

GEOPOLITICS OF RENEWABLE ENERGIES IN LATIN AMERICA

A SURVEY



GEOPOLITICS OF RENEWABLE ENERGIES IN LATIN AMERICA

A SURVEY

SUPPORTED BY

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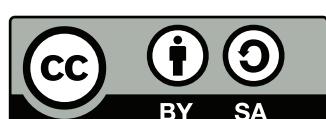
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FOREWORD

BY CHRISTIAN HÜBNER

Latin American energy policy is currently undergoing fundamental structural changes. Previously valid certainties regarding critical players and the importance of specific energy sources are scarcely applicable anymore. Primarily, the unilateral distribution of fossil fuel resources has been the pivot, and core issue in Latin Americans' often ideologically charged integration of energy policy.

Above all, the concentration of fossil fuels in Venezuela has been the central issue. This analysis was within a global mindset where the focus of geopolitical energy was on fossil energy sources.

Nevertheless, hydropower and biomass are also an established part of Latin America's energy supply –

although in the debate this has often been neglected or directly handled in a less ideological way. Indeed, hydropower is the dominant energy resource in the region's electricity sector and, going back to the oil crises in the 1970s, biomass in the form of ethanol as a petrol blend has made significant contributions to energy security, especially in the Brazilian transport sector.

The rapid change in the political and technical conditions in Latin America, above all Venezuela's economic and political descent, the numerous energy-economic deregulation programs, the articulation of climate protection goals, the substantial reduction in prices for wind and solar electricity, the discovery of shale gas in Argentina and the pre-salt

oil reserves off the coast of Rio de Janeiro, Brazil, as well as the no longer ignorable presence of China in the region, have all already completely changed the energy policy map.

On top of this, in Latin America and the states of the Caribbean, climate change has become a widely perceived and ever-present challenge for politicians and society. However, hurricanes, melting glaciers, droughts, and flooding are merely images seen in the media and the effects on energy security are only very gradually getting widespread attention – when, for instance, hydroelectric power stations can no longer supply electricity because of drought or long-term shortages of glacier water.

Renewable solar and wind shift even more distinctly into the foreground. Latin America enjoys the finest geographical conditions for these energy sources, too.

Energy-geopolitical studies of the Latin American region must address the political and economic conditions of precisely these energy sources, and the following survey aims to make a specific contribution to this. Politicians, bureaucrats, and business representatives from numerous Latin American countries were questioned about the dimensions of renewable energy geopolitics. The findings give the first impression of how well this new political topic is understood and the ways it may be addressed in the future.

EXECUTIVE SUMMARY

This study presents the outcomes of a survey about the geopolitical importance of renewable energy in Latin America. The survey was carried out considering that renewable energy is abundantly available in Latin America and, in the case of hydropower and biomass, enjoys a long tradition.

The survey interviewed 697 elites members in 10 Latin American countries: Argentina, Brazil, Bolivia, Chile, Colombia, Costa Rica, Ecuador, Mexico, Panama e Peru. The elite members were academics, members of the executive power, legislators, businesses people, and members of non-governmental organizations. Between 12th November and 7th December 2018, the survey collected 697 interviews by telephone, and 423 interviews online. The methodology annex provides further information on the sample and raw proportions segmented by country and elite group.

The survey results show the respondents desire to use their domestic renewable energy resources efficiently addressing both the security of their energy supply and the challenge of climate change.

Above all, wind and solar energy should be significantly increased, in order to secure energy supply and mitigate climate change.

Considering the high standards of hydropower and biomass, this is no surprise. In order to be able to use renewable energy, supraregional power grids are needed. Corruption, bureaucracy, and lack of international cooperation are the most significant obstacles to building such grids.

Investments are essential for the implementation of renewable energy projects. Respondents welcomed international investments but did differentiate between their origins. Investments from countries in the European Union (EU) are mostly seen in a positive light.

The expansion of renewable energy is considered as beneficial to international relations. Most respondents were aware of the impact of climate change and recognized its risk to water and food supplies. Moreover, risks such as increasing migration and social tensions were also seen as applicable. Respondents saw the expansion of renewable energy as a possibility for reducing climate change or reducing extreme weather events. In this context, respondents understood fossil fuels as the cause of climate change and most endorsed the use of a CO₂ tax. Most respondents were in favor of investments in renewable energy, despite the presence of fossil fuel resources in the region.

The primary energy consumers and producers Brazil and Argentina are seen as the principal winners in

the expansion of energy in Latin America. Moreover, Chile which hardly has any of its fossil fuel resources is also engaged in successfully developing renewable energy. Venezuela was seen by respondents as the biggest loser.

Overall, respondents endorsed the financial provision of a joint fund to advance the development of renewable energy. However, they do want more from the fund than they are willing to pay in, except Brazil, where there is a preponderant willingness to pledge more.

The necessity to develop a power grid across the whole Latin America was supported by all respondents, despite high costs. Regarding investments in developing renewable energy in Latin America, financial support should mainly go to domestic companies.

INTRODUCTION

In the last decades, renewable energies have experienced remarkable growth. Primarily motivated by climate change mitigation, many countries are changing their energy matrix towards clean and renewable energy sources.

The European Union provides an excellent example of the vast potential of renewable energies. In the Netherlands, solar panels and wind power already account for a significant share of the domestic energy production (Dignum, 2018), and Germany's Energiewende has placed renewable sources at the centre stage of the country's energy sector (Sattich, 2018).

Developing countries are also quickly catching up. For instance, Brazil already has most of its electric energy supplied by hydroelectric plants. India has launched a massive renewable energy investment program, and clean sources currently represent about one-six of the nation's total energy production (Chawla, 2018). However, the most significant player in this area is China: over the past five years,

China has taken the lead in the energy front, and renewable energies have become an essential piece in China's strategy to mitigate climate change and reduce environmental damages (Freeman, 2018, p.192). Alongside the European Union and the United States, China has a highlighted potential for international cooperation in renewable energies.

Nevertheless, the transition to a clean energy matrix also carries significant risks. Reliable and sustainable energy sources remain scarce, and access to energy market can trigger geopolitical tensions in several parts of the globe. Oil-producing countries may face political instability if commodity prices fall sharply, responding to lower demand (Graaf, 2018). Rare-earth minerals such as Neodymium and Lanthanum, necessary for renewables hardware, are

unevenly distributed, only being available in a few countries. There are also high entry barriers in the renewables' markets that gives substantial power to rare-earth producers. This increased market power may lead to escalating prices and attrition, as these materials increase in value (O'Sullivan, Overland, and Sandalow, 2017).

Moreover, developed nations hold a disproportionately large share of patents, and distribution of technology may restrict the access of emerging economies to cleaner energy sources (Sivaram and Saha, 2018).

Latin America exemplifies some of the dilemmas presented above. The regions' renewable energy sources are wind, biomass and solar. However, Latin American countries still need to overcome

several geopolitical obstacles to fulfil their real potential. For instance, electric power transmission grids require international cooperation and massive public-private investments, but such long-term commitments have proved difficult in the region. Additionally, Latin American countries are sometimes cautious about accepting foreign investments in energy due to national security issues. Therefore, if stakeholders are to promote clean energy in Latin American countries, how should they proceed?

The present study aims at answering these questions, helping policy-makers, firms, and governments to understand how the Latin American elites perceive the geopolitics of renewable energies in the region.



Renewable Energies Production

Energy has historically been a core factor in the Latin American geopolitics, and it is traditionally related to the availability of oil and natural gas in the continent. However, renewable energies are fast catching up with expanded production of solar, wind, and hydroelectric power.

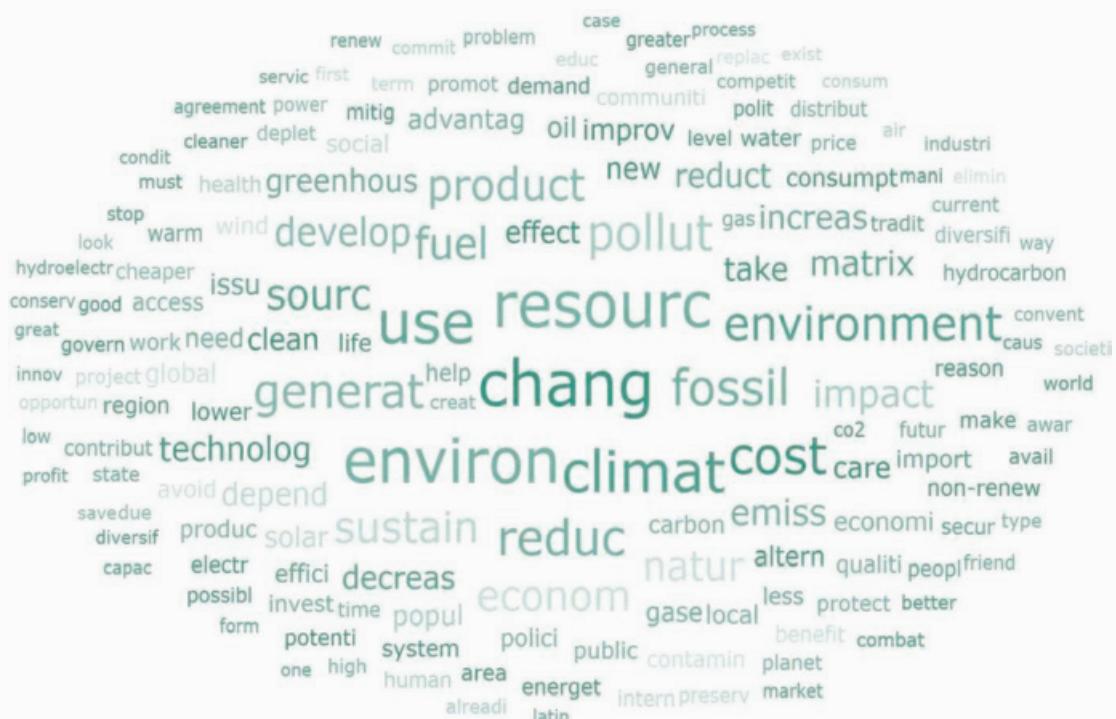
Although there still are substantial oil producers and exporters in the region, such as Venezuela, Brazil, Mexico, and Colombia, Latin America also has a large renewables capability, especially in terms of hydroelectric and solar power. The region has played a decisive role in the world's uphill energy transition due to its large hydropower production and potential.

As the elite opinion has a significant influence over the governmental decisions, this survey asked them about their perceptions of the geopolitical implications of a shift toward a higher renewable energy production in Latin America. The first question asked about the main reasons to invest in renewable energies in Latin America.

Q: In your view, what are the most prominent reasons for increasing renewable energies production?

The most frequent words used in the reasons for more renewables are *climate change*, *environmental resource*, *use*, *fossil fuels*, and *reduce*. A quick view of the results suggest that the elites want to invest in assets to mitigate climate change and to better use natural resources.

Once the elites pointed out that they are willing to mitigate climate change renewables knowing which sources will improve most facilitates policy implementation.

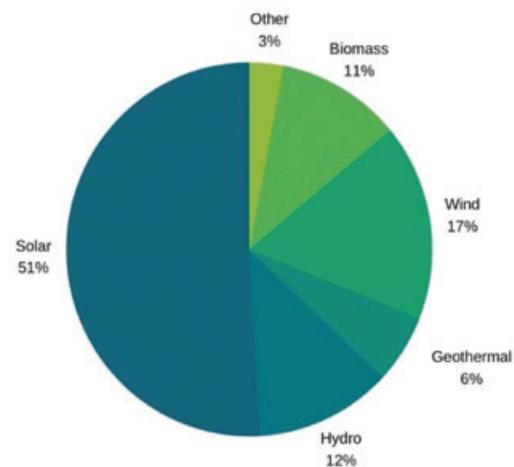


Q: If Latin America countries decide to increase their renewable energy production, which sectors will improve the most?

The elites perceive solar power as the energy type that will increase the most with more renewables (51%), followed by wind (17%), hydroelectric (12%), and biomass (11%). The results might be related to the current Chinese investments in solar energy and the large regional capacity for solar farms. Moreover, solar power can be produced in small scale and is suitable to fulfil the need of small towns and isolated rural areas. The current improvements in the storage facilitate even more the use of solar power off hours, increasing the reliability of solar energy.

A successful renewable energies implementation will require a transnational smart grid to carry the electric power across the countries and take advantage of changes in daily energy production. The implementation of an interconnected transnational

grid will face many challenges in Latin America. In this sense, we asked elites about the three most significant challenges they perceive in the creation of the smart grid.



Q: What are the three greatest challenges that a Latin America transnational smart grid project will face?

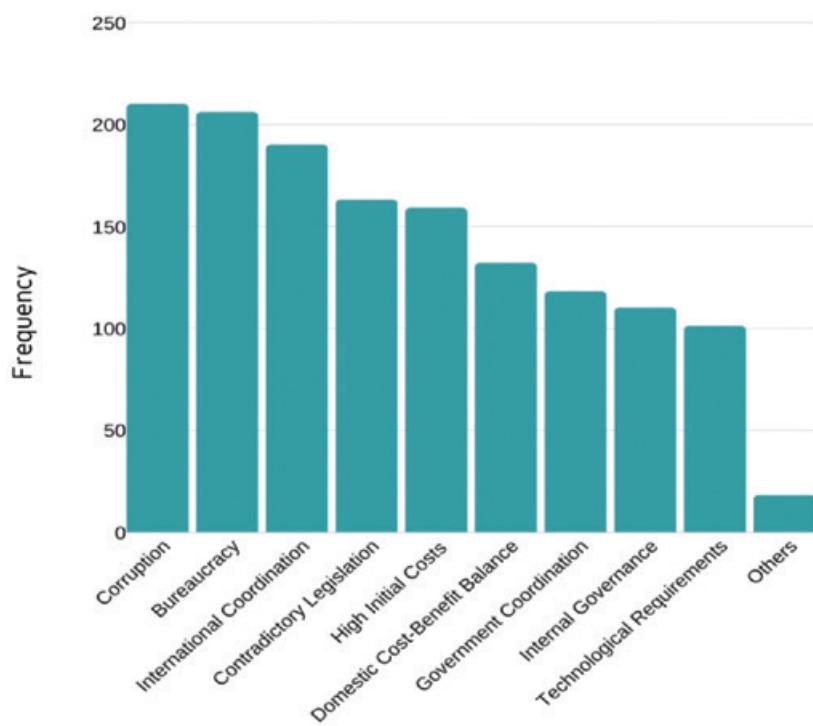
The challenges perceived for a smart grid implementation relate to corruption and government inefficiencies. Elites believe that the main problem that Latin America will face to have an entirely connected grid different from what a developed economy would have predicted. Instead of lack of technology or resources, elites believe that corruption, the bureaucracy, and the international coordination

among countries are the three most significant pitfalls for a Latin American smart grid project.

Finally, the ownership structure will heavily influence the decisions on renewable energies production, and every type of energy has its peculiarity, resulting in different energies being more suited for a state or private ownership. Historically, hydroelectric power

has been state-led endeavors in Latin America, as the costs are frequently impeditive for private firms to alone dam rivers, purchase turbines, and pay the environmental and social costs associated with the project. On the other hand, solar farms can be as

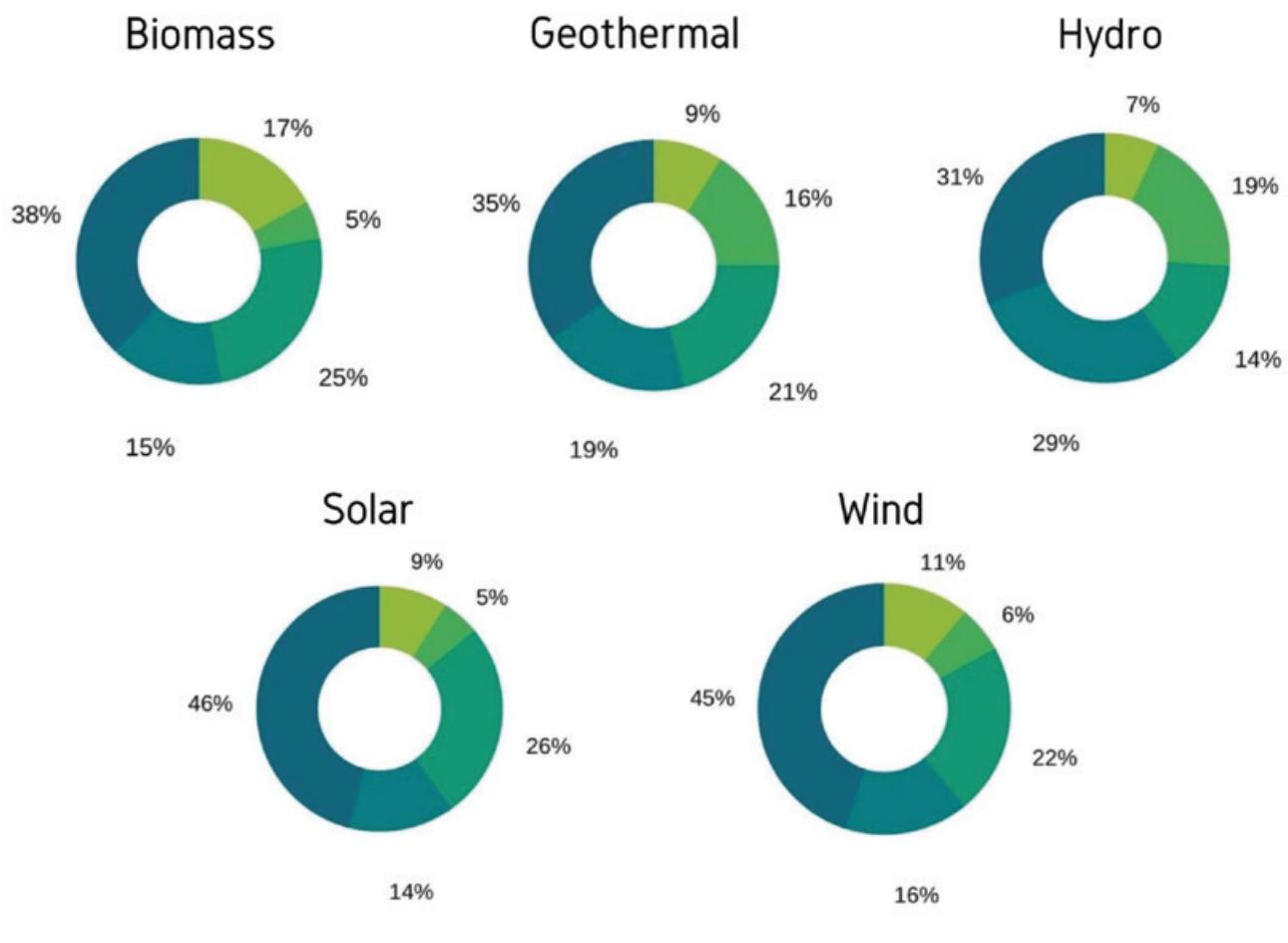
small as a house rooftop, and still produce energy to satisfy the need of a family. We asked elites what types of ownerships structure they prefer, varying the ownership for private-public participation for each renewable energy source.



Q: What ownership structure do you believe is better for the following renewable energies?

Elites believe that for the government and private companies, the production of biomass, such as sugarcane or corn alcohol is best and should be undertaken by private companies. For mostly government companies, they believe hydroelectric

is better, due to the difficulty in terms of costs and conflicts associated with it. The shared partnership is preferred by most of the types, signalling that this alternative is equally decisive in terms of energy production.



-
- | | | | |
|---|---|---|------------------------|
| | Government and private companies | | Government only |
| | Mostly government, but also private companies | | Private companies only |
| | Mostly private companies, but also government | | |
-



Geopolitical Risks

Investments in renewables, will reshape the geopolitics of gas and oil, increasing the importance of clean energies in the energy mix. Renewable energies, different from fossil fuels, need more political cooperation and agreements to a successful large-scale implementation.

This assumption motivated analysts to conclude that the geopolitics of renewables was less prone to conflict than fossil fuels-based energy sources.

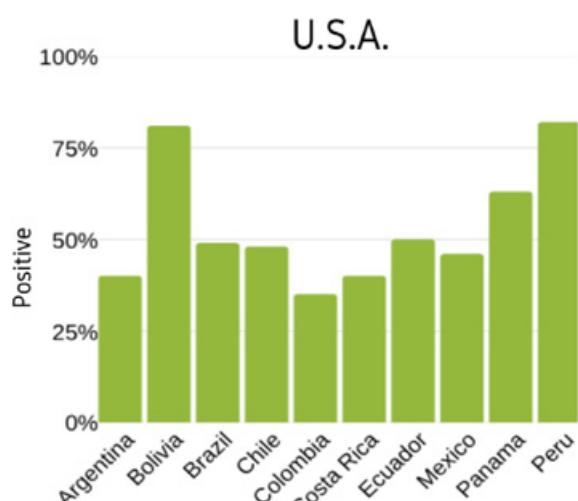
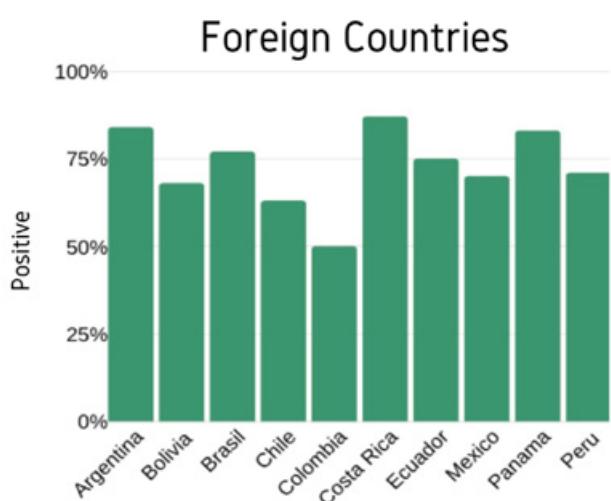
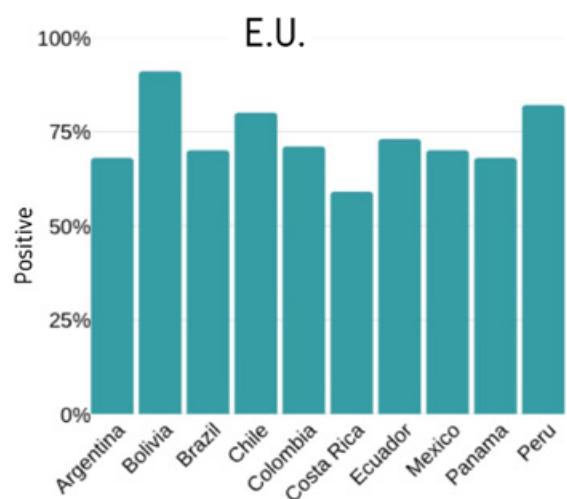
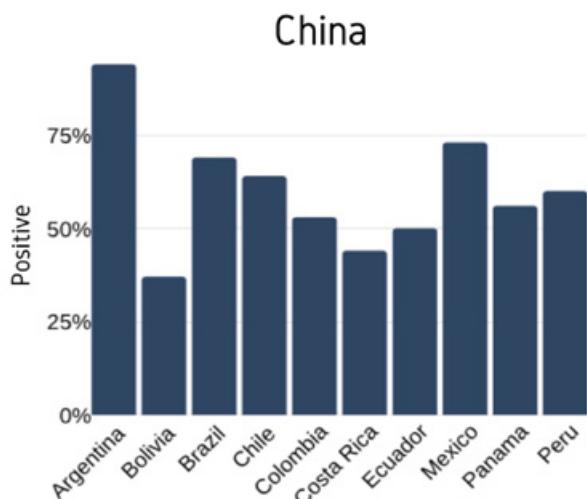
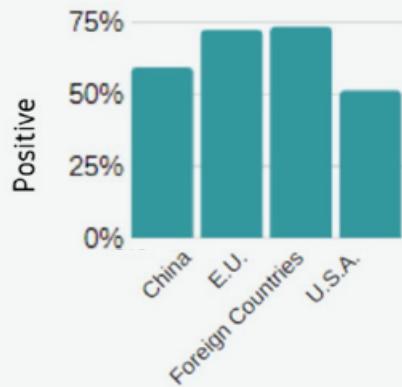
However, O'Sullivan et al (2017) highlighted that many other problems could result from renewable energies. There are at least three issues that could be triggered by increasing reliance on renewables:

- *Hydropower dependence*: as large-scale hydroelectric plants generate a considerable amount of energy, most of the region can overly shift the renewables balance toward hydroelectric power. This energy source may cause a substantial socio-environmental impact on countries.

- *New Resource Curse*: renewables hardware production needs minerals and rare earth. As the resources are unequally distributed, they could build a cartelized structure, such as oil producers did with the OPEC.
- *Reliance on foreign relations*: production, transportation, and storage need a considerable amount of investments and technologies. These assets are foreigners that could take strategic advantages over the other countries.

First, the survey asked about the general view of the respondents on foreign investments in the renewable energy sectors of their respective countries

Q: What is your general view about a foreign nation's investing in your country's energy sector?



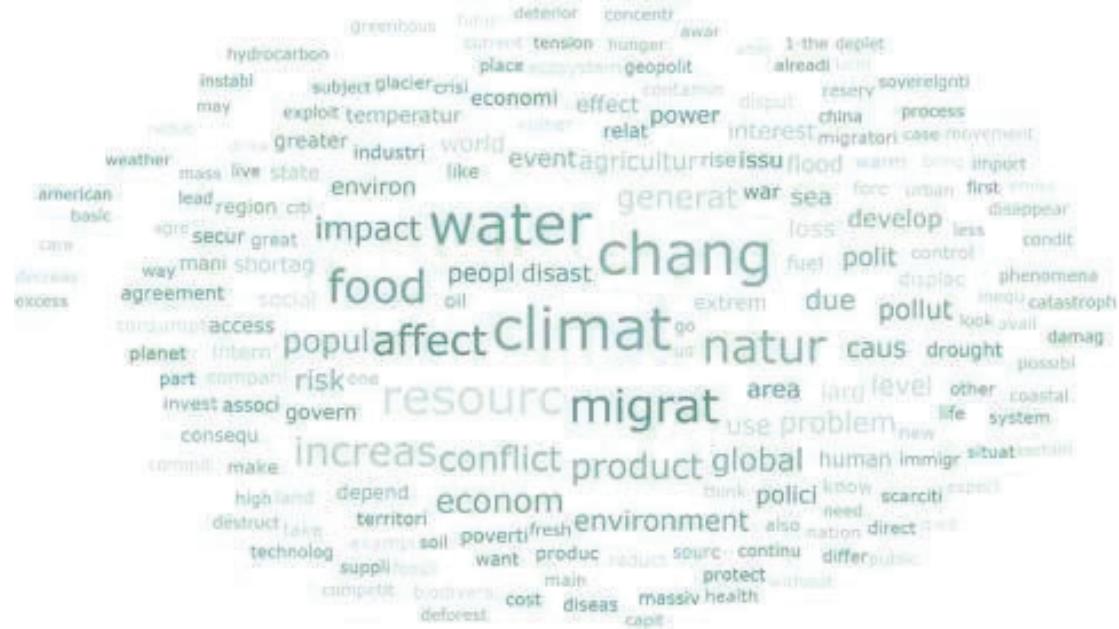
We find that respondents are overall open to investments from foreign countries. However, when we mentioned China and the United States, the largest investors in the regions, the opinions vary considerably. 73% of respondents hold a favourable view of an unnamed foreign nation investing in their 72% of positive ratings. China and the United States come next, with 59% and 51% of positive ratings, respectively. When looking at specific country-level variation, the country that is overall most sceptical of foreign investments is Colombia, only having positive ratings when talking about European Union. Peru is the most welcoming country, with rating all over 60%. When talking about specific investors, the European Union is the most welcomed investor, with a minimum 58% of positive ratings. The United States is the most unwelcome partner, with rating as low as 35% (for Colombia).

These results highlight an aversion to powerful nations and they have two practical implications. On the one hand, it shows that Latin American countries would welcome investments from their fellow neighbors, which could facilitate regional cooperation. In the other hand, powerful nations, with considerable investment capabilities, are seen with scepticism, and this may be because the companies currently investing in these countries are from the United States or China. Otherwise, besides the scepticism, most of the population prefer to receive investments regardless of the partner (average 63% and a minimum of 51% for the United States).

Risk are also significant when reasoning about climate change mitigation and renewable energies investments. The study divided the risks into two categories: global risks and Latin American specific risks. The next question asked about the global geopolitical risks associated with climate change.



Q: In your opinion, what are the biggest global geopolitical risks associated with climate changes?



This question aims to capture the perceived costs of not acting to mitigate climate change. Investing in renewables are already cost-effective, as costs dropped sharply, and investments are quickly paid off.

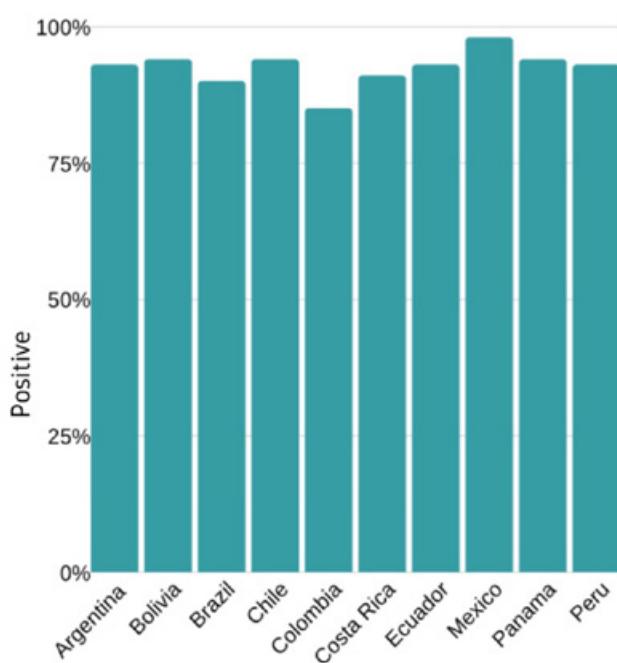
However, perceiving that a non-action in this part would increase the costs considerably makes renewables even more attractive. In the answer, the most frequent substantive words are water, nature, food, affect, resources, disasters, and lack. The findings suggest that the primary concerns are water and food supplies, which might be affected by climate change disruption. Next, people suggested that natural disasters are a big concern when it comes to climate change. Finally, respondents are

also concerned with their country's sovereignty, as they also mention words such as conflict, power, sovereignty, and tension. These insights are supported by some less frequent words, such as scarcity, shortage, and supply. Moreover, the less frequent words teach us that elites consider broader impacts of climate change, such as migration and immigration problems, poverty, and inequality.

We also asked elites about the importance of more renewables in their foreign relations. This is important, as renewables will substantially change the geopolitics of oil and gas, that was commonplace in the past century.

The views on the geopolitical risks are consistent with a low-risk assessment of investments and support for a massive renewables production. Moreover, elite have a clear perception of costs that will be generated by the extreme weather events coming with climate change.

Q: What impact do you believe that increasing the share of renewable energy in the Latin America energy mix will have the latin American countries foreign relations?



As we can see, elites are almost unanimous in their belief that increasing the share of renewables, will have a positive effect on the countries' relations. Overall, 92% of respondents perceive increasing as positive. When we break the proportions by state, the vast majority hold above 90% of positive views on renewables. The exceptions are Brazil and Colombia, mostly because they are already suffering from Venezuelan migration, and fewer fossil fuels would intensify the Venezuelan problems even more.

In summary, the views on the geopolitical risks are consistent with a low-risk assessment of investments and support for a massive renewables production. Moreover, elite members have a clear perception of costs that will be generated by the extreme weather events coming with climate change.



Climate Change Mitigation

The anthropomorphic climate change will be one of the most substantial sources of income and property loss in the following years.

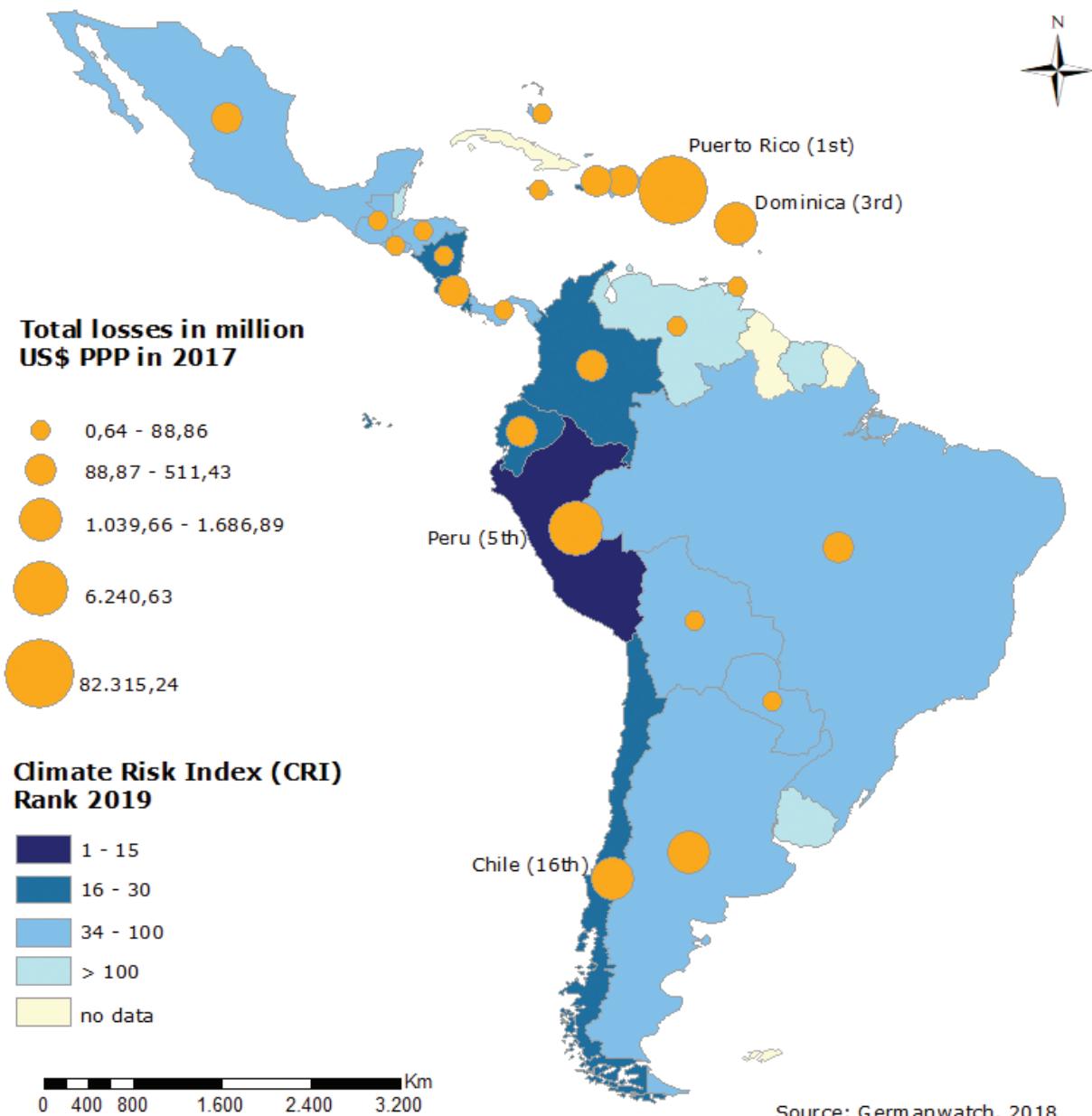
Estimations from scientists reassure the catastrophic forecast that if we fail to keep carbon emissions by 53 tons of carbons dioxide by 2030 (a mark that we, unfortunately, reached in 2017), we will experience extreme weather conditions that are likely to affect most of our income and wealth in the years to come.

For instance, the NGO Germanwatch calculated the current socio-economic losses caused by extreme weather events in the world. The Global Climate Risk Index (CRI) combines social economic data collected from the Munich Re's NatCatSERVICE, a comprehensive database for analysing and evaluating the effects

of extreme weather events such as storms, floods, heat waves, among others. The Global Climate Risk Index considers absolute and relative impacts, ranking countries, regarding the expected economic losses resulting from extreme weather events.

The socio-economic losses for Latin America are astonishing: we have three of the most affected countries in the world: USA, (Puerto Rico), Dominica, and Peru. Moreover, the Caribbean is the most affected region by extreme weather conditions in the entire planet. The following map shows the 2017 losses in Latin America according to the CRI 2019 ranking.

SOCIO-ECONOMIC LOSSES FROM CLIMATE CHANGE IN LATIN AMERICA



Renewable energies are crucial to improve climate change and to lower greenhouse emissions. However, if elites fail to perceive that the region will be affected by extreme weather events and that investing in renewables is a viable alternative to mitigate climate change, then it will be hard to justify the investments. When costs are high, investments are risky, and there are considerable fossil fuels reserves available, investing in renewable energies could have a dynamic like a prisoner's dilemma: although extreme weather events will cause substantial

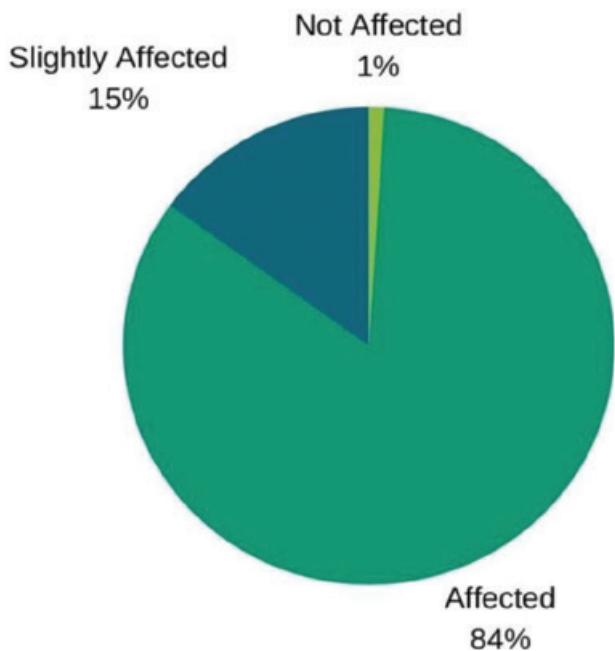
costs, the benefits from keep fossil fuels at the center of the energy matrix are even higher. This survey asked four questions to the Latin American elites, aimed at understanding their views about climate change mitigation.

First, we asked elites whether they believe that the region will be affected by extreme weather events. This question aims to measure the elites' perceptions about the seriousness of the events that are currently occurring in the region.

Q: How much do you believe that Latin American countries will be affected by extreme weather events?

In our sample, 84% of the respondents believe that the Latin American countries will be hugely affected by weather events. If we sum the "Affected" and "Slightly Affected" responses, they almost unanimously think that extreme weather conditions will impact the Latin American countries. This result highlights that the number of climate deniers in Latin America is low among stakeholders in the energy sector.

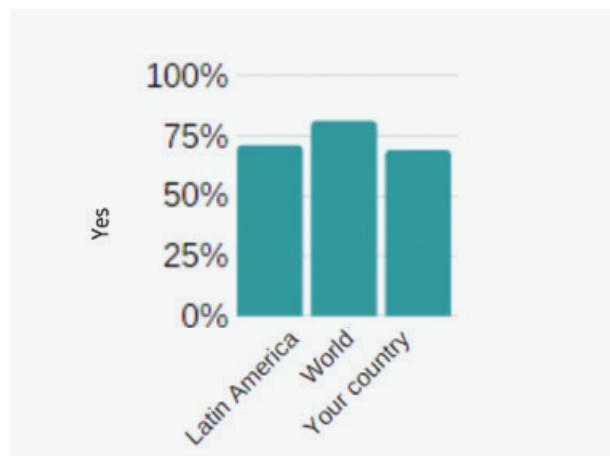
To increase the renewables' production, elites should believe that this may improve the weather condition. This perception could change the cost-benefit evaluation toward renewables, even when renewables give a lesser net benefit. The survey asked whether respondents believed that investments in renewable energies would affect extreme weather events.



Q: Do you believe that investing in renewable energies will lower the likelihood of extreme weather events in:

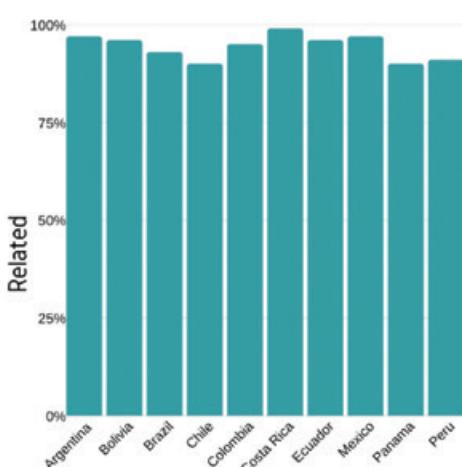
We varied the question phrasing, asking about Latin America, the World, and their home countries. The results demonstrate that elite members strongly perceive renewables as part of the solution for extreme weather conditions. However, the respondents feel that the world will benefit more from the investments than their home countries. This perception could be troublesome, as it may motivate an understanding that other countries are free-riding from elite member nation's efforts. Note that these proportions represent the number of respondents that answered Yes to the question, for each of these three possibilities.

The relationship between climate change mitigation and fossil fuel consumption is crucial for the elite behaviour relative to future stranded fossil fuel assets. The survey asked respondents how much of the current weather events are related to fossil fuels. In our sample, it is almost unanimous that the nexus between fossil fuels and climate change: 93% of respondents believe they are related.



Disaggregating by country, we can see that in Costa Rica they think is the highest (97,8%) while in Chile the belief is the lowest (88,6%). Costa Rica makes sense, as it suffers from the costs more directly, while Chile seems an intriguing case from this perspective, as the sizeable coastal line expose the country to many potential damages for extreme weather events.

Q: In your opinion, how much the recent disasters and extreme weather events are related to the fossil fuel consumption?

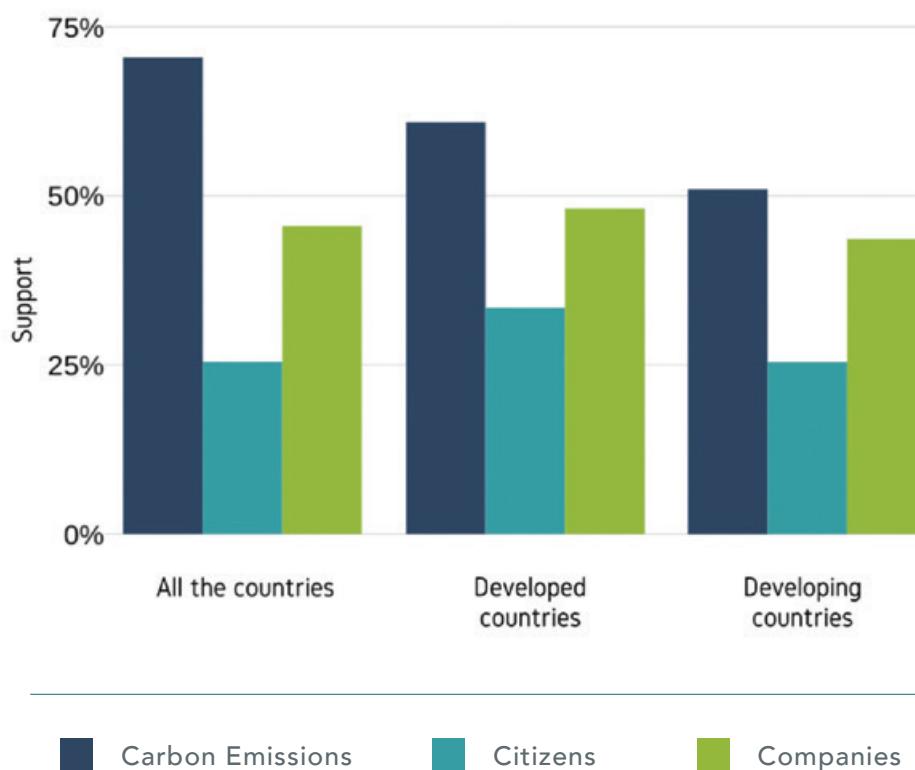


Finally, the transition to renewables, especially in the early, is expected to be expensive. To measure the willingness of elites to bear with the transition costs, the survey asked elites about scenarios in which they would perceive that it is fair to increase taxes for improving renewables' production. The question varied in two axes: first, priming different country levels as partners that adopted such taxes (all, developed, and developing); second, varying the types of taxes in three levels (carbon emissions, citizens, and companies).

Q: In order to increase the renewable energies production and mitigate the effects of climate change, countries may consider to further increase the taxes. Do you support or oppose an increase in the tax burden?

The results show a significant agreement to carbon emission taxes and an overall disagreement with citizens' taxes across all scenarios. Moreover, the majority agreement is reached when all countries agree applying the taxes, suggesting that perceptions of free-riding plays a substantial role in a taxation decisions.

In summary, the behaviour of energy sector stakeholders in Latin America is consistent with the expectations about the effects of climate change in the world. Elite consistently relate the costs generated by extreme weather events related with fossil fuels consumption. They also perceive renewables as an alternative to improve the situation, despite seeing that the world would benefit more than their home countries.





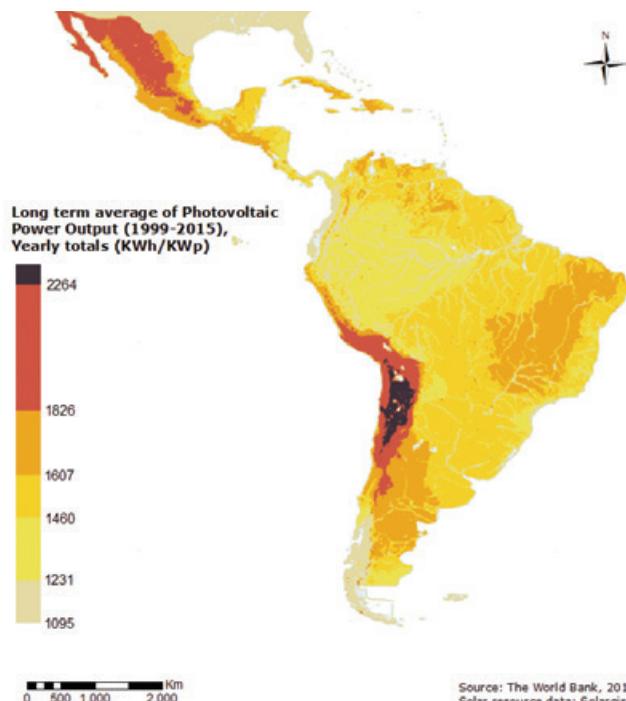
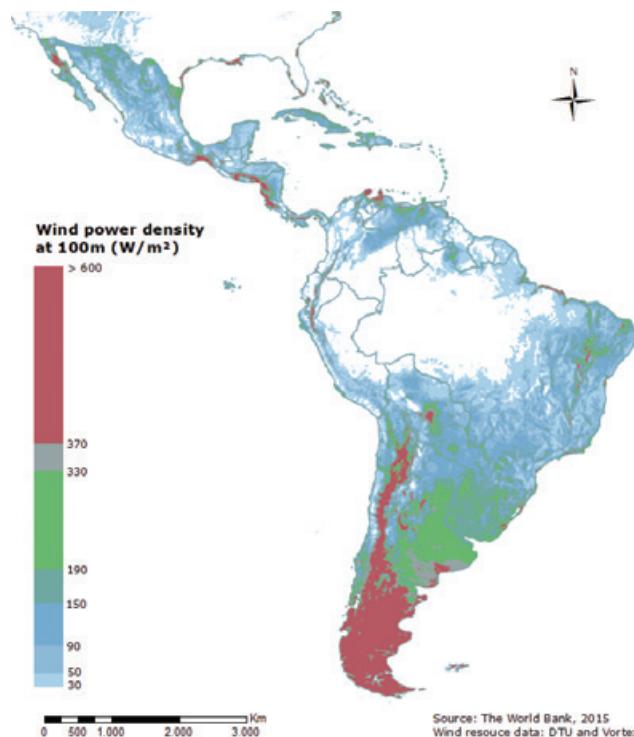
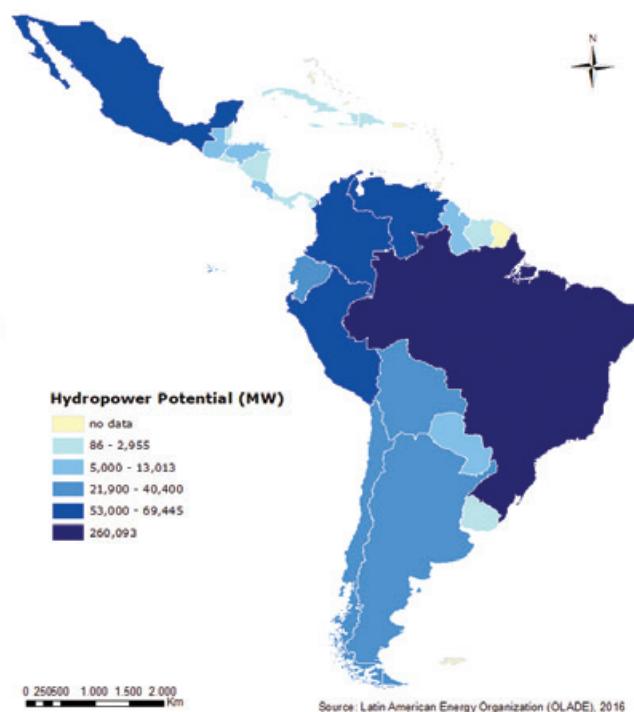
Costs and Benefits of Renewable Energies

Cost-effectiveness is vital for the long-term sustainability of renewable energies production. For longer, the main drawback of renewable energies were their high costs, when compared to the little in terms of energy output. Moreover, different from fossil fuels, renewables are harder to transport and store. However, these limitations are rapidly being overcome by the benefits of renewables.

These drawbacks limited the capacity of renewables to take off. In this scenario, hydroelectric power was the only type of renewable that succeeded. However, as a side-effect, it produced many environmental and social adverse outcomes, such as displacement and conflicts. Therefore, besides large hydroelectric plants in the '70s and '80s, when environmental laws were insufficient and social conflicts ignored, the net output of other renewable energy projects were hindered.

Since 2010, however, the costs of hydropower, solar photovoltaic, and onshore wind energy dropped

significantly. Solar PV and wind energy costs are currently competitive to fossil fuels, not to mention the lower hydropower production costs, thanks to its technological maturity in the continent. For instance, the deployment of onshore wind projects in Brazil has influenced the drop in its values of installed capacity. It reached a Levelised Costs of Energy (LCOE) of only USD 0,045/kWh in the most competitive projects (IRENA, 2016a). These features suggest that technological improvements and market maturity reduced the installed costs, improving the feasibility of renewable energies.

SOLAR ENERGY POTENTIAL**WIND POWER DENSITY****GEOTHERMAL CAPACITY INSTALLED****HYDRO POWER POTENTIAL**

The capacity of renewable energies output is considerable. Solar power, for instance, is higher in production capability in poor areas of Mexico, Peru, Bolivia, and Brazil. Wind energy achieves the highest productivities in the urban highlands and the southern cone of South America. Hydroelectric power production is already high, with larger countries having an edge, as they tend to have more water streams to be barraged.

Increasing the share of renewables will cause considerable benefits in competitiveness and employment in Latin America. Investments in renewable energies will contribute not only for the GDP growth, but also to the economic diversification

of countries, extending the value chain of renewables, and providing the revenues for creating and sustaining other industries, inside and outside the energy helm (OXFORD, 2008).

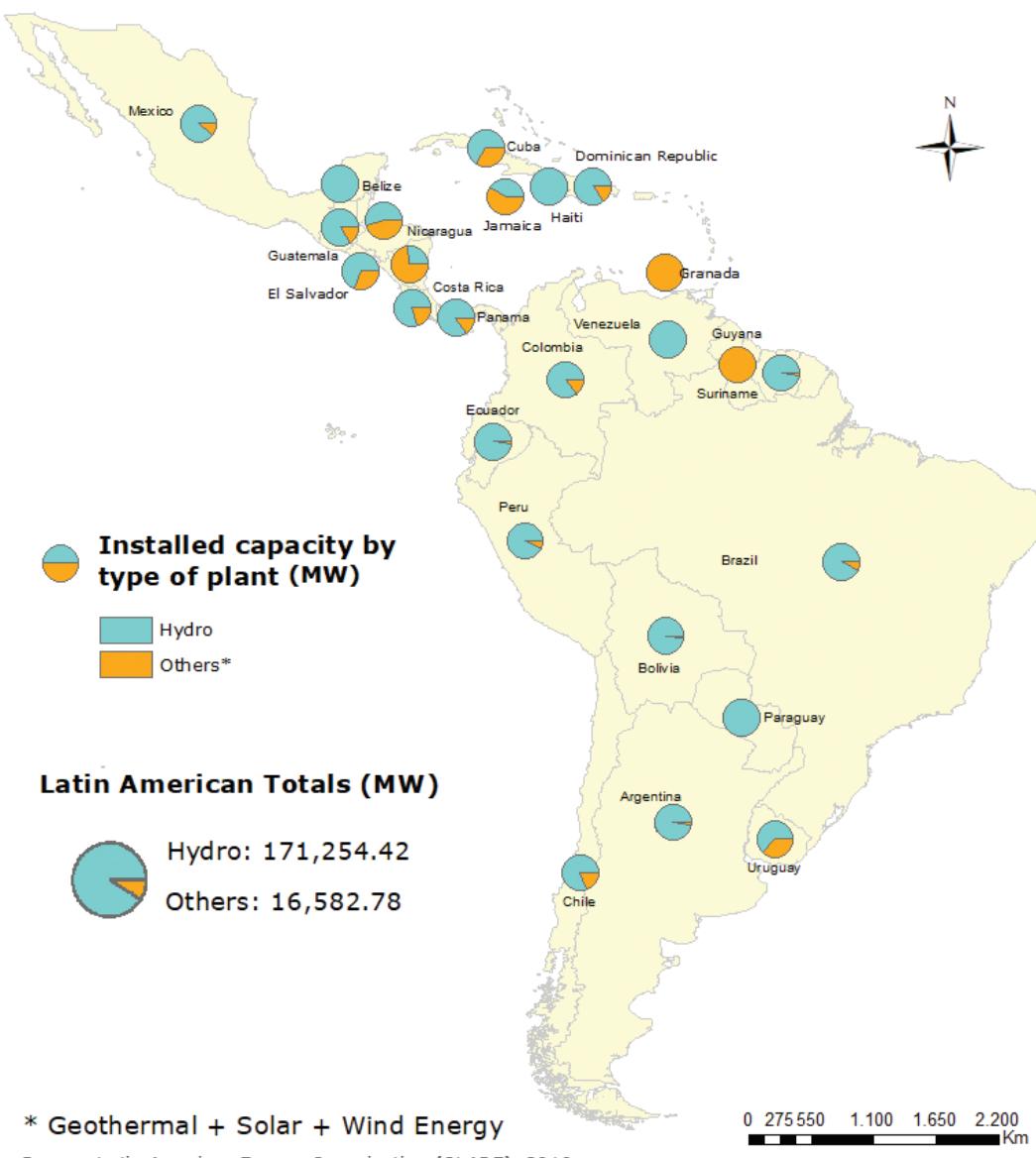
Furthermore, an energy transition toward renewables has expanded the workforce on a variety of sectors throughout the continent, employing millions of workers (IRENA, 2016b). Biofuels, hydroelectric, and wind remain the segments mostly labour-intensive, but it is worth mentioning that renewable energies also employ informal or temporary employees working, for example, in sugar cane harvests or the construction of mega dams.



According to map Main Sources of Renewable Energy Production in Latin America, the significant dependence of Latin America on hydroelectricity is substantial. Even though hydropower constitutes an option of energy production with low-cost and expressive availability in the continent, it is susceptible to climate change effects, such as higher incidence of droughts and limited access to water.

On the other hand, the increasing demand for biofuels, also challenges food security in the continent, since prioritizing their crops affects agricultural lands. Off-grid renewable energy solutions, targeting remote rural areas, are particularly relevant to achieve a more balanced nexus between energy, food and water supply chains in an unequal region as Latin America (IRENA, 2016c).

MAIN SOURCES OF RENEWABLE ENERGY PRODUCTION IN LATIN AMERICA (2016)



Costs and benefits also require elites to perceive the impacts of renewables and to be willing to invest in them, either by providing fiscal incentives or by advocating that countries receive fiscal incentives to improve the renewable energies production.

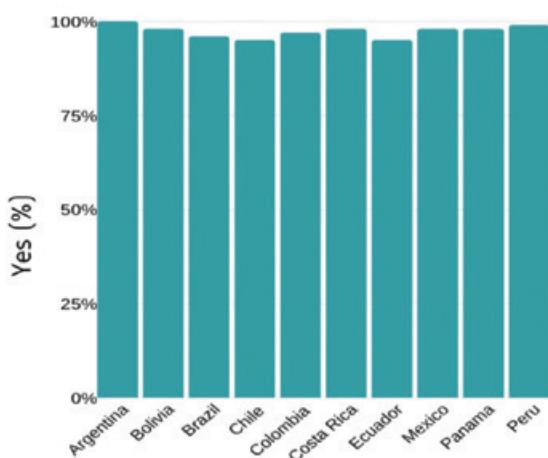
The first question asked on the costs and benefits of renewables was about the stranded assets problem. Stranded assets are resources such as oil or coal reserves that are untapped but are still accounted for as assets by countries and firms. These reserves are usually traded in futures markets and are used to

capitalize on firms in the stock market, even though investors may not be consuming the resources. This problem generates a pressure to use the resources actively and to lower the economic burden on subsidizing fossil fuel companies; a strategy must be devised to ease the pressure on investors and to keep a steady investment on renewables, despite the existence of fossil fuel reserves. To capture the elite attitudes regarding the stranded assets problem we asked the elites whether they believe that countries should keep investing in renewables, even though they have fossil fuels reserves.

Q: Do you believe that countries should invest in renewable energies, even when they have a considerable amount of fossil fuels reserves?

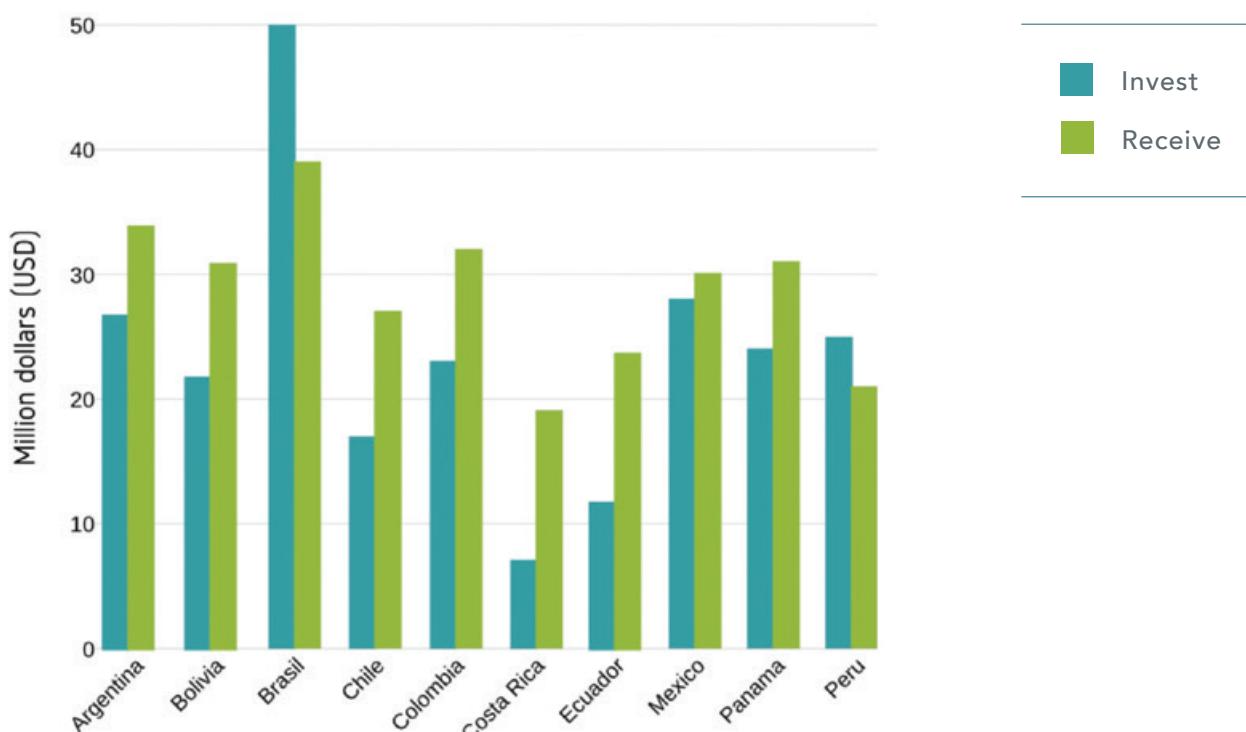
Overall, 97% of elite members believe that countries should keep their investments in renewables regardless of fossil fuel reserves. Ecuador, on this side, has the lowest agreement. This because in Ecuador, the oil reserves still play a significant role in the economy. On the other extreme, Argentinian elites unanimously agree that the country should invest in renewables, despite the fossil fuel reserves. The result is surprising, as Argentina has the fourth-largest oil reserve in South America.

However, the stranded assets survey response suggest that elites support a uniform investment to further the production of renewables in Latin America. The investment will require considerable coordination from countries, that may compose investment pools to fund the transnational mobilisation, especially in areas such as the smart grid interconnection. To capture this problem, we asked



the elite members about their perception of how much they believe their countries should invest in or should receive from an investment of 100 million dollars for renewable energies.

Q: Suppose that Latin American countries [have US\$ 100 million to invest] in renewable energies. How many millions in round figures do you believe your country should [recieve from/contribute to] the investment pool?



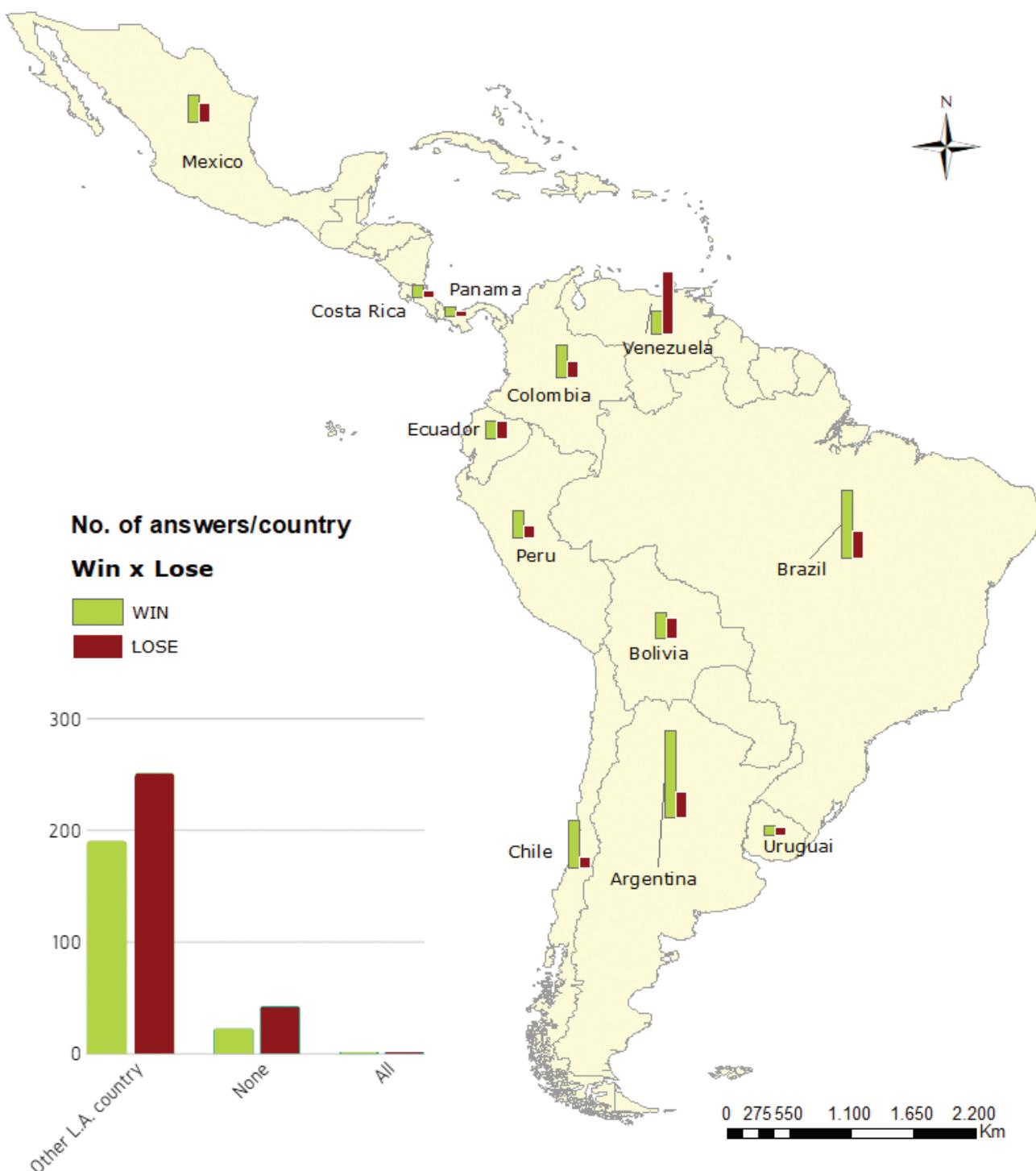
The standard free-riding theory would assume that all countries would want to receive more than donate. It makes sense, as common pool resources put considerable pressure on states to gain more benefits at the expense of others. In our results, two remarkable outliers are worth note: the Brazilian and the Peruvian elites believe that they should invest more than the amount they should receive back in investments.

The Peruvian case is probably due because they are one of the most affected countries by extreme weather events in the World according to the NGO Germanwatch. The Brazilian case is harder to interpret; however, we believe that the willingness to

pay more than receive reflects the idea of a regional leadership claimed by the Brazilian elites. All other countries remain in accordance with the free riding theory, most of them wanting to receive on average ten more million than the amount they believe their country should donate.

In this environment, mostly plagued by free riding, but with the explicit recognition that there should be considerable investments in renewables, it is difficult to foresee which countries that those elites believe that will win or lose in the new geopolitics of renewable energies.

POTENTIAL WINNERS AND LOSERS OF RENEWABLE ENERGY PRODUCTION





This question, nonetheless, is fundamental for understanding the geopolitical consequence of increased renewables production. There are two critical hypotheses for the winners and losers. First, the winners and losers could coincide with the countries that have more economic capability: the rich countries could be considered winners while the developing countries the losers. Second, the winners and losers could be a function of the capacity to produce renewable energies. In this sense, winners are the countries that could produce more and losers the countries that cannot produce at the same high level. To test this hypothesis, we asked elite members to cite countries that they perceive that would benefit or lose more with the increased renewable energies level.

The results point that Brazil and Argentina are the ones that both win and lose with the renewables. This result is due because both countries have a vast potential of producing all types of renewables that would become stranded with a massive renewable

investment. It has a curious effect on the perception of winners and losers with changes in the provision of renewable energies.

On the winners' side, the third most cited is Chile, whereas for the losers, the most referred is Venezuela. The Chilean case is probably due because of the extensive coastal-line, with potential for wind, solar, and tidal energy, while Venezuela is the biggest loser because of the massive oil reserves that would become stranded.

We also asked about factors that would help or hinder the investments on renewables. It is essential to have a better picture of the winners and losers, and what elites are thinking when they reason about the phenomenon. Concerning the factors that are likely to help countries, the most cited keywords were *resources, cost, nature, development, potential, and economy*. These words highlight the fact that elites perceive renewables as cost-effective and see this fact as the most critical feature to propel renewable energies investments.

Q: Can you list two factors that are likely to HELP the investments in renewable energies in your country?

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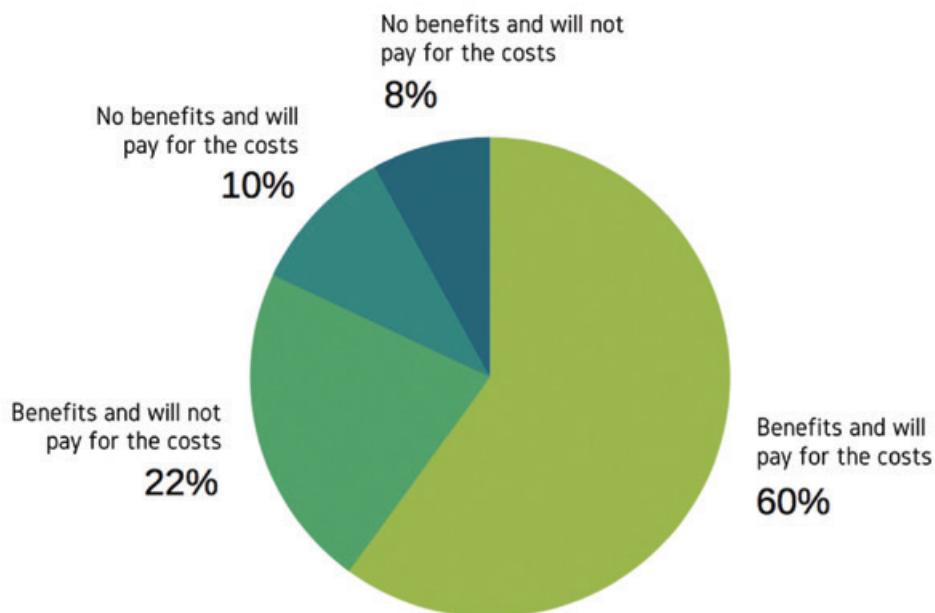
Q: Can you list two factors that are likely to HINDER the investments in renewable energies in your country?

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On the other hand, when the survey asked two factors that would hinder the development of renewables in the region, the most frequent words were *politics, government, investments, economy, cost, and technology*. The outcome suggests two conclusions: first, that political problems are perceived as crucial for hinder the renewables developments, and that prices of investments are among the most significant barriers to the renewables.

A critical feature about renewables is the difficulty to transport and store. Presently, the developments of batteries have taken care of storage problem, but renewables require transnational grids, that react to daily changes in renewable energies production. To capture this feature, the survey asked about the beliefs on the costs and benefits of a transnational smart grid in the region. Most respondents believe that there will be benefits (81%), but substantial fraction also finds that countries will have to pay significant costs (30%).

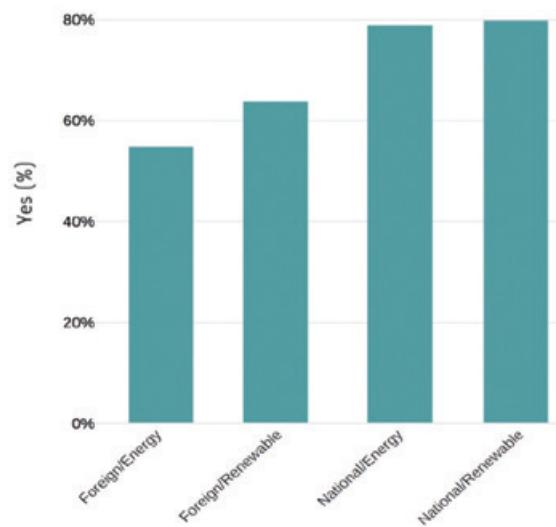
Q: If the Latin American countries implemented a transnational smart grid, do you believe that your country will receive:



Q: Do you believe that [national firms/foreign firms] investing in [renewable energies/the energy sector] should receive fiscal incentives?

Finally, the survey asked whether firms investing in the energy sector should qualify for fiscal incentives. The types of firms and their nationality varied in two axes: foreign versus national and energy in general versus renewable energies. Latin American elites unanimously support that domestic firms should receive investments (80%), but they see that foreign companies investing in renewables should be favoured more (65%) than foreign energy companies (56%).

In summary, renewables have a high production potential and are perceived as cost-effective by elite. Elites have a clear picture that the region has a potential to up the renewables productivity, and they see the drawbacks, such as costs and the high initial investments. They also believe that countries will receive considerable benefits from a transnational



smart grid, emphasizing that they perceive the transmission problem as a crucial issue for renewables transportation.





International Partnership

International partnerships are crucial for a successful transition to low carbon. International partnerships may facilitate the acquisition of technology and hardware to generate renewable energy. They may increase the amount of capital available for a given project.

The implementation of smart grids will need cooperation with other countries both, for harmonizing the legislation that countries have, and to acquire technology required to operate the transnational grids. Therefore, international partnerships are helpful to boost the renewables' provision.

However, there are three issues to understand how the geopolitics will interrelate with partnerships in the region. First, an economic partnership for an infrastructure project is evaluated both accordingly to the capacity of the other party to contribute to the project, as well as the policies that the partners

are implementing in their own countries. Second, the minerals and rare-earths needed for renewables hardware production are unequally distributed in the world. This distribution encourages countries to create cartel-like institutions, which would harm most countries while keeping large profit margins for the producers.

Finally, countries could aim at motivating others to comply with the Paris Accords by providing targeted loans, specifically to be invested on renewables. It might be interesting to observe in which sectors would most countries believe that investments are

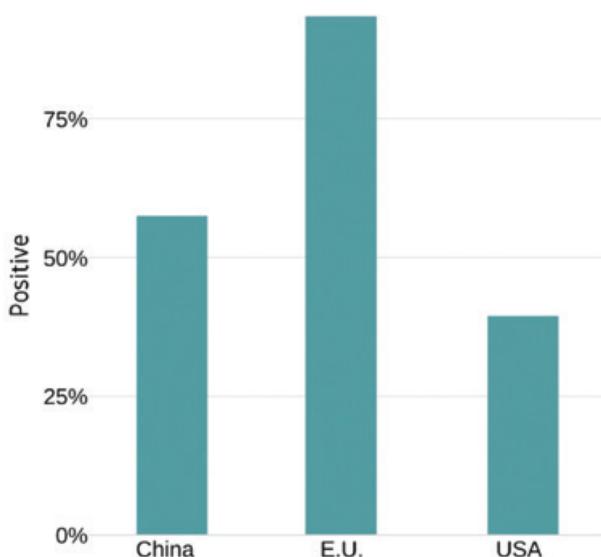
more effective (see page 33). Therefore, partnerships are geopolitically sensitive and intricate.

The most significant partners investing in large-scale infrastructure projects in Latin America are China, the European Union, and the United States. They are the countries with cheaper capital stocks and are the patent holders of most of the hardware technologies needed in renewable energy projects.

For instance, the United States holds most patents when it comes for storage of energy while China and the European Union hold essential patents on wind turbines and photovoltaic cells.

The survey asked Latin American elites which countries have the most positive renewables policy, to understand the views on China, the US, and the EU.

Q: How do you evaluate the current governmental policies on renewable energies in the following countries?



The European Union received 93% of positive evaluations on their renewables policies. In the second place, 57% find that the policies enacted by China

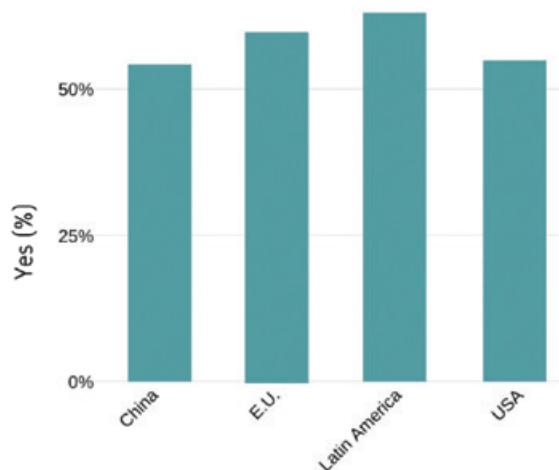
are favorable for renewables. Finally, only 39% find the policies carried out in the US as positive for the renewables. The result for the US is understandable, as the Trump administration has been heavily favoring oil and coal over renewable energies. An interesting point to notice is that, despite the significant investments in renewables, the Chinese policies are not as perceived as positive as the European Union's renewables' policies. The difference is likely to be related to the fact that China is presently one of the largest polluters on the planet.

The opinion about a possible partner's internal policies may also influence the willingness of countries to accept investments from such partners. To measure the opinion regarding partners, the survey asked which countries elites believe that would be able to get the investment on a transnational Latin American smart grid to be successful.

Q: Suppose that the following countries announce a Project of a transnational smart grid integrating all the Latin America countries. Do you believe that the initiative will be successful?

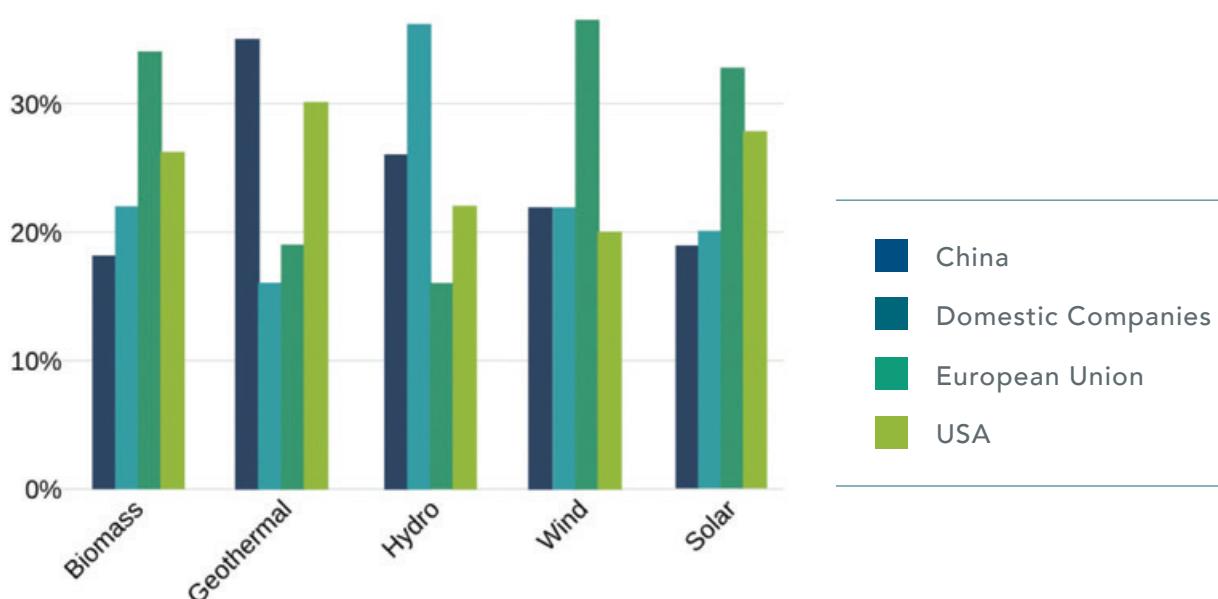
The survey questioned about four different possible partners: China, the European Union, the United States, and Latin American countries. The results show that investment from other Latin American (63%) countries as believed as the most effective, followed by the European Union (60%), China (54%), and the US (55%). This outcome was unexpected, but if we think that the effectiveness of an investment could be related with the proximity and likelihood of receive benefits of the investor, it makes sense that countries perceive the Latin American countries as the most reliable partners.

Then the survey investigated the preferred partners for a renewable energies project, varying the type of renewables, to capture the specialization of the part-



ners on the production of renewables. This question added the option of elites suggest a domestic firm provide the service. The idea is to capture the sense of nationalistic views on renewables production.

Q: Which partner would you prefer for start a renewable energy investment?

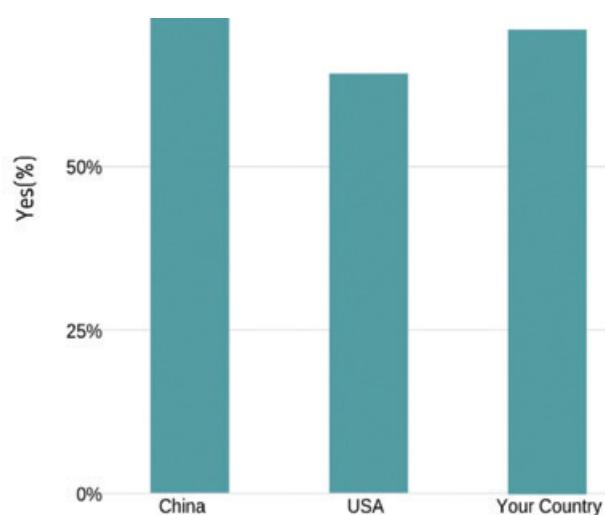


Elites view domestic companies as the most adequate to implement hydroelectric projects, and this is due because most of the currently installed capacity is already national.

Elites view domestic companies as the most adequate to conduct hydroelectric projects, and this is due because most of the installed capacity was already domestic. For wind and solar plants, the preferred partner was the European Union while for Geothermal was China. The US did not reach the top in any energy, although it ranked well in Geothermal.

The cartelization of production plagued international partnership in oil and gas. Although the same possibility could be perceived as unlikely in the renewable energies market we still asked the elites about the fairness of an assembly of cartel like institutions in the renewable's hardware production.

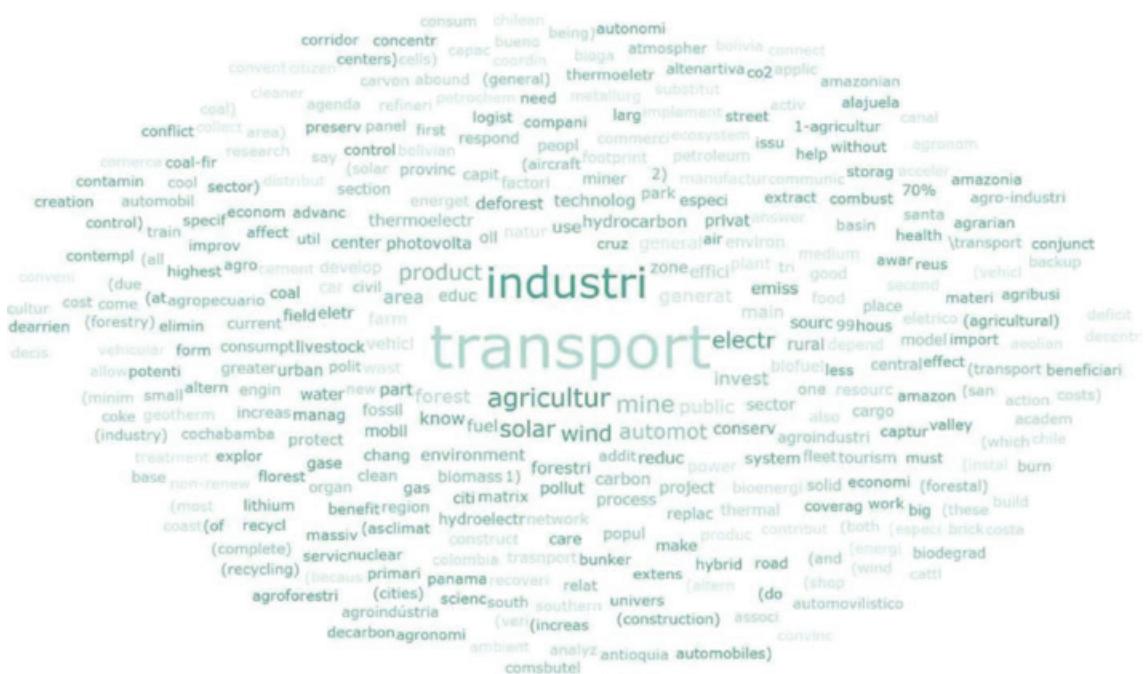
Q: Suppose that [your country/US/China] produces large quantities of mineral resources such as lithium or rare earths, necessary for renewable energies hardware. Would you say it would be unfair if the producers form an organization, such as OPEC?



As expected, the majority of respondents dislike the idea of having an OPEC-like institution for renewables. Curiously, they believe that China would mostly be unfair if it builds a cartel. This result suggests that the elite know well that China is the largest producer of these mineral.

Finally, the survey asked respondents which sectors the investments in renewables would be more effective. This question aims to capture the perceptions regarding the current technology and willingness to use the investments in the best way from a productivity standpoint.

Q: Suppose that your country receives a massive foreign investment in technologies to reduce carbon emissions. What sectors do you believe that the investments would be more efficient?



Elites believe that the transportation sector is where the investments would be more productive. The green car revolution probably may be affecting already the way that Latin American elites perceive the future of renewable energies investments. The second sector, which is highly intensive in energy consumption. It points out towards a perception by the elites that renewables are competent enough to produce in such a large quantity that could satisfy the industrial needs.

In summary, international partnerships are well considered by the Latin American elites. They have a consistent opinion on other partners' national policies, they have preferences on the investor, favoring Latin American Countries, and they believe the industrial and the transportation sectors as the most effective to invest.



Energy Security

To boost renewables energies production, elites must perceive that renewables can successfully contribute to a secure and a steady flow of energy.

The long-term sustainability will depend on investments now that would create the infrastructure necessary to deliver the energy increased. However, energy security in the region depends on three components:

1. Investments in renewables production;
2. Partnership to acquire technology;
3. Efficient transport and store the produced energy.

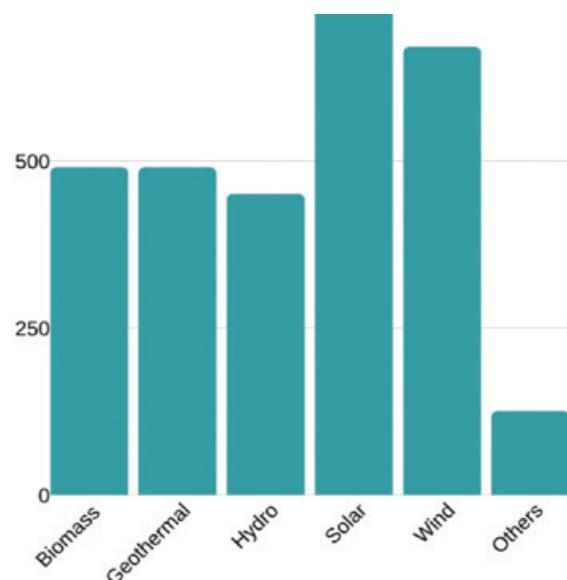
To understand how elites perceive the impact of renewables in energy security and stability, the survey asked what sources elites believe are better to achieve energy security in Latin America.

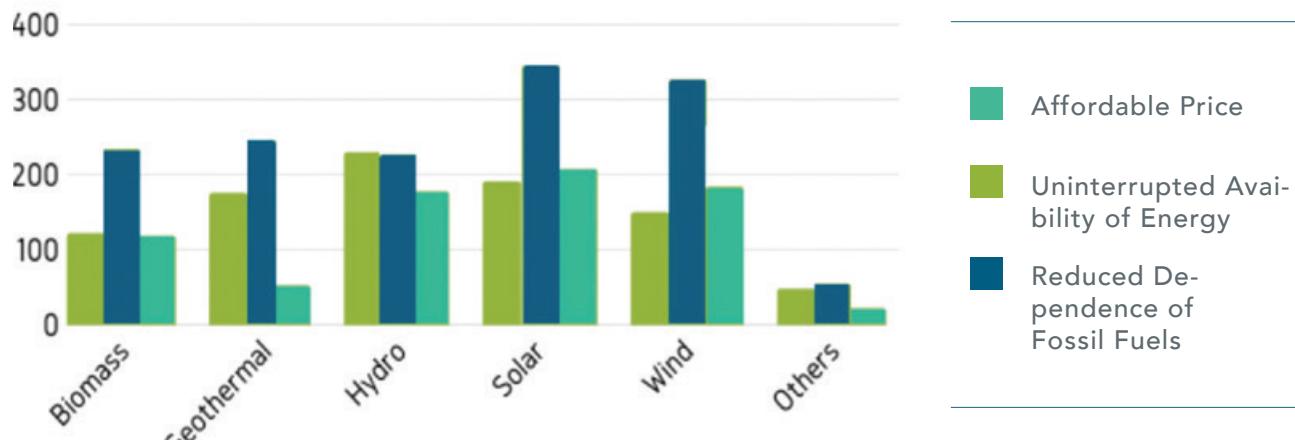
We divided the energy security into three dimensions: affordability, fossil fuel independence, and uninterrupted energy flow.

Q: Which renewables do you believe are better for your country in terms of energy security?

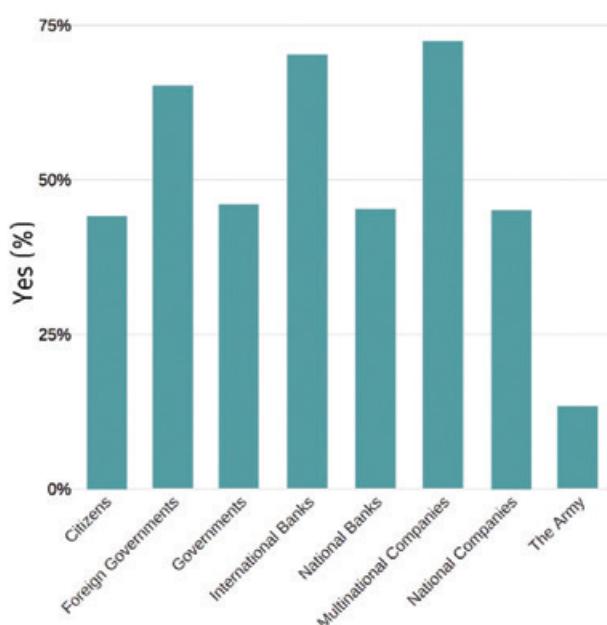
Renewables are still perceived as an expensive alternative to fossil fuels, despite the improvements in the terms of price: only 25% of respondents perceive renewables as a cheaper alternative to fossil fuels. Regarding the energy flow, renewables are still perceived as unreliable: 29% see renewables as capable of providing a steady flow of renewable energy. Finally, the majority of respondents (46%) see renewables as an alternative to fossil fuels.

It suggests that in terms of energy production, elites fail to perceive the benefits of increased renewables in terms of its impacts on the energy supply. The most prominent reason is to decrease fossil fuel dependence, which could prove volatile if oil prices drop abruptly.





Q: Do you think that these actors are interested in investing in renewable energies?

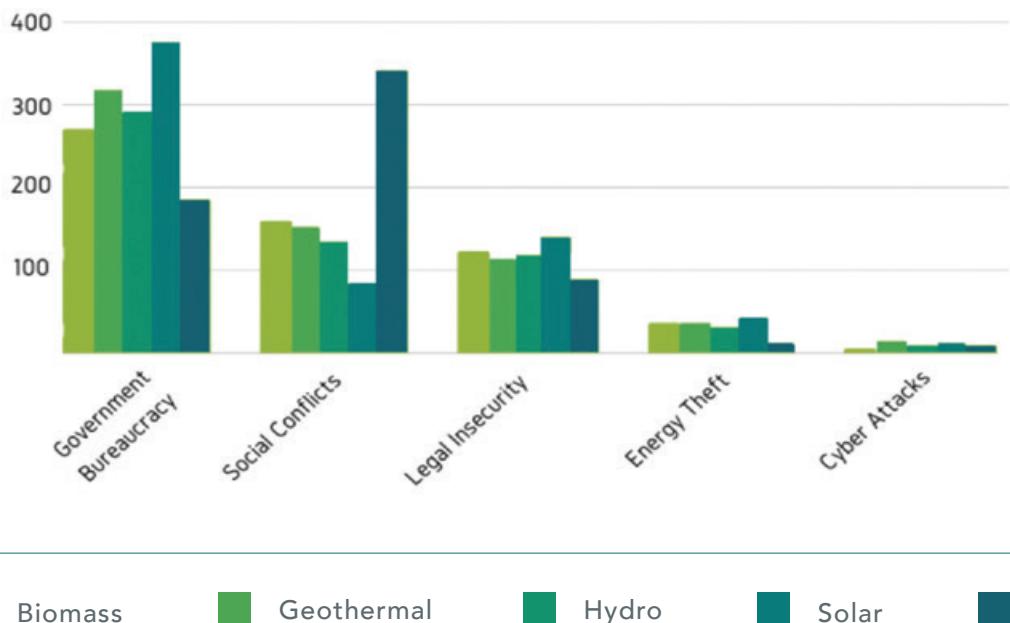
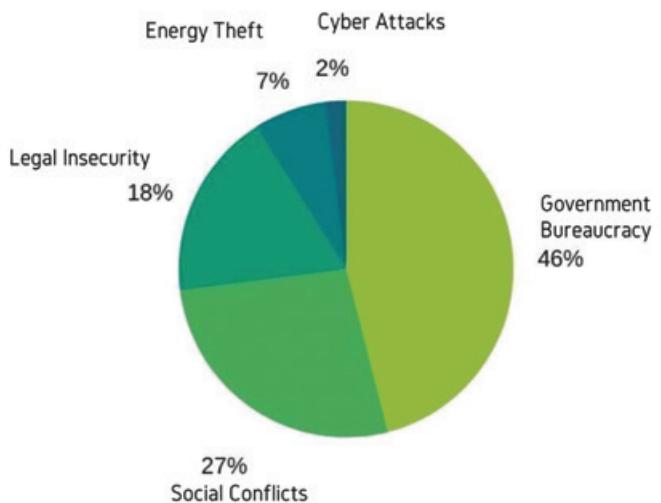


Elites believe that national actors, such as government, national companies, and banks, and the armed forces, have no interest in investing in renewables. The foreign actors on the other hand, are perceived as more willing to invest in renewables. The only national exception is the citizens, indicating that the elite members would be willing to raise their investments on renewables personally.

Finally, the survey investigated which are the more critical threat to energy production. The standard concern in developed countries usually mounts to investments and the presence of hardware. However, in developing Latin American countries, the elite members ranked the threats on five levels: social conflicts, energy theft, cyber-attacks, government bureaucracy, legal insecurity (poor contract enforcement).

Q: Which threats do you think are more critical for renewable energies production?

The overall measures point that the government bureaucracy is the most critical threat against renewables' production (46%). Next comes social conflicts with 27%, follows by legal insecurity with 18%. A threat substantial in developed economies, such as cyber-attacks, is believed to be important by only 2% of respondents.



In summary, for energy security, elites believe that solar and wind are the energies that have the most growth potential, but they still see the hydroelectric as the gold standard in terms of reliability. Moreover, the perceived threats are mostly related to internal

politics, instead of international relations and geopolitical risks. It asks for further investigation on the internal politics of Latin American nations, as this may clarify the perspectives for improvement in renewables in the region.



Domestic Politics

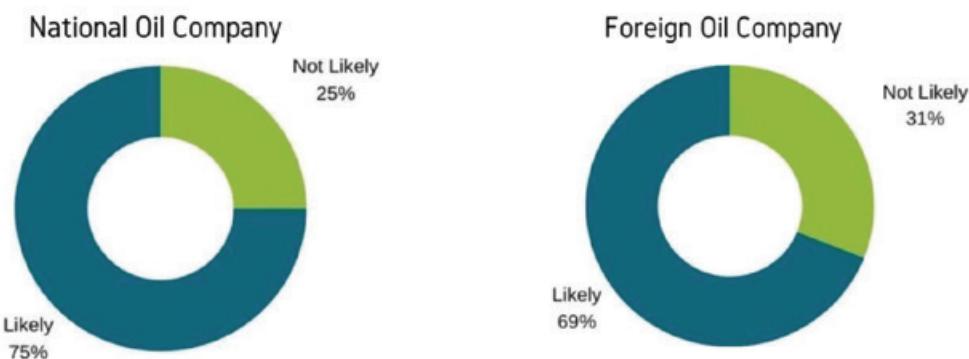
The crucial problem in Latin America is internal politics.

While most analysts believe that the fight against global warming requires regional coordination, others correctly highlight that most of the countries will be unable to comply with the Paris accords because of their internal political dynamics. In Latin America, problems such as corruption, bad governance, contradictory legislation, weak institutions, judicial insecurity, and rampant violence will have a disproportionately negative influence

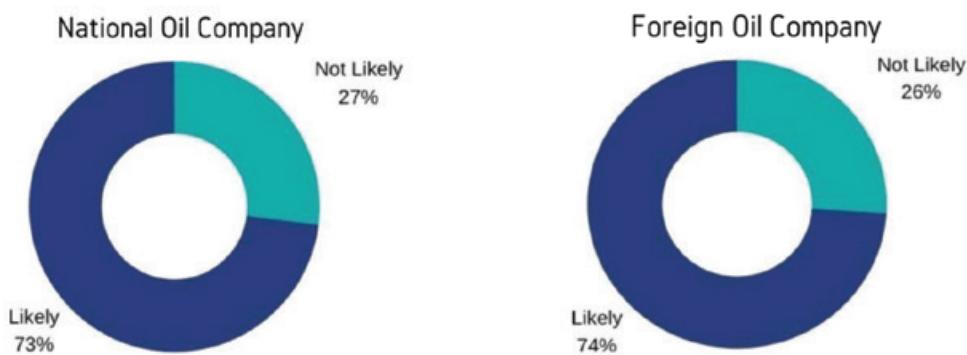
on the region's capacity to deal constructively with the challenges posed by global warming. In this section, we asked elite member regarding the possibility of a lobbying company to delay the development of renewable energies and about what are their most prominent thoughts regarding their country's investments in renewables. The answers are crucial to understanding the capability to improve renewables production.

Q: Suppose that companies focus their lobbying activities in your country. How likely do you believe they are to be successful?

DEVELOPMENT OF RENEWABLE ENERGIES



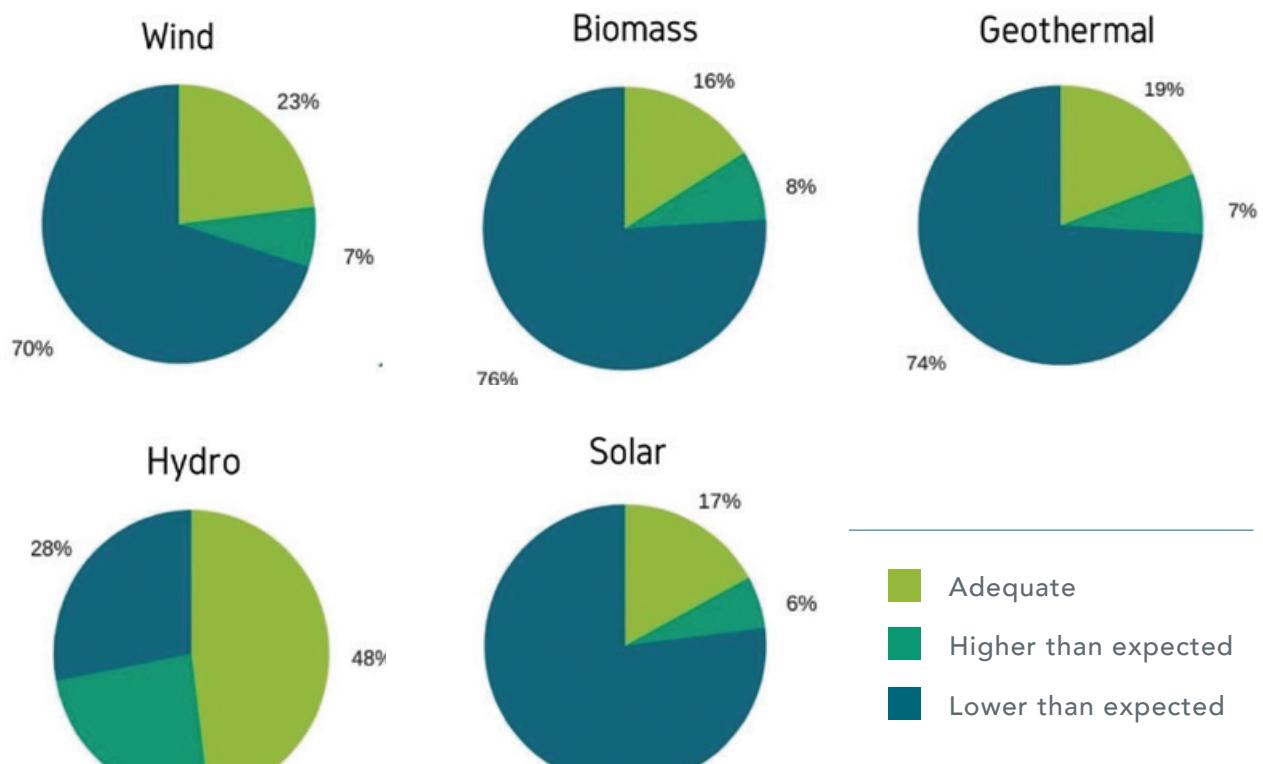
DEVELOPMENT OF FOSSIL FUEL MARKET



The broad consensus in this question seems to be that Latin American elites comprise that companies are likely to be successful in their lobbying activities, regardless of their country of origin or the specific policy they support. When asked the likelihood of the companies being successful in lobbying in support of protecting the fossil-fuels market, 73% of the respondents affirmed that it would be successful in their lobbying. In the same sense, when asked a similar question related to foreign oil companies, 74% agreed that it is likely that they would obtain success.

This pattern does not seem to differ much when respondents are asked about the likelihood of companies being successful lobbying in favour of the postponement of the development of renewable energies. 75% of the respondents believe that it would be likely that a national oil company would be successful in lobbying in favor of delaying the development of renewable energies. Similarly, 69% think that a foreign oil company would be likely to be successful in their lobbying.

Q: Thinking about your country's investments in renewable energy, what is your opinion of the level of governmental investment?



From this analysis, we can conclude that elites, in general, dissatisfied with how much the government spends on renewable energies. 76% of the respondents believe that government spending on biomass is lower than expected. Similarly, 70% affirmed that government investment in wind energy is lower than expected. When it comes to thermal energy, this pattern does not seem to change, 74% of the respondents think that government spending is lower than expected.

Lastly, 77% that government investment in solar energy is lower than expected. This trend seem to be reversed when it comes to hydroelectric energy

48% of the respondents believe that government spending on this type of renewable energy is adequate, while 28% believe that government spending is higher than expected, and only 24% think it is lower than expected.

In summary, internal politics play a significant role. Elites perceive that a lobby against renewables would be very successful. Moreover, areas with high productivity potential, such as Solar, Wind, Geothermal, and Biomass, are perceived to receive less than optimal investments from the governments. It suggests that there is considerable room for governments to improve their policies in the region.



MANAGING COMMON POOL RESOURCES

Climate change prevention requires large-scale collective action. While scientists mostly agree about the urgency of climate issues, civil society still has not reached a consensus on the best way to promote climate governance. A major topic of discussion is the international level due to the global nature of the problem. Conversely, others suggest that decentralized governance mechanisms are more effective because of higher civic participation and organizational flexibility.

In democratic countries, representatives need to take public preferences into account when formulating

climate policies. However what type of agreement would public support?

We address this issue with a conjoint experiment. A conjoint experiment is a statistical technique that allows individual to express their preferences on multiple attributes of a single topic. We present two scenarios for individual, each containing a series of attributes that we intend to evaluate. The individual chooses one of them. As the attributes are randomized and individuals choose between different pairs of hypothetical scenarios, we can estimate how individuals' values each of the conjoined elements.

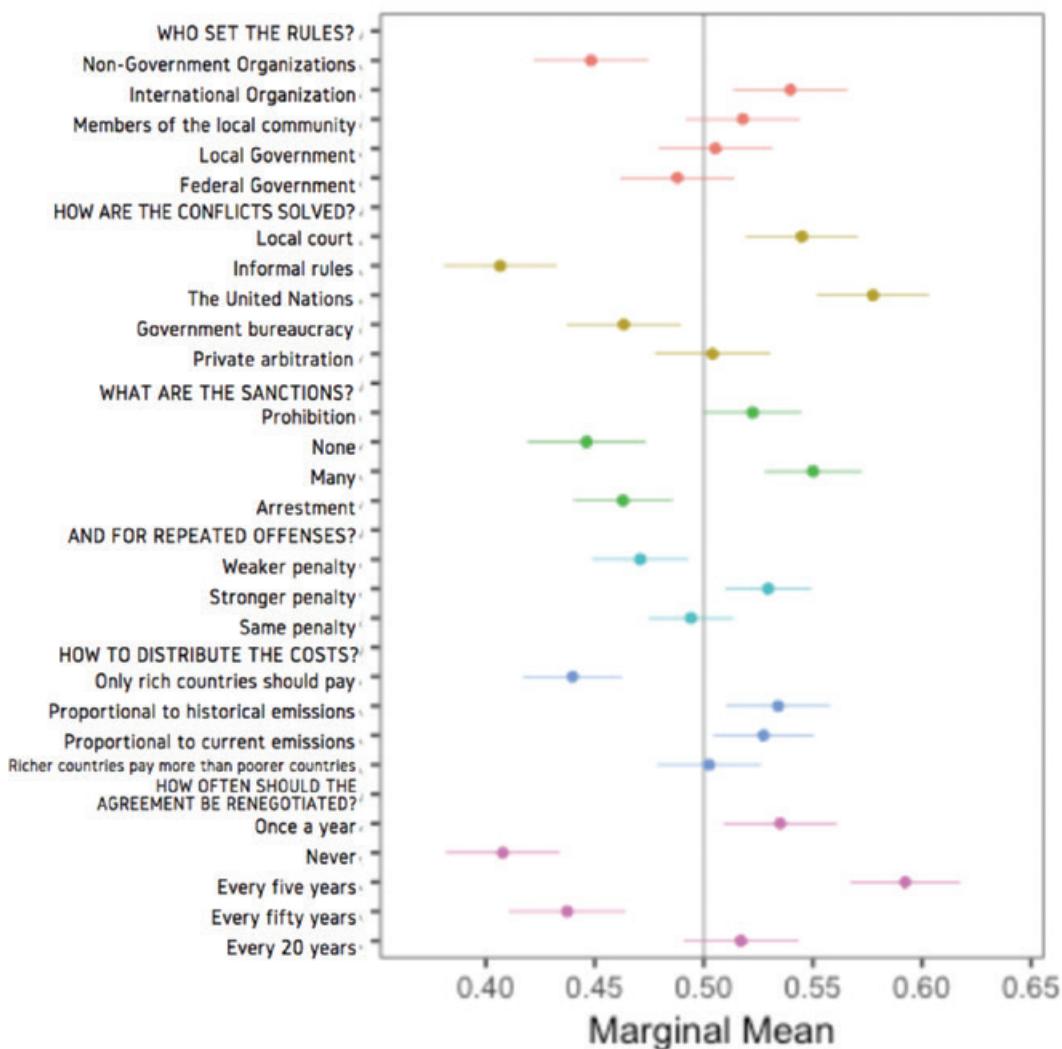
As for punishments, we have options ranging from do nothing to fines and incarceration. We also asked whether the costs of climate change agreements should be paid mostly or exclusively by developed countries, by polluter countries regardless of their wealth, or if costs should be allocated according to the history of emissions of a given nation.

In our research, we ask what features elite members would like to see implemented in a climate change agreement. We ask their opinion on six questions: 1) who makes the rules; 2) who enforces the rules; 3) what punishment should be used against lawbreakers; 4) how repeated violations are punished; 5) how are costs distributed; 6) how often the agreement will be renegotiated. Each of the questions has four to five different attributes. For the first two questions, we ask individuals if they would rather have the community, local governments, federal governments, or international organizations to create or enforce rules.

As for punishments, we have options ranging from do nothing to fines and incarceration. We also asked whether the costs of climate change agreements should be paid mostly or exclusively by developed countries, by polluter countries regardless of their wealth, or if costs should be allocated according to the history of emissions of a given nation. Individuals also state their preferences for short-term agreements, a proxy we use for flexibility, or for long-term ones, what we see as a proxy for the stability of rules.

Conjoint experiments have many advantages. First, as each chooses between many pairs of possible climate agreements -- seven in our case -- we can drastically increase our sample size without incurring in further financial costs. The design thus maximizes our research budget. Second, individuals rarely decide considering one attribute at a time, as presented in other types of survey experiments. In that regard, our conjoint analysis mirrors how people naturally make their choices, that is, by simultaneously considering several characteristics.

Finally, as the experiments consist of a simple choice between A and B, conjoint analyses are easy to understand and to implement. This research design reduces the cognitive load interviewees have while answering surveys and as a result, we can expect more accurate responses from our sample.



The results indicate that Latin American elites strongly favor polycentrism when dealing with climate change. Elites agree that sanctions should be gradual to repeated offenders, and they also believe that costs should be allocated proportionally to

the history of past emissions. In line with the idea of proportionality, the respondents indicate that law-breakers should be punished with fines, which could be increased if necessary.

We find no evidence that rich countries should bear the lion's share of climate change mitigation costs just due to their current levels of wealth. Conversely, our experiment shows that elites believe that developing countries should also contribute to the provision of public goods.

The evidence in favor of multilevel arrangements is unequivocal when we analyse political variables. Our results suggest that elites support both the United Nations and local courts to mediate conflicts, a finding we interpret as pro overlapping jurisdictions.

Another exciting result of our experiment is that respondents like the idea of international organisations and local communities being together the primary sources of rules.

Regarding the agreement duration, elites are interested in a balance between stability and flexibility.

This result lends strong support to Elinor Ostrom's theory of polycentric climate change governance.

Our sample firmly rejects agreements that cannot be modified or that last for 50 years. Their preference lies in agreements that can be renegotiated every five years, as they are stable enough to provide long-term incentives to the parties, yet flexible to incorporate new demands from local-level groups.

Altogether, the findings are encouraging. They show that not only there is a broad consensus over the topics of climate change treaties, but also that elites are open to inclusive, democratic ways of addressing the issue. They acknowledge the significant role that civil society can play in the design of international treaties and highlight the importance of stable and accountable international institutions.





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ANNEX

ACKNOWLEDGMENT

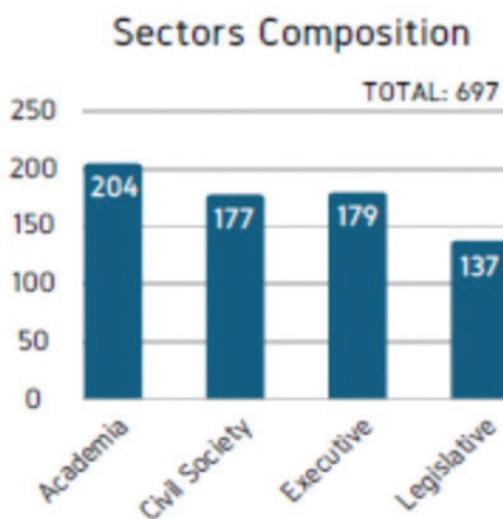
This report was collective endeavour since its beginning. The project was possible with the collaboration between the FGV School of International Relations and the Regional Programme of Energy Security and Climate in Latin America at the Konrad Adenauer Stiftung.

The work of the many readers and reviewers are heavily thanked. They helped us to correct errors and improve the document in many dimensions. We would like to thank particularly Flávio Augusto Lira Nascimento and Pablo Necoechea Porras, Konrad Adenauer Fellows at the European Center for Energy and Resource at King's College London (respectively in 2014/5 and 2016/7) for their important comments. We would like to thank the participants and respondents, that took their time to answer our

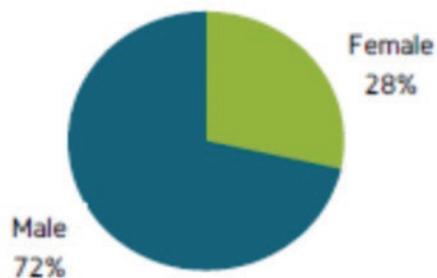
survey. They helped us to understand better the geopolitics of renewables in Latin America. We also want to thank all the participants in the several steps of the research, from survey instrument construction to telephone interviewers and data analysts.

This report does not necessarily reflect the positions of FGV or KAS. All the remaining errors are unrelated to the previous persons or the institutions aforementioned.

METHODOLOGY



Gender Composition



The survey interviewed 697 elite members in 10 Latin American countries. A dataset was compiled with 6188 potential respondents from Argentina, Brazil, Bolivia, Chile, Colombia, Costa Rica, Ecuador, Mexico, Panama, and Peru. The likely respondents were academics, members of the executive power, legislators, businesspeople, and members of non-governmental organisations.

Between August and September, the academic coordinators of FGV and EKLA-KAS developed the questionnaire for the survey, based on the comments received from experts of the region. FGV pre-tested the questionnaire and adapted it. The survey instrument was comprised of 40 questions, divided into seven themes regarding the geopolitics of renewable energies in Latin America, following the same logic as in this report. After the validation, the survey instrument was piloted with specialists and reviewers from several sectors, to ensure that the questionnaire was relevant and logically sound.

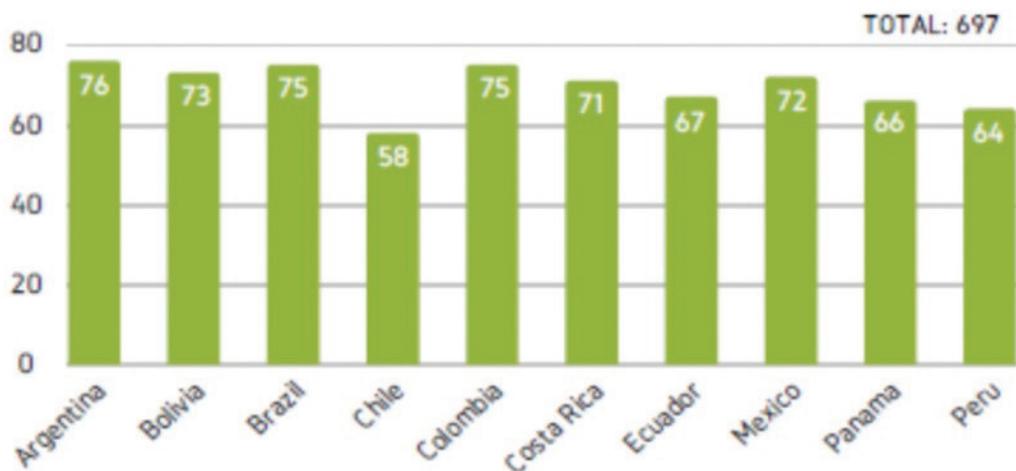
Between 12th of November and 7th of December 2018, the survey was collected by telephone, with the help of native Spanish and Portuguese speakers. The same study was also applied to an entirely

online sample, to complement the data collection. The original aim was to survey around 400 respondents, and to do so we assembled two teams of interviewers, one based in Rio de Janeiro and another in São Paulo.

At the end of the research, we achieved more than twice the amount of respondents we aimed at. By telephone, we interviewed 697 people and online 423. Some countries such as Bolivia and Peru have been particularly challenging, but in general the research was mostly successful. The full online version was successfully implemented and played an essential role in increasing our sample size in countries where data collection was challenging.

In the figures below, the raw proportions of respondents, segmented by employment sector, gender, and country is presented. The most striking feature is the severe gender imbalance in the sample because the definition of elites focuses on the energy sector workers, unfortunately, usually comprised of male professors or male bureaucrats. Moreover, the gender imbalance in legislature is well documented in Latin America.

Country Composition



WORD-CLOUDS METHOD

As the research comprised of an elite survey, it makes sense to add open-ended questions. Elite members usually want to explain their views, and as they are specialized in the field, they find to give the explanations compelling. Therefore, several open-ended questions pose specific challenges for the analysis.

To avoid coding, and the subjectivity of choosing meaning to the persons' answers, this study opted for providing word-clouds for the open-ended questions. The word-clouds were built in the following way.

First, we translated all the texts to English using an R-Google Translate API interface. Second, we itemized the words, taking out the stems using the Porter Stemmer. This reduces the variety of words that have the same meaning but are graphed differently. Third, we applied a stopping words remover to take out words with empty meaning, such as prepositions.

Finally, the cloud consists of the word count, putting in the centre the words that are more frequent, and decreasing the word size as the frequency of the word diminishes. These graphs provide an exciting form of viewing the resulting data.



CONCEPT OF ELITES

This project selected elites from four employment sectors: legislative, executive, academia, and civil society. For legislative, we considered federal and provincial senators and representatives, plus the most important elite members in the representative's staff.

We give preference for members working with energy or environmental causes. The executive members were comprised of bureaucrats that worked in the federal or provincial governments, in the energy or

environmental sectors. The academics were mostly engineers that worked with renewables or fossil fuel energy.

Finally, the civil society was comprised of NGO or firm owners, working in the energy or the environmental sectors. Several reasons have motivated our choice for an elite survey. First and foremost, elites have oversize influence over governmental decisions. Interest groups and political parties can

The topic remains understudied in academia and discussions about renewable energies are often framed in technical terms. The relative uncertainty regarding the future costs and benefits of transitioning to cleaner energy resources also require that participants have specialized skills to engage in this debate.

select winners and losers in public policy and redistribute costs across sectors of civil society. Second, in contrast with popular belief, elites are not a highly cohesive group and often have vast disagreements about societal issues. This diversity of viewpoints is often neglected in social science scholarship, yet it produces valuable insights not only about how the political process takes place but also how elites solve collective action problems.

Furthermore, elites have specialized knowledge that can be very useful for scholarly and practical purposes. For instance, elites can provide researchers with testable hypotheses about their study object or suggest new ideas that can be implemented at some point in the future.

These issues are particularly relevant to renewable energy governance. The topic remains understudied in academia and discussions about renewable energies are often framed in technical terms. The relative uncertainty regarding the future costs and benefits of transitioning to cleaner energy resources also require that participants have specialized skills to engage in this debate. Our elite survey has measurements on geopolitical winners and losers, free-riding, corruption, lobbying, stranded asset problems, as well as measures on the beliefs on overall future trends of renewables in the region, and trustworthiness of foreign investors.

References

- Chawla, K. (2018). "Drivers, apparatus, and implications of India's renewable energy ambitions". In: SCHOLTEN, Daniel (ed.). *The geopolitics of renewables*. Cham: Springer International Publishing AG, pp.203-227.
- Dignum, M. (2018). "Connecting visions of a future renewable energy grid". In: Scholten, Daniel (ed.). *The geopolitics of renewables*. Cham: Springer International Publishing AG, pp. 257-2276.
- Freeman, D. (2018)."China and renewables: the priority of economics over geopolitics". In: Scholten, Daniel (ed.). *The geopolitics of renewables*. Cham: Springer International Publishing AG, pp. 187-201.
- Germanwatch. Climate Risk Index, 2019. Available at: <<https://germanwatch.org/en/16046Spreadsheet>>. Accessed on: Feb 18 2019.
- Graaf, T. V. (2018). "Battling for a shrinking market: oil producers, the renewables revolution, and the risk of stranded assets". In: Scholten, Daniel (ed.). *The geopolitics of renewables*. Cham: Springer International Publishing AG, pp. 97-121.
- IRENA (2016a), "Renewable Costing database", IRENA, Abu Dhabi. <https://www.irena.org/costs>
- IRENA (2016b), "Renewable Energy and Jobs - Annual Review 2016", IRENA, Abu Dhabi. <http://www.irena.org/menu/index.aspx?mnu=Subcat&PriMenuID=36&CatID=141&SubCatID=585>
- IRENA (2016c). "Renewable Energy Market Analysis Latin America", IRENA, Abu Dhabi. https://www.irena.org/documentdownloads/publications/rena_market_analyses_latin_america_2016.pdf
- Latin American Energy Organization (OLADE), 2016. Anuario de Estadísticas Energéticas 2017. Available at: <<http://www.olade.org/publicaciones/anuario-estadisticas-energeticas-2017/>>. Accessed on Feb 18 2019.

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- O'Sullivan, Meghan, and Overland, Indra and Sandalow, David, The Geopolitics of Renewable Energy (June 26, 2017). HKS Working Paper No. RWP17-027. Available at SSRN: <https://ssrn.com/abstract=2998305> or <http://dx.doi.org/10.2139/ssrn.2998305>
 - Sattich, T. (2018). "The international reverberations of Germany's Energiewende; Geoeconomics in the EU's geo-energy space". In: Scholten, Daniel (ed.). The geopolitics of renewables. Cham: Springer International Publishing AG, 2018, pp.163-185.
 - Sivaram, Varun, and Sagatom Saha (2018). "The geopolitical implications of a clean energy future from the perspective of the United States". The geopolitics of renewables. Springer, Cham, 2018. 125-162
 - The Oxford Institute of Energy Studies (2008), "Economic diversification in the context of the energy transition" OXFORD, Eleventh Arab Energy Conference Marrakesh, Morocco, 1-4 October 2018. <http://www.oxfordenergy.org/wpcms/wp-content/uploads/2018/10/Economic-diversification-in-the-context-of-the-energy-transition.pdf>
 - The World Bank, 2015. Wind Resource Data: DTU and Vortex. Available at: <<https://globalwindatlas.info/>> Accessed on: Feb 18 2019.
 - The World Bank, 2017. Solar Resource Data. Available at: <<https://globalsolaratlas.info/downloads>>. Accessed on: Feb 18 2019.
 - World Economic Outlook, 2018. GDP per capita by country. Available at: <<https://www.imf.org/external/datamapper/NGDPDPC@WEO>> Accessed on: Feb 18 2019.
 - World Energy Council, 2016. Geothermal Capacity Installed in Latin America and the Caribbean. Available at: <<https://www.worldenergy.org/data/resources/region/latin-america-the-caribbean/geothermal/>>. Accessed on: Feb 18 2019.
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