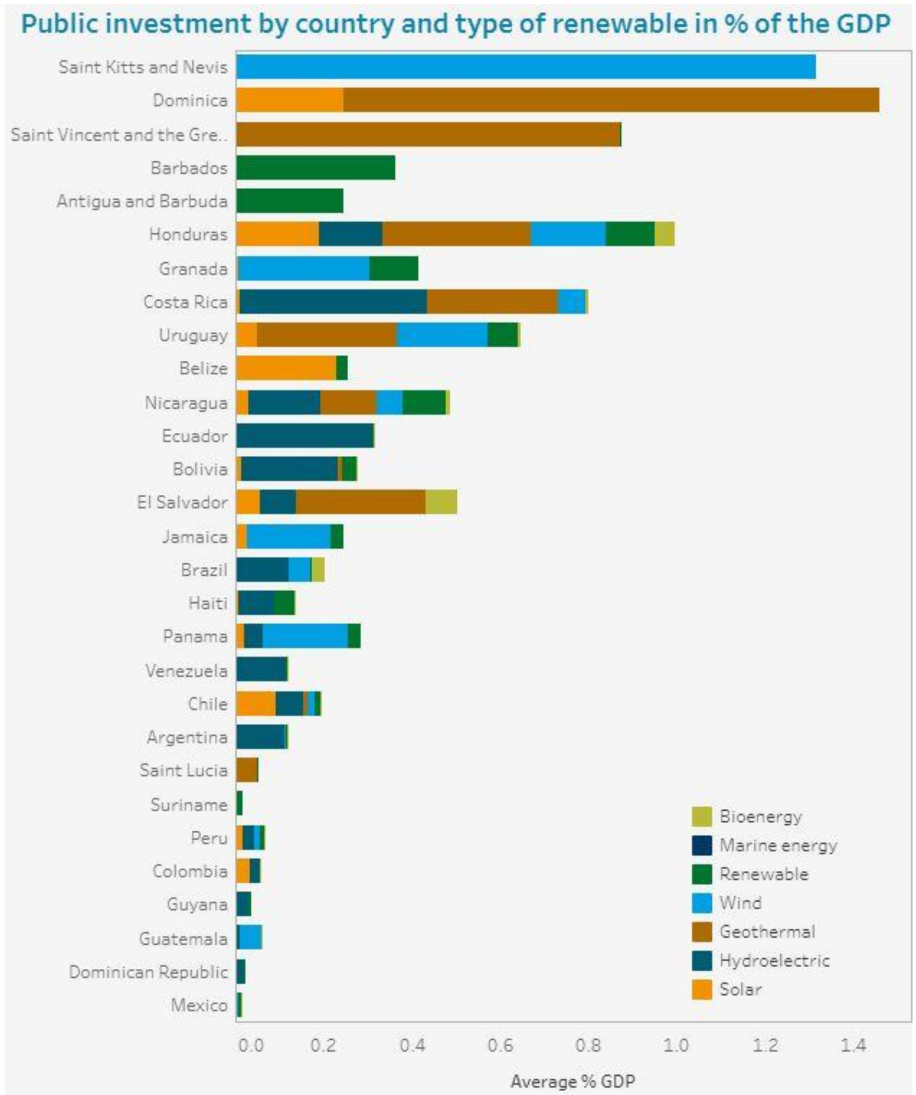

Figure A3. Public investment by renewable source by country between 2006 and 2016 by type of renewable and by country in % of GDP

Source: Elaborated by the Energy Hub using IRENA (2021). (https://www.irena.org/Statistics/View-Data-by-Topic/Finance-and-Investment/Renewable-Energy-Finance-Flows)

As Figure 5 below points out, the energy sectors in Bolivia, Chile, and Uruguay have also become more innovative. They have focused on key sectors and developing enabling technologies to continue the smooth transition towards green energy. These key sectors can be summarized as electromobility, distributed solar generation, storage, and smart metering, in addition to the renewable energy sources just discussed. For instance, Chile has been the most innovative, and by far, in terms of electricity storage for public service. Concerning electromobility and the number of chargers per electric vehicle, it also ranks considerably high, along with Uruguay. Uruguay has been the leader in innovation in the electric mobility sector, relative to other countries of the region included in the comparison. Another sector in which Uruguay and Chile have been noticeably innovative.

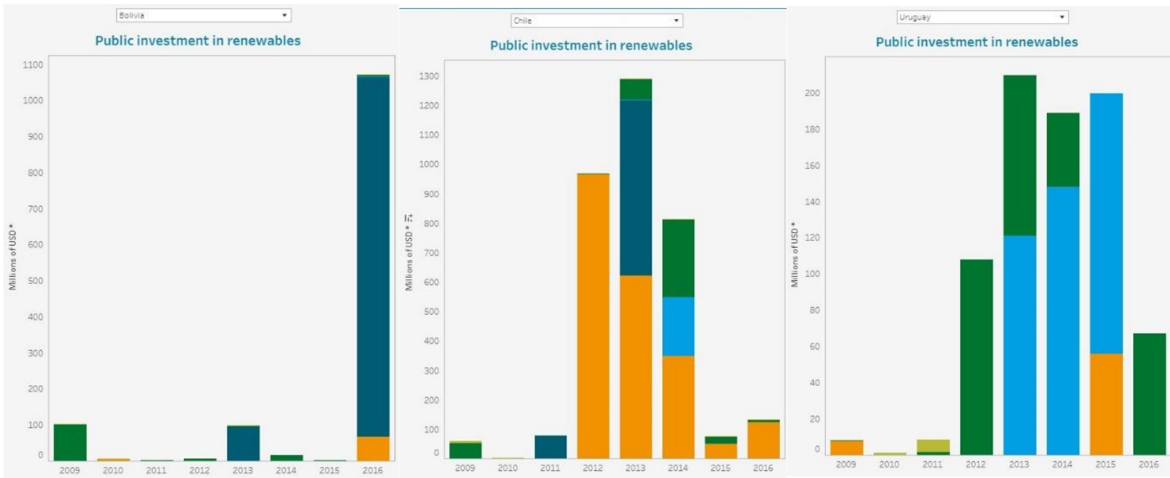

Figure A4. Public investment in renewable energy sources in millions of USD, 2009-2016

Source: Elaborated by the Energy Hub using IRENA (2021)(https://www.irena.org/Statistics/View-Data-by-Topic/Finance-and-Investment/Renewable-Energy-Finance-Flows)

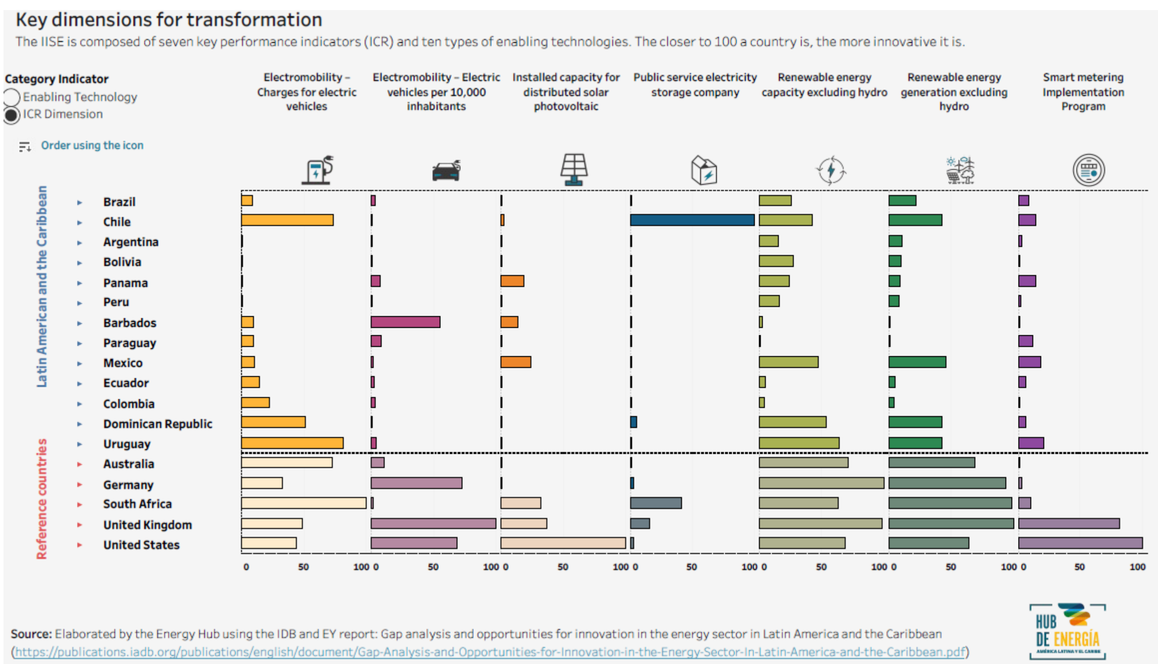

Figure A5. Key components of the energy sector's transformation for the transition and progress made by a selection of countries, 2018

Source: Energy Hub using the IDB database and the SIELAC Latinobarometro[18]

[18] This interactive graph can be reproduced online from: https://hubenergia.org/es/indicators/explorando-la-innovacion-del-sector-electrico-un-indice-para-america-latina-y-el-caribe.

As these trends show, the energy transition in the LAC region is not limited to renewables. It includes many other sectors, such as electromobility, storage, and smart metering just mentioned, but also other sectors, such as energy efficiency and hydrogen. An effort has been made to consider all these sectors in the definition of the universe of firms that contribute to the energy transition. We now look at the methodology used to collect the data and our survey sample data.

Annex VII. Average numbers and percentage shares of workers for each profile and qualification level for emerging, generation, and engineering firms, including the number of observations (obs.)

	Bolivia		Chile		Uruguay	
	No.	%	**No.**	%	**No.**	%
Directory & management						
STEM	2		3		2	
No STEM	0	2	1	5	1	4
Not qualified	0		0		1	
Professionals & technicians						
STEM	16	30	47	81	10	17
No STEM	12		17		8	
Construction						
Not qualified	59	64	10	13	23	21
Services						
Not qualified	1	1	1	1	9	8
Others						
Not qualified	2	2		0	54	50
Total STEM	18	20	50	63	12	11
Total no STEM	12	13	18	23	9	8
Total not qualified	62	67	11	14	87	81
Total	**92**	**100**	**79**	**100**	**108**	**100**
Obs.	*4*		*23*		*18*	

Table A6. Average number and percentage share of workers for each profile and qualification level for emerging firms

Source: Own elaboration based on the surveyed sample

NB: some percentages might not add up to a hundred because of rounding.

	Bolivia		Chile		Uruguay	
	No.	%	**No.**	%	**No.**	%
Directory & management		18		12		10
STEM	4		3		1	
No STEM	2		1		0	
Not qualified	0		0		1	
Professionals & technicians		18		26		35
STEM	5		7		3	
No STEM	1		2		4	
Construction		3		26		20
Not qualified	1		9		4	
Services		3		3		10
Not qualified	1		1		2	
Others		59		32		25
Not qualified	20		11		5	
Total STEM	9	26	10	29	4	20
Total no STEM	3	9	3	9	4	20
Total not qualified	22	65	21	62	12	60
Total	34	100	34	100	20	100
Obs.	*8*		*53*		*27*	

Table A7. Average number and percentage share of workers for each profile and qualification level for generation firms

Source: Own elaboration based on the surveyed sample

NB: some percentages might not add up to a hundred because of rounding.

	Bolivia		Chile		Uruguay	
	No.	%	**No.**	%	**No.**	%
Directory & management						
STEM	1	2	3	19	2	4
No STEM	0		1		1	
Not qualified	0		0		1	
Professionals & technicians						
STEM	12	31	5	43	7	66
No STEM	4		4		66	
Construction						
Not qualified	32	62	6	29	28	25
Services						
Not qualified	1	2	2	10	1	1
Others						
Not qualified	2	4		0	4	4
Total STEM	13	25	8	38	9	8
Total no STEM	4	8	5	24	67	61
Total not qualified	35	67	8	38	34	31
Total	52	100	21	100	110	100
Obs.	*16*		*7*		*32*	

Table A8. Average number and percentage share of workers for each profile and qualification level for engineering firms

Source: Own elaboration based on the surveyed sample

NB: no obs for not qualified others for Chile; some percentages might not add up to a hundred because of rounding.

Annex VIII. Number of observations (obs.) for a share of female workers for generation technologies and emerging activities

	Bolivia			Chile			Uruguay		
Generation technology	Average	Total share	***Obs***	Average	Total share	***Obs***	Average	Total share	***Obs***
Thermal	30		***1***	30	21	***5***			
Hydroelectric	5	5	***4***	8	17	***6***	9	9	***1***
Wind				34	52	***7***	35	10	***4***
Solar	13		***1***	28	26	***30***	25	18	***20***
Bioenergy				16	7	***5***	4	5	***4***
Minihydro run-of-river	6		***1***	19	33	***7***			
Waste				20		***1***			

Table A9. Share of female workers by technology for generation firms (%)

Source: Own elaboration based on the surveyed sample

NB: blanks correspond to missing information.

	CHILE			BOLIVIA			URUGUAY		
Emerging activities	Average	Total share	***Obs***	Average	Total share	***Obs***	Average	Total share	***Obs***
EV	23	25	***5***	17		***1***	0	0	***4***
Hydrogen	60		***1***				32		***1***
Storage	13	20	***5***				18	15	***2***
Solar panel installation	9	10	***11***	39	37	***4***	85	91	***4***
Energy efficiency	16	21	***22***	55		***1***	35	39	***8***
Advisory for independent clients	17	13	***13***				0	0	***2***
Consulting in renewable energy	16	21	***20***				10	14	***4***

Table A10. Share of female workers by activity for emerging firms (%)

Source: Own elaboration based on the surveyed sample

NB: many overlaps for emerging firms in Chile.