

CLIMATE AMBITION BEYOND EMISSION NUMBERS

**Taking stock of progress by looking inside
countries and sectors**

CHILE

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Marcia Montedonico, and Rigoberto Torres*

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Disclaimer

The results presented in this report are outputs of the academic research conducted under the DDP BIICS project as per the contractual agreement. The academic work does not in any way represent our considered opinion for climate negotiations and also does not reflect the official policy or position of the Government of Chile.

How is this document relevant to the Global Stocktake?

This document is part of a collective report that assesses the evolution of climate ambition in 26 countries and 3 hard-to-abate sectors through a granular and context-specific analysis of trends and progress of national and sectoral transformations.¹ This approach allows identifying what hinders and spurs action in countries and sectors, and understanding the conditions that can support enhanced ambition, which could be political, social, economic, governance.

These insights are directly relevant to four overarching functions of the Global Stocktake in support of its desired outcome, i.e. "to inform Parties in updating and enhancing, in a nationally determined manner, their actions and support in accordance with the provisions of the Paris Agreement, as well as enhancing international cooperation for climate action" (Article 14.3 of the Paris Agreement):

- Create the conditions for an open and constructive conversation on global cooperation (on e.g., technology, trade, finance, etc.), based on an in-depth understanding of the international enablers of enhanced country ambition.
- Organize a process for knowledge sharing and collective learning, based on concrete examples of actions already in place or being discussed, including best practices.
- Create space for open dialogues across different stakeholders to support better coordination of actions, based on a detailed understanding of the levers to be activated to enhance ambition in national and sectoral transitions
- Facilitate ownership by decision-makers of the climate challenge and the risks and opportunities of the low-emission and resilient transition, based on context-specific and granular analysis of barriers and enablers.

More specifically, the collective report in general – and this document in particular – can contribute to address some of the key guiding questions for the Global Stocktake², notably:

- What actions have been taken to increase the ability to adapt to the adverse impacts of climate change and foster the climate resilience of people, livelihoods, and ecosystem? To what extent have national adaptation plans and related efforts contributed to these actions (Decision 19/CMA.1, paragraph 36(c))?
- How adequate and effective are current adaptation efforts and support provided for adaptation (Article 7.14 (c) Paris Agreement)?

¹ The full report « Climate ambition beyond emission numbers - Taking stock of progress by looking inside countries and sectors" can be found at: <https://www.iddri.org/en/publications-and-events/report/climate-ambition-beyond-emission-numbers-taking-stock-progress>

² Draft Guiding Questions for the Technical Assessment of GST1 (version 20th October 2021), available at: https://unfccc.int/sites/default/files/resource/Draft%20GST1_TA%20Guiding%20Questions.pdf

- What are the barriers and challenges, including finance, technology development and transfer and capacity-building gaps, faced by developing countries?
- What is the collective progress made towards achieving the long-term vision on the importance of fully realizing technology development and transfer in order to improve resilience to climate change and to reduce greenhouse gas emissions referred in Article 10.1 of the Paris Agreement? What is the state of cooperative action on technology development and transfer?
- What progress has been made on enhancing the capacity of developing country Parties to implement the Paris Agreement (Article 11.3 Paris Agreement)?
- To achieve the purpose and long-term goals of the Paris Agreement (mitigation, adaptation, and finance flows and means of implementation, as well as loss and damage, response measures), in the light of equity and the best available science, taking into account the contextual matters in the preambular paragraphs of the Paris Agreement:
 - What are the good practices, barriers and challenges for enhanced action?
 - What is needed to make finance flows consistent with a pathway towards low GHG emissions and climate-resilient development?
 - What are the needs of developing countries related to the ambitious implementation of the Paris Agreement?
 - What is needed to enhance national level action and support, as well as to enhance international cooperation for climate action, including in the short term?
 - What is the collective progress made by non-Party stakeholders, including indigenous peoples and local communities, to achieve the purpose and long-term goals of the Paris Agreement, and what are the impacts, good practices, potential opportunities, barriers and challenges (Decision 19/CMA.1, paras 36(g) and 37(i))?

Foreword

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Country commitments as reflected in enhanced Nationally Determined Contributions submitted to the UNFCCC are insufficient to put the world on track to achieve the collective objective of the Paris Agreement to hold temperature increase below 2 °C or 1.5 °C above pre-industrial levels. Furthermore, concrete policies and actions adopted by countries on the ground are often not sufficient to achieve these NDC targets. These conclusions highlight the need to increase ambition and to provide convincing evidence to accelerate action in the immediate and short term to give effect to this ambition. Yet these assessments are not sufficient to effectively guide the progressive increase of ambition, as organized by the cyclical process of the Paris Agreement.

APPROACH

With this imperative in mind, this report adopts a different, complementary, perspective on climate ambition. It seeks to open the box of emission pathways, by considering multiple dimensions of the conditions that will make these pathways possible. These are technical, economic, political, social and governance considerations in need of attention to enable the required far-reaching and systemic transformation towards the long-term goal. On the one hand, the revision of emission targets needs to be directed by an assessment of how drivers of emissions should change to trigger transformation. On the other hand, converting emissions' targets into pertinent concrete implementation requires well-designed policy packages and investment plans that are also informed by a clear and detailed understanding of the starting point, priorities and interplays between the available levers of transformation.

This bottom-up assessment aims at contributing to the process of collective learning in support of the progressive increase of collective ambition, as inserted at the core of the Paris Agreement paradigm. Approaching climate ambition through the lens of underlying transformations calls for reflecting the heterogeneous nature and the multi-faceted aspects

of transitions in different sectors and countries. This forces a move away from a purely global perspective and adopts a more granular approach based on country and individual sector perspectives. Thus, the report explores trends and progress on these transformations, as locally observed over the past years, notably since the Paris Agreement. This 'backwards looking' approach can help identify where developments are going in the right direction, where they should be accelerated and where major tensions remain that should be addressed as a priority to avoid undermining the transition. The picture of the state of the ambition discussion, firmly embedded in the country and sectoral realities, can provide means for reflection and action within the international climate community, particularly to inform focus areas for advancing the collective ambition agenda.

STRUCTURE OF THE REPORT

This country report describes the recent evolutions of domestic discourses on climate ambition, national climate policy, national governance and concrete policies and actions with a significant effect on GHG emissions. The chapter highlights a selection of striking and structurally important elements to advance the transformation towards carbon neutrality from an in-country perspective.

This report is part of a full series of 26 country chapters and three sectoral chapters. The full report includes a "summary for decision-makers" to present 10 cross-cutting messages emerging from the country and sector analysis, as a guide to the selection of priorities for collective action in the post-COP26 period.

You will find the full report at: https://www.iddri.org/sites/default/files/PDF/Publications/Catalogue%20Iddri/Rapport/DDP_beyond%20emissions%20report.pdf



FIVE YEARS BEFORE AND AFTER THE PARIS AGREEMENT

This chapter has been written thanks to the support of the International Climate Initiative (IKI) of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU).

This brief draws special attention to selected developments that took place in Chile over the last 10 years to illustrate the progress on climate policy and support the appraisal of the country's capacity to align with the Paris Agreement mitigation goal. It does not aim to be comprehensive, as it rather relies on expert judgement from the authors.

CLIMATE POLICY AND CLIMATE DISCOURSE IN CONTEXT

Chile took an important boost and commitment in the fight against climate change, following the adoption of the Kyoto Protocol and the presidency of COP 25. Despite this, the uncertainties associated with the pandemic and social conflicts, together with the usual resistance of the main emitting sectors, mean the risk of not achieving these goals is very significant.

The month of October 2019 and its associated complex political situation eventually led to an agreement to draft a new Constitution. To this end, the 155 members of the constituent assembly who will draft the new Constitution over the next two years were recently elected. Thus, this instrument is expected to open a path to enhance the credibility of institutions, political parties and, in particular, to address the underlying problems of equity and minimum rights present in the Chilean society.

In addition to the above, the COVID-19 pandemic has deeply affected the economic situation and the mood of the country. By the end of this year,

Chile will hold a presidential election for the next four-year term.

In the transformational context described above, environmental awareness, climate change, biodiversity, the use of natural resources and energy poverty have become particularly relevant affairs. For example, the first Framework Law on Climate Change¹ is currently being discussed in the Chamber of Deputies and is likely to become a Law of the Republic before the end of the year. On the other hand, the plan for the retirement and/or reconversion of coal-fired units was announced by the end of 2019 as a result of a voluntary yet binding agreement between the private sector and the Government². Recently, in July 2021, the early retirement of other coal-fired plants by 2025 was added to this announcement, adding 1,000 MW to the previously agreed plan³. A specific law for the early phase-out of coal-fired generation plants by 2025 is under discussion in the Senate⁴ as well.

Despite the progress made, Chile continues to be highly dependent on fossil fuels, adding up to 57% of their final energy consumption. In this context, renewable energy has had an unprecedented development since 2015 (See figure on the Evolution of Solar installed capacity in the Addendum).

Furthermore, the first 110 MW concentrated solar power tower plant in LATAM came into operation in Chile this year. Renewable technologies now represent 52% (13,500 out of 26,000 MW) of the total installed capacity of electricity generation in the country. Solar, wind, biomass and mini-hydro power account for 28% (7,300 MW) of installed capacity and have already exceeded 20% of the annual generation. Although renewable energy development has been impressive, it still represents a very low percentage of Chile's estimated potential of 1,800,000 MW⁵ and growing. The country accordingly sees a great opportunity in the future of renewable energy development that creates an exporting trend of these resources.

Also, the energy efficiency law has been enacted, which is expected to reduce energy intensity by 10% at a national level, in addition to producing significant monetary savings and reducing GHG emissions⁶.

In this context, "we should not forget that not only climate change represents a risk factor in accelerating, strengthening, amplifying and multiplying situations of uncertainty, conflict, violence and political crisis in the future, but proposed control and mitigation measures may also generate conditions of instability. Climate risks will be increased by the local conditions of poverty and inequality, but they may be controlled by means of adequate investments in institutional response and adaptation capacities, which implies structural transformations that strengthens the social fabric, the preparation of the population and governance conditions. On the contrary, the adoption of inappropriate policies may accelerate or even amplify uncertainty and conflict. The current social crisis in Chile is a stark reminder of these two types of enabling conditions that we need to consider." [1].

Although the constituent process is still undergoing its organization stage and that the runners for the presidential office have not yet shown clear leadership, it has been noted that most of the government programs proposed so far have climate change, clean energy and sustainable development as key pillars for the future development of the country. This augurs well for the performance of climate policies and associated efforts in the country.

POLICIES AND ACTIONS: NDC UPDATE

Chile's increased ambition is reflected in the updated NDC, notably reflecting a growing conviction across the board on the need for environmental protection plus the impulse from the Paris Agreement to structure domestic commitments in an international context of progression. Achieving the long-term goals requires setting an adequate allocation of sectoral responsibilities in mitigation and adaptation, and resolving how to make most advantage of the country's renewable potential in end-use sectors such as mining, transportation and commercial/residential.

Chile submitted its INDC to the UNFCCC secretariat in September 2015, which included five pillars: i) mitigation, ii) adaptation, iii) capacity building, iv) development and transfer of technologies; and v) financing. For the mitigation pillar, Chile chose to submit its contribution by employing an emission in-

1 <https://leycambioclimatico.cl/leyccchile/>

2 <https://n9.cl/y6ld>

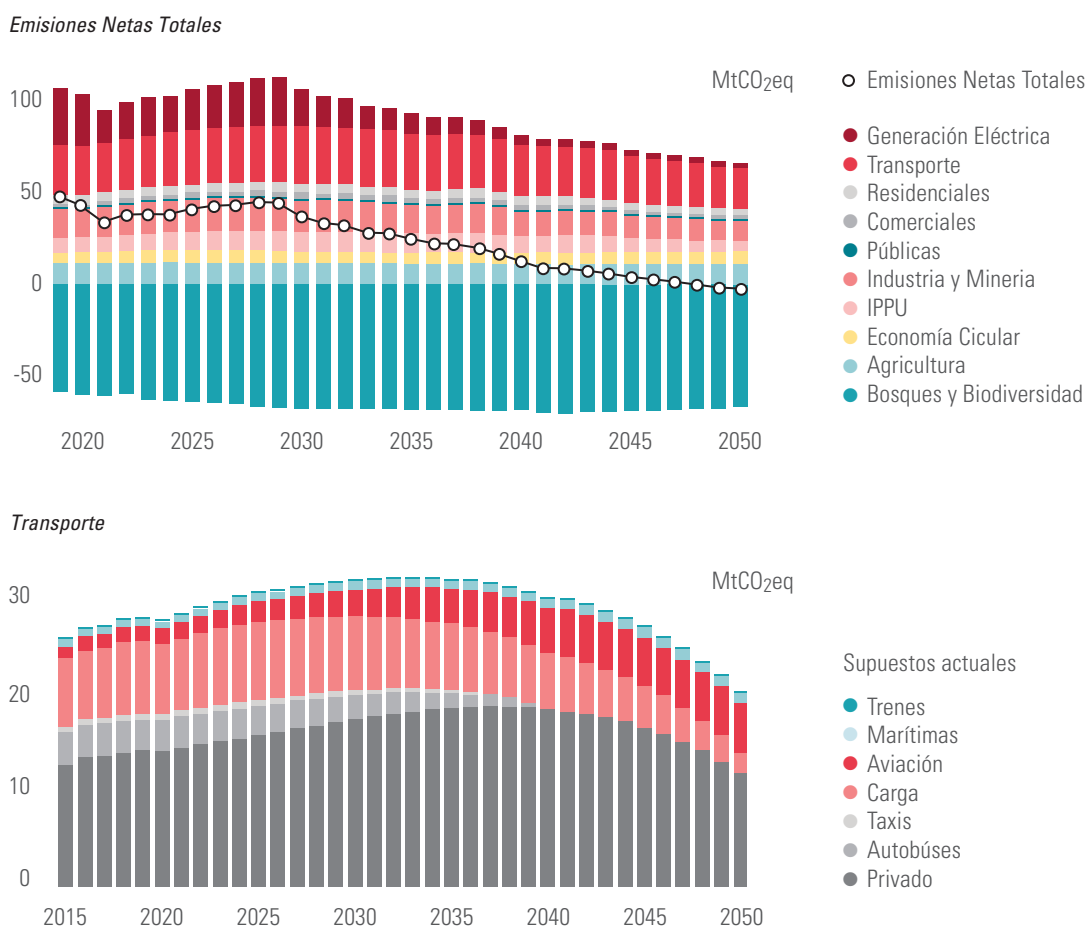
3 <https://n9.cl/vepk3>

4 <https://n9.cl/4jemu>

5 <https://n9.cl/caha4>

6 <https://energia.gob.cl/ley-y-plan-de-eficiencia-energetica>

Figure 1. Options for achieving carbon neutrality by 2050 in Chile under conditions of uncertainty (IADB, 2021).



tensity format (CO₂ equivalent tons per unit of gross domestic product in million (CLP\$ 2011)). The mitigation commitment included all sectors excluding those comprised of land use, land-use change and forestry (LULUCF). The reason for this is that LULUCF is both a net sink of CO₂ emissions and – also due to the high annual variability of their capture and emissions – less dependent on economic growth.

In April 2020, Chile was one of the first countries to officially submit an updated Paris Agreement target to the UNFCCC⁷. It endorsed a GHG-neutrality target by 2050. Consortiums like The Climate Action Tracker recognizes that Chile has increased its climate ambition. Nevertheless, the rating just moved from “Highly Insufficient” to “Insufficient”⁸.

We believe that the main reason behind the qualitative step forward in the level of ambition is that Chilean society, regardless of the political sector, has a growing conviction towards the need for environmental protection. It is a more empowered society that has managed to stop emblematic projects such as the Hidroaysén hydroelectric dam and nuclear energy in 2010. The issues of air pollution in the capital city of Santiago and the country’s vulnerability to climate change have also contributed to this awareness. Finally, the Paris Agreement has undoubtedly played a key role in structuring a path to formalize agreements on a domestic basis and transform them into international commitments. The main challenge for the long-term climate strategy is to achieve an adequate allocation of sectoral responsibilities in mitigation and adaptation. Given the significant share of the energy sector in Chile’s national emissions (almost 80%, see section 2), this

⁷ <https://n9.cl/b761s>

⁸ <https://climateactiontracker.org/countries/chile/>

sector plays a critical role in the climate change mitigation actions. In this sense, the sectors that have been most resistant to change are the mining, transportation and commercial/residential sectors. The following figure shows that these sectors only manage to stabilize their emissions. In the case of transportation, the trend is set by private transportation and aviation⁹.

Private transport electrification in Chile will directly depend on international prices; there is no local industry to set specific conversion targets as in Europe. The determination of standards or fuel taxes become the main instruments to promote this transformation. The possibility to (and authorization to operate) convert internal combustion vehicles into electric vehicles is an option that the authority is currently assessing.

The mining sector has set targets for reducing greenhouse gas emissions, which are based on the electrification of their processes and the future use of hydrogen in their mining trucks (CAEX), however this does not allow for a significant reduction in direct emissions. In the Addendum, a list of commitments and strategies by the sector's main stakeholders can be found.

In Chile, firewood is one of the major energy sources for residential heating and cooking, representing the second most important energy resource in the country (20%) after oil!

There are different initiatives to achieve an actual substitution of firewood as an energy source in households in order to defeat the harmful effects on health caused by its domestic use. Regulating the market and substituting the use of firewood with other energy sources without increasing the cost to the household is a great challenge. Additionally, there are no district heating developments or other clean options that could become a real solution in the south of the country.

The best way to take advantage of these renewable resources in the country is probably a combination of both: substitution via electrification and the use of district heating, together with improvements in the thermal conditioning of housing.

INSTITUTIONAL DEVELOPMENT

Although there is still a long way to go for Chile to have a robust climate change institutional framework, significant progress has been made in the last 10 years. The main concern is not being able to advance at the sufficient pace demanded by climate urgency decisionmaking.

Within the current climate change governance set-up we have the role of the Climate Change Office (CCO) at the Ministry of Environment to keep and report countries' climate change-related progress to the UNFCCC. This includes the keeping, coordinating and updating of the National Greenhouse Gas Inventory, the Biennial Update Reports and NDC, among others. In order to deliver these commitments, the CCO coordinates with all other relevant government institutions. In this context, the MAPS¹⁰ (Mitigation Action Plans and Scenarios) initiative that has its roots in the Long-Term Mitigation Scenarios Project designed in South Africa between 2005 and 2008 was developed between 2012 and 2015. The project, whose main objective was to develop evidence for decision-making on climate change issues (exploration of possible emission pathways), received the support of 7 ministries and created a participatory process that involved around 150 stakeholders. The project generated a series of tools that served as a basis for future studies and capacity building at the local level. On the other hand, from the governmental point of view, the difficulties in ensuring energy security constituted an essential objective of the work of the newly established Ministry of Energy (2010), which during 2014-2015 developed the long-term energy policy "Energy 2050"¹¹. This strategy, that also involved changes in the law for the electricity auctions mechanisms and transmission planning, and enabled a radical change in the composition of the energy matrix with a spectacular development of wind and solar power plants, taking up more than 20% of the matrix, without government subsidies, and with a fall in electricity prices. In the update, the E2050 incorporates the 2050 carbon neutrality objective. For this purpose, the ministries have working teams and tools at their

⁹ <https://n9.cl/4iu9h>

¹⁰ <https://mapschile.mma.gob.cl/>

¹¹ <https://n9.cl/wkbr5>

disposal with which they can develop this type of analysis on an internal basis.

During 2017, the Ministry of Environment (MMA) coordinated a Working Group from the Public Sector focused on discussing the 2020 NDC updates (WGPS-NDC), as required by the Paris Agreement. Additionally, 2018 saw the creation of the new Chilean Ministry of Science, Technology, Knowledge and Innovation. One of the relevant goals for this ministry is to become the source of evidence for the development of robust public policies. Consistently, a Scientific Advisory Committee on Climate Change (SC) was appointed by this Ministry in April 2019 to coordinate the contributions of the scientific community towards the 2019 United Nations Conference on Climate Change COP25¹². The Committee was formed by seven working groups: two cross-sectional groups- Mitigation and Adaptation-; and five sectorial groups- Water, Biodiversity, Cities, Cryosphere and Oceans. Since its creation, as mentioned in the previous section, the SC – supported by the national scientific community – has provided information for decision-making in different areas, including: sectorial reports, advice for the Framework Law on Climate Change, Climate Observatory, Long-Term Climate Strategy, Seminars and Workshops.

In this context, it is important to highlight the positive evolution of knowledge on the mitigation of GHG emissions across the country. In higher education institutions, most have included the topics of renewable energy, energy efficiency and climate change in their educational curriculum, while in the public sector, the technical teams of the main ministries involved have been strengthened, and new tools have been developed (such as the National Foresight System), among others.

ACTION LANDSCAPE: CHALLENGES AND OPPORTUNITIES

In the context of the current pandemic, climate policy is expected to be pressured into different directions. On one hand, the economic impact on households will exert influence on the management of the transition, its costs and distribution.

¹² <https://www.minciencia.gob.cl/comitecientifico/>

On the other hand, greater attention will be given to the unique opportunities that Chile has, for instance on decentralized energy solutions and the potential as energy exporter country, to enhance both the recovery and the social condition of country's citizens. Research and innovation will need to be enhanced to support the transformations ahead.

Chile presents great challenges in achieving energy transformation towards sustainability. However, at the same time, it has a unique opportunities offered by its renewable resources and the growing conviction of its inhabitants to take care of the environment for future generations.

Energy, comfort and income of households

The pandemic has had a strong impact on household resources (economy), where the cost of energy services can reach 17% of the monthly budget. In a country of near 19 million citizens, more than 700 thousand customers have not been able to pay their electricity bills. Furthermore, there are 30 thousand homes with no access to electricity in Chile, while 11% of the families are in the need of hot water services. There is also the need to improve the thermal comfort standards of homes, and reduce the hours of blackouts that today have an average of 12 hours with some places exceeding 22 hours a year¹³. This situation will be included in the social demands that Chile will present in the upcoming months.

We can refer to the recent legal initiative to reduce in 50% the specific tax on automotive gasoline and diesel oil¹⁴ as an example. This is a sign of the current pressure to reduce transportation costs given the economic situation which goes in the opposite direction of being able to reflect about the negative externalities of these fuels.

Decentralized energy solutions

A decentralized energy solution (DES) is characterized by setting the energy production and management facilities close to the location of energy consumption

¹³ <https://n9.cl/yoeyb>

¹⁴ <https://n9.cl/3q3ge>

and use. Energy technologies based on decentralized solutions are emerging strongly in the world after a long hegemony of centralized solutions.

DESS include, for example, distributed electricity generation, microgrids, electromobility, prosumers, demand and generation aggregators, demand management, virtual generators, combined heat and power plants, smart heat/cold (e.g., heat pumps and air conditioners), energy efficiency, smart meters, among others. Chile has unique advantages for DES, however, the low penetration that these sources have compared to large plants (close to 0.2 GW compared to near 7 GW of installed capacity of solar and wind energy) is not reflecting it yet. Current initiatives to mitigate climate change and the assessment of integrated solutions in the fields of energy, water, food, and health as a result of the pandemic and confinement situation support the existing potential.

Recent studies show that the reduction in transmission costs is capable of offsetting the higher development costs and lower plant factors of distributed generation compared to large-scale generation in many areas of the country [3].

Specifically, the analyses reveal that efficient installation levels would be around 6.22 GW of generation and 14.6 GWh of distributed storage by 2040 in average scenarios, where distributed generation would account for about 40% of the new capacity between 2020 and 2040. These results could even be conservative. The study also quantifies some impacts not captured by the expansion model, particularly in terms of employment, where a positive impact of distributed solutions may also be noticed. The base scenario creates 96,257 direct job-years in the construction stage by 2040, and 231,103 total job-years. This overview makes it essential to define a national strategy for the development of distributed energy resources.

Chile as an energy exporting country

The fact that a scenario for renewable energy exportation from Chile has not been considered by the current available analyses and studies is a limitation. This exportation can be performed by a combination of electricity networks in LATAM (Latin America), production of synthetic fuels (i.e. hydrogen), or the at-

traction of foreign energy intensive industry to Chile. The economic impact of this type of scenarios should be assessed in new studies.

This context is the basis for the green hydrogen development strategy that was recently proposed by the Government¹⁵. The competitiveness of Chile in renewable energy production and the global need for clean energy carriers will open the door to the creation of an economic sector that could rival the magnitude of the Chilean mining sector. The proposal is to start by accelerating the deployment of green hydrogen-specific applications to build local supply chains and gain experience. Thus, an industry of green ammonia production and exportation will be carried out through the support of GW-scale consortiums. Offtake and investment commitments for ammonia and hydrogen exports will be secured. In a final step, Chile should exploit synergies and economies of scale to grow as a global supplier of clean fuels. Although hydrogen can be produced in Chile at low cost (1-2 USD/kg), it faces the challenge of being located far from consumption centers for export purposes.

A study is underway to provide in-depth recommendations and a roadmap to establish a comprehensive and well-targeted economic instrument scheme in Chile to catalyze the energy transition needed to comply with Chile's NDC and its carbon-neutrality commitment (Ministry of Energy and World Bank with the support from local consulting teams). The assessment should specially consider the role of carbon pricing instruments in accelerating the growth of a green hydrogen industry in the country. The economic instruments should aim to incorporate climate externalities in fuel and energy carrier markets, by harmonizing existing instruments and recommending new ones. The implementation of this strategy is expected to begin before the end of the year.

In general terms, Latin America (LATAM) has a great renewable energy potential that can play a key role in sustainable development on a global scale. No previous studies have addressed the contribution of LATAM's energy potential in a context of climate change and global economic impact. Preliminary results based on an adapted economic and climate assessment model

¹⁵ <https://n9.cl/mfjqa>

show that [2]: (i) the export of renewable energy on a global scale and from LATAM to the different regions of the world generates economic benefits for all regions, but is not able to reduce the effects of global warming and, on the contrary, ends up aggravating it; (ii) if renewable energy exports are carried out accompanied by policies that discourage the use of polluting energy sources (e.g. Pigouvian taxes), it is possible to slow down global warming and, in turn, generate significant economic gains for all regions against the case with no exports. (iii) Although all regions benefit from exports, LATAM experiences economic gains of around 5 times the global average; (iv) delaying the development of exports reduces economic gains not only in the period of delay, but also in the years following the start of exports. The simulations and sensitivities presented with respect to tax levels and future uncertainties, allow us to argue that exports of renewable energy from LATAM to other regions, together with policies that reduce carbon emissions, give rise to a virtuous scenario that reduces climate change. This exporting vision of LATAM changes the way of thinking about electrical interconnections at a regional level. Thus, it is possible to move away from bilateral cooperation schemes to multilateral objectives that allow us to take advantage of LATAM's great renewable potential.

Attracting foreign energy-intensive industry to Chile is an unexplored possibility. This would avoid facing the costs of transporting hydrogen and its derivatives or the losses and infrastructure to export electricity through electrical grids. For example, circular economy initiatives could position Chile as a center for the recovery of valuable materials. However, these ideas will face criticism for possible environmental impacts. With all of the above, the export of these resources – as is the case of copper resources in Chile – can become a source of income for Chile to address the eradication of energy poverty. To this end, we are discussing the creation of a development model that is not a copy of the oil industry, but rather one that effectively offers an opportunity for the sustainability of the country and its export destinations.

Additionally, this type of strategies will contribute to the positioning of Chile in terms of the cooperation schemes under the Paris Agreement. There is a need to better understand the role of Article 6 in implementing its NDC and whether Chile is going to use

cooperative approaches in this context. Recent studies by the World Bank and the International Emissions Trading Association set out that this Article 6 has the potential of substantially reducing the costs of NDC implementation by mid-century, together with reducing global emissions in a relevant portion.

Research and innovation

Science budget today in Chile only amounts to 0.38 percent of the country's GDP, far below the 2.4 percent average investment of OECD countries in this area, and much further away from others such as Israel and China, where this investment is close to 4 percent¹⁶.

This is still a great challenge when considering facing the energy transformation that Chile is seeking. There is also the need for technical personnel training and a service network that reduces the costs of product development and new solutions.

Energy transformation also requires active participation of the private sector and options for the development of demonstration projects. The removal of market and knowledge barriers would then become feasible.

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¹⁶ <https://n9.cl/tasw6>

ADDENDUM: ADDITIONAL INFORMATION

Evolution of Solar installed capacity

Figure 2 Show developments in solar energy installed capacity.

NDC Update: Additional information

Figure 3 summarizes the current targets according to its enhanced NDC ¹⁷.

In the context of the development of the NDC, data between 2005 and 2016 was obtained from the National GHG Inventory, while 2017 to 2018 are estimates, and those from 2019 to 2050 are the projections of two scenarios. The green and the red areas have been shaded for illustration purposes, and represent the commonly expected uncertainties associated with the projections, which increases the further the time horizon is.

Regarding the level of ambition of the NDC mitigation proposal [1]:

- GHG-neutrality target for Chile by year 2050 is aligned with the climate change agreement reached in Paris (COP 21) and the 1.5 °C target.
- The level of ambition of the updated NDC proposal is clearly higher than the INDC (expressed in the reference scenario from the figure). In fact, under the BAU scenario, current NDC increases annual GHG emissions by year 2030.
- Following the recommendations for the presentation of information on contributions (Katowice Measures) and international trends, the NDC update has integrated absolute targets, the carbon budget and maximum peak per year. Compared with the current NDC, this change is a clear progress in the type of metrics adopted, thus improving the transparency of the commitments and monitoring systems. In addition, specific studies have sought to provide the necessary evidence.
- The mitigation actions studied for the NDC proposal are consistent with GHG-neutrality by year 2050. Nevertheless, these results are highly dependent on LULUCF capture levels (65 MtCO₂eq yearly). This

issue is identified as a relevant uncertainty. For instance, the fires during year 2017 increased Chile's net-emissions in around 50,000 ktCO₂eq.

- Additionally, the voluntary phase-out plan for coal-fired power plants is also a major uncertainty that should be considered, as it is not legally binding. In addition, this transition is associated with the need to coordinately incorporate flexibility resources in electricity systems (reserves for frequency control, expansion of transmission systems, storage systems, demand-side management, among others).
- On the other hand, specific nature-based and non-energy solutions have not been considered in these strategies, so they are described as a great potential and challenge for systematic studies in the near future. To focus on such measures may offset – to some extent – the risks associated with the forestry sector, in addition to their positive impacts on biodiversity and environment in general.
- Moreover, a macroeconomic assessment of scenarios with and without mitigation measures should become a key element in the future methodology that supports Chile's NDC.
- Having a climate observatory has also become relevant. Although the government has begun to structure this initiative, the low budgets allocated are jeopardizing the availability of an efficient system to validate the commitments made and to provide proper evidence for future decisions.

Development in the mining sector

Table 1 summarizes the commitments and strategies proposed¹⁸.

¹⁸ <https://consejominero.cl/areas-de-trabajo/energia-y-cambio-climatico/>

¹⁷ <https://n9.cl/9qf0t>

Figure 2. Evolution of installed solar energy capacity in Chile

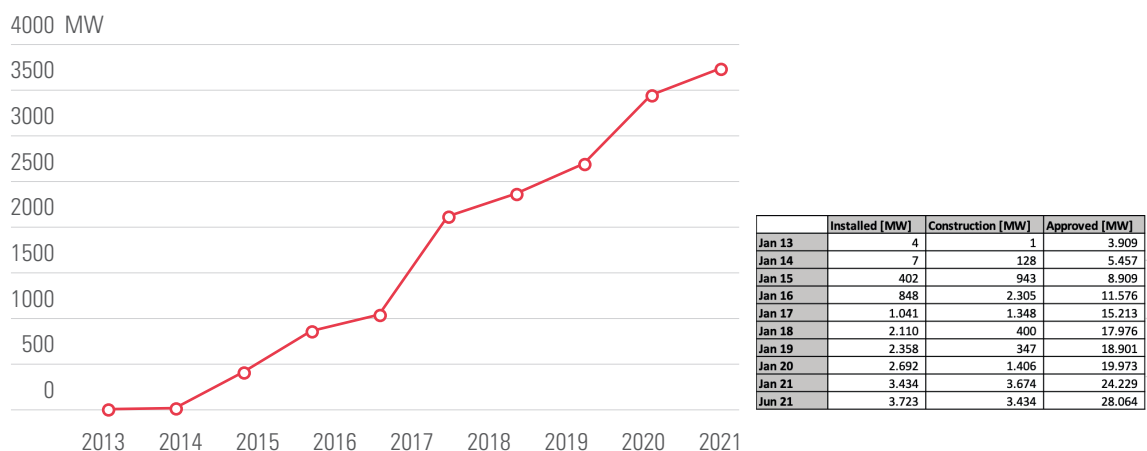


Figure 3. Summary of Chile's updated NDC.

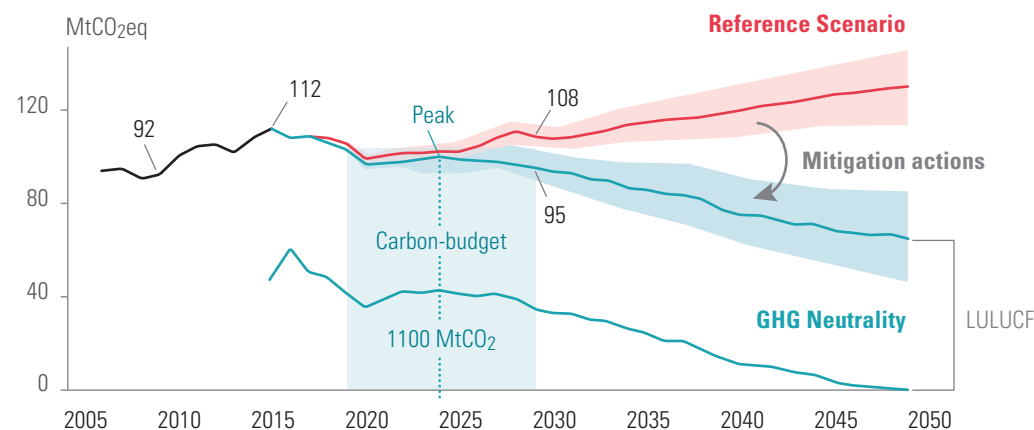


Table 1. Mining sector commitments.

Company	Greenhouse gas emissions reduction target
Anglo American	Overall reduction of 30% by 2030 compared to 2016, and carbon neutrality by 2040, with 8 carbon neutral operations by 2030.
Antofagasta Minerals	Reduction of Scope 1 and 2 emissions by 30% by 2025 compared to 2020, equivalent to 730,000 tons of CO ₂ e, and carbon neutrality by 2050.
Barrick	Overall reduction of 10% or more by 2030 compared to 2019.
BHP	Global reduction of 30% by 2030 against 2020, and carbon neutrality by 2050. As for Chile, 70% of emissions reduction by 2025.
Caserones	Zero Scope 2 emissions from 2021.
Codelco	70% reduction in emissions by 2030 compared to 2019.
Candelaria	Reduction of 80% or more of Scope 2 emissions by 2023.
Collahuasi	Zero Scope 2 emissions from April 2020 and net zero balance of Scope 1 and 2 emissions by 2040. Scope 1 and 2 by 2040.
Freeport McMoRan	As for the Americas, 15% reduction in emissions per copper cathode by 2030 compared to 2018. Zero Scope 2 emissions by 2021.
Glencore	Global reduction of 40% of Scope 1, 2 and 3 emissions by 2035 against 2019, and carbon neutrality by 2050.
KGHM	In Sierra Gorda, 40% reduction of Scope 2 emissions by 2021 and 100% by 2023.
Rio Tinto	Overall reduction of 30% in emissions intensity and 15% in absolute emissions by 2030 compared to 2019, and carbon neutrality by 2050.
Teck	33% reduction in emissions intensity by 2030 compared to 2019, and carbon neutrality by 2050.

DDP

The DDP is an initiative of the Institute for Sustainable Development and International Relations (IDDRI). It aims to demonstrate how countries can transform their economies by 2050 to achieve global net zero emissions and national development priorities, consistently with the Paris Agreement.. The DDP initiative is a collaboration of leading research teams currently covering 36 countries. It originated as the Deep Decarbonization Pathways Project (DDPP), which analysed the deep decarbonization of energy systems in 16 countries prior to COP21 (deepdecarbonization.org). Analyses are carried out at the national scale, by national research teams. These analyses adopt a long-term time horizon to 2050 to reveal the necessary short-term conditions and actions to reach carbon neutrality in national contexts. They help governments and non-state actors make choices and contribute to in-country expertise and international scientific knowledge. The aim is to help governments and non-state actors make choices that put economies and societies on track to reach a carbon neutral world by the second half of the century. Finally, national research teams openly share their methods, modelling tools, data and the results of their analyses to share knowledge between partners in a very collaborative manner and to facilitate engagement with sectoral experts and decision-makers.

www.ddpinitiative.org

IDDRI

The Institute for Sustainable Development and International Relations (IDDRI) is an independent, not-for-profit policy research institute based in Paris. Its objective is to identify the conditions and propose tools to put sustainable development at the heart of international relations and public and private policies. IDDRI is also a multi-stakeholder dialogue platform and supports stakeholders in global governance debates on the major issues of common interest, such as actions to mitigate climate change, protect biodiversity, strengthen food security, and to manage urbanisation. The institute also participates in work to build development trajectories that are compatible with national priorities and the sustainable development goals.

www.iddri.org